



DESIGNING CITIES FOR PEOPLE ON BIKES

PERSONAL EXPERIENCES FROM DENMARK & THE NETHERLANDS



Bike path on school roof | Source: Bridgette Bottinelli



Biking in Houten | Source: Bridgette Bottinelli



Bicycle parking in Utrecht | Source: Gemeente Utrecht

SUSTAINABLE BICYCLE TRANSPORTATION PLANNING CLASS

The COVID-19 Pandemic laid bare the impacts that social isolation can have on people, yet in the United States it also demonstrated how comfortable walking and cycling can be without the overwhelming presence of cars in cities. After two years of limited travel and social interaction the University of Oregon Sustainable Transportation Study Abroad course took to the streets of Denmark and The Netherlands with seventeen students, six transportation professionals, two instructors and the support of three local guides.

For some it was their first trip abroad, for others it was a return to a favorite city, but either way the experience of cities designed for people was the same: cycling next to friends, staying out late without a worry about personal safety, taking a dip in the cold waters of Copenhagen's harbor or using robust public transit all led to better mental and physical health.

While many would say "it could never happen in my city," or "America is different," the stories and images in this book are designed to share what it is like to go from a state of unknowing about how a city can function for people on bikes to a place of inspiration that such a reality is in fact possible. Students share what inspired them, the technical details behind it, and communicate this through a series of vignettes for different audiences. The vignettes are oriented towards family and friends, technical experts, and politicians. During this class, we were also joined by six professionals from all around Oregon – these professionals shared their own insights throughout the class and provided context for working on these topics in the U.S. The students goal was to be inspired, be critical, and ultimately understand what lessons from abroad could be brought back to the U.S. context. Students choose a topic and research it during the four week class. This book is a compilation of those projects.

During the course, we stayed in four larger cities (Copenhagen, Odense, Utrecht, and Amsterdam), met with local professionals across sectors, and visited numerous other places during long day trips. The city is our classroom – we rode bikes like normal people to go to meetings, to recreate, to socialize, and to explore the cities. As we're experiencing cities on bicycles, we also tried to notice how the systems worked, how people behave, what design features make the system work, and how policy and culture impact transportation choices available to residents and tourists. We experienced what it is like to be able to go from anywhere to anywhere on a bike with freedom, comfort, safety, and convenience.

One of the explicit goals for this course is to translate lessons learned abroad into the U.S. context. Each individual student will undoubtedly carry their own insights throughout their professional careers, but students wanted to produce something that could be shared more broadly so that the insights and inspirations they experienced abroad could inform policy and practice back home. We hope you enjoy this compendium, find some inspiration, and remember the message we strove to impart on students: it's always about more than just bikes.

- Rebecca Lewis & Nick Meltzer
Faculty Trip Leaders

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The students would like to thank Professor Lewis and Nick Meltzer for leading our group and providing support on this adventurous trip. Their guidance, insight, and compassion was invaluable.

And finally, a big thank you to Bridgette Bottinelli and Brendan Irsfeld for their efforts as Scan Design Fellow for spending many hours to compile the thoughts and insights of students into this publication!



CLASS ITINERARY



**Itinerary is not comprehensive, but rather a highlight of class activities.*



Exhibit 0.1: Group photo with PSU students and professional fellows | Source: Nick Meltzer

WHO WE ARE

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Trip Leaders

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Professional Fellows

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 Robin Lewis - City of Bend
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Exhibit 1.1: Nyhavn canal in Copenhagen | Source: Bridgette Bottinelli



INTRODUCTION



Exhibit 1.2: Bikes | Source: Bridgette Bottinelli

EXECUTIVE SUMMARY

AUTHOR: Brendan Irsfeld

Students that participated in the **2022 Sustainable Bicycle Transportation** study abroad course compiled their learning and experiences into a month-long, individual project. On the last day of the course, each student delivered a brief presentation to the group about a chosen topic. Part of this course project included a written component articulating the students' projects as a report, case study, personal reflection, article, and even a sample workshop to engage community members around the topic of bicycle transportation.

This report presents the collective work of students' effort while participating in this month-long course. The original student work was edited for consistency and formatting by Scan Design Fellows producing this report. We also complemented the text with supplemental graphics. The report is organized into nine chapters. The first chapter presents a brief introduction to Denmark and the Netherlands. Following this introduction, chapters 2 through 8 include students' final written projects. The projects are organized along common themes related to bicycle transportation: framing and values, communication, creating space, nature and recreation, youth cycling, infrastructure, and case studies. The last chapter serves as an appendix and contains a secondary part of the project. Students crafted brief messages to a selected audience to argue in support of how bicycle transportation benefits communities. These audiences include community members, policymakers and public officials, and car enthusiasts. Sources used for each of the student projects can be found following the audience narratives.

Throughout our time in these two countries, we traveled almost exclusively by bike. Much of what we could observe is what we personally experienced. Although each student's key lessons varied as reflected in their individual projects, you will notice several common takeaways from this experience. One is how safe everyone felt biking despite doing so in crowded urban environments also supporting automobile traffic. What Denmark and the Netherlands built allowed that freedom of movement on a bike and students took advantage to explore the cities beyond our scheduled visits. Another takeaway is the vibrancy of the places within these cities. People actively move about, socializing, shopping, and working. We found it in the large metros and the smaller cities. The environment surrounding us felt welcoming and abundant. We saw how bicycle transportation influenced such an outcome in how cities developed and evolved over time. Students recognized the societal benefits that bicycle transportation provided, from healthier and happier residents to cheaper transportation networks to build and maintain. With more people choosing to bike as their way of moving from one place to another, for whatever purpose, fewer cars go onto the road and even motorists can benefit from less traffic congestion. There is a benefit for all kinds of people and the community at large.

Perhaps most of all, what students took away from the experience is that what exists in Denmark and the Netherlands can be done; it can be built. Some places in the United States have started their efforts to create functional and effective systems for bikes in their network. Yet there is still a long way to go for U.S. cities. In these projects, students highlight practical, effective actions that we as communities can start today. Doing so can accelerate the United States' transformation from an automobile dominated society to one where our communities enjoy a balance of transportation options. In that future, cyclists, public transit riders, pedestrians, and drivers alike enjoy a safe, efficient trip from departure to arrival. How our communities can grow within that change holds enormous potential for rising quality of life throughout the country. Our experience is that of discovering one way of planning for people: through the bike.



Exhibit 1.3: Group on Æro Island | Source: Nick Meltzer

PLACES WE VISITED

AUTHOR: Brendan Irsfeld

Denmark and the Netherlands are both considered to be global leaders for implementing biking into the transportation culture. During this study-abroad course, students experienced biking as transport in a number of cities, ranging in size from urban metropolitan places such as Copenhagen and Amsterdam, to mid-sized cities such as Utrecht, Odense, and Nijmegen, and finally, to smaller cities and countryside communities, including Svendborg. Each place offered its own unique experience in how cyclists can conveniently and safely move about from place to place. Through these immersive learning opportunities, students recognized a number of important lessons to bring home as guidance for how to improve and promote biking as a transport mode in the United States.

Despite many similarities between Denmark and the Netherlands, the countries possess important differences, such as population and physical terrain.

Exhibit 1.4 provides a summary of some differences in the metrics associated with each country's population and biking infrastructure.

The investment both nations continue to make in building bike supportive infrastructure has produced noticeable results in the travel behavior of its residents. For example, Copenhagen has set a goal for 2025 that 50% of all trips to work and schooling will be taken by bike. As of 2019, the share of all work and school trips taken by bike was already 44 percent (VisitDenmark, 2022). In the Netherlands, the presence of cycle tracks, traffic calming infrastructure, and laws that prioritize cyclist safety and efficiency over automobiles on many roads has resulted in extensive ownership and use of bikes in the country. It is estimated that the Dutch own more than one bike per person throughout the entire country: 23 million bikes for 17 1/2 million residents (Dutch Cycling Embassy, 2019).

Exhibit 1.4: Statistics about Denmark and The Netherlands, Geography, Population, and Cycling Infrastructure

Topic	Denmark	The Netherlands
Land Area (sq. miles)	26,367	25,813
Coastline (miles)	4,544	280
Population (2022 est.)	5,920,767	17,400,824
Urban Population (% of total pop.)	88.4%	92.9%
Miles of Cycle Paths Nationally	7,456	21,748
Total Miles Biked per Day by Population	5,000,000	25,535,802

Source: CIA World Factbook, VisitingDenmark, Denmark.dk, Bicycle Dutch, and Euronews.next

That supportive infrastructure covers a range of purposes, from highly micro-scale designs such as "slip lanes" as the students frequently observed in Odense, Denmark's third most populous city, to regional biking networks connecting cities to suburbs and countryside villages. Denmark often calls such networks "cycling superhighways." In the

Netherlands, this concept often takes the form of exclusive biking routes separated from car traffic and removes the need for cyclists to stop at intersections. A prime example is the RijnWaalpad, an 11-mile cycling highway connecting the Dutch cities of Arnhem and Nijmegen where the user will only yield or stop to traffic twice on the entire route (European Cyclists' Federation, 2017).

A sizable population in both countries choose the bicycle as their preferred form of transportation and investing in shaping a system that accommodates the bicycle has yielded numerous benefits in each society. For Denmark, they often point to the correlation between cycling and health. Biking is a form of physical activity and helps people to get additional exercise while doubling as a commute. Healthier individuals use fewer sick days, boosting productivity in the economy and reducing spending on healthcare expenses.

Advocates for cycling in Denmark frequently publish findings from studies attempting to measure the socio-economic benefits that result from higher rates of cycling compared to driving. For example, the organization State of Green noted how many studies estimated the cumulative socio-economic benefits of cycling added 1 euro for every kilometer

cycled compared to driven by car (State of Green, 2016). These per individual benefits compound to yield sizable savings of public funds and help recoup the cost of infrastructure investments to support cycling. Take the "Bicycle Snake" (or Cykelslangen) bridge in Denmark's capital city of Copenhagen, which connects a shopping mall area to the wharf located on the western side of the city (Exhibit 1.5). At a cost of 5 million euro, the city estimated the average number of trips across would support overall gains in economic benefits of 700 thousand euro per year, which would recoup the cost for building the bridge in seven years (State of Green, 2016). Initially, planners and designers expected the bridge to support approximately 12,500 cyclists each day; their estimates turned out to be off by nearly 8,000 cyclists, that is, 8,000 more cyclists using the bridge than expected in 2015 (Danish Architecture Center, 2022).

The Netherlands touts similar benefits in how cycling promotes the health of its people as well as how a cycling transportation culture promotes their economic resilience. In examining the shopping behavior of people who cycle compared to driving, studies suggest that while cyclists spend less per visit, they visit businesses far more often than individuals that mainly drive. Given the high rate



Exhibit 1.5: Cycle Serpent | Source: Jakob Munk via Wikipedia Commons

of cycling in the Netherlands, this results in cyclists spending more in the economy each year (Dutch Cycling Embassy, 2019). Part of what drives this pattern among Dutch consumers is the fact that individuals cycling more frequently spend less income on car expenses, mainly gasoline and maintenance. Those earnings can be used in other ways, including spending in the local economy. The local government is also not spending as much of its money on road maintenance given the extensive amount of biking infrastructure that reduces the amount of land used for roadways.

Reclamation of space is another vitally important component of both countries' stories in building a cycling supportive system. One of the immediate benefits of redesigning roads to include bike supportive infrastructure is how it reduces the amount of space used for automobiles and not all that space is necessary to provide for biking purposes. The land could be re-purposed for productive uses, whether supporting new housing, businesses, parks, or cultural amenities. The resulting effect was evident in every city we visited.

One surprising fact you may learn about both these societies is that the average person bikes only about a mile per day (it's estimated to be just about a mile in Denmark, and in the Netherlands, recent estimates suggest three quarters of a mile to a mile in a half). Many people can make trips without biking an extensive distance to meet their needs. This is because supporting this form of transportation is part of both culture and policy. Local, regional, and national governments support biking throughout the countries. Much of what students took away from our time here is the numerous effects supporting cycling can have on many aspects of society's present challenges: chronic health issues, rising costs of living, economic disruptions, and the persistent strain on local budgetary resources.

Many of the lessons we took from visiting these countries are not radical changes. Separating spaces between bikes and cars is not necessarily a radical idea. Yet, the compounding effects that result when more people choose to bike can be transformative, and provide wide reaching benefits for individuals, businesses, governments, and the

whole of society alike. The cities in both Denmark and the Netherlands offered examples of what can work in nearly any city on Earth and exist as models to be adapted here in the United States. Each of us were excited to take in that experience and offer our own perspective about how to apply it in our home communities.



Exhibit 1.6: Bike touring | Source: Nick Meltzer

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Exhibit 2.1: Amsterdam bridge | Source: Bridgette Bottinelli



FRAMING AND VALUES



Exhibit 2.2: Painted bikeway | Source: Bridgette Bottinelli

DESIGNING FOR HAPPINESS

AUTHOR: Payton Lagomarsino

Cities are like gardens in the way that they must be tended. Ensuring that a garden or city thrives takes time, energy, sunlight, and water. Whether a garden produces flowers depends on how the gardener adapts to changing elements in the environment. A flower can outgrow its pot or a tree branch can fall and obstruct the amount of sunlight other plants receive. A gardener must be ready to identify risks and protect its garden. Like a gardener, city officials must be ready to address risks surrounding its city (garden) and residents (flowers). City planners and policy makers should ensure that people within a place are happy and healthy. Planners should be designing for one end goal: happiness.

There are many things that contribute to a person’s happiness. How our built environment dictates our day to day lives can affect our stress, mood, health, and happiness. When government policies help create more equitable housing opportunities, many people’s overall quality of life is improved for example. Policy and effective design solutions can improve our overall happiness when implemented in tandem.

RESEARCH

To understand how design, infrastructure, and policy all contribute to a person’s happiness, we must look at how it is measured. The World Happiness Report is “a study that examines the

connections between happiness and development, all while encouraging policymakers to place more of an emphasis on the former” (World Happiness Report, 2022). This study measures different factors that contribute to a person’s overall happiness and comparatively ranks countries to see which country is generally happiest. While traditionally the success of a country is expressed through overall GDP and economic output, one could argue that the World Happiness Report is more important in examining how a country spends its money on its people. Another study, the Better Life Index,

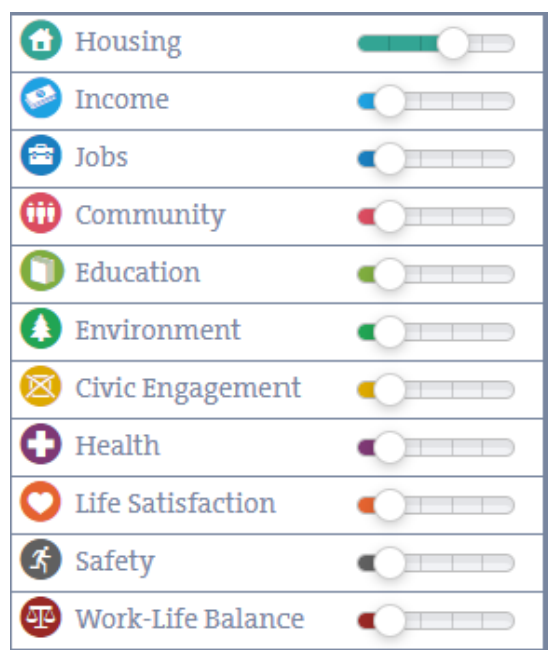


Exhibit 2.3: Quality of life factors | Source: Better Life Index

clearly outlines the different categories that are “identified as essential, in the areas of material living conditions and quality of life” (OECD Better Life Index, 2022). As seen in Exhibit 2.3, housing, income, jobs, community, education, environment, civic engagement, health, life satisfaction, safety, and work-life balance all contribute to one’s extent of happiness. Of the happiest places to live in the world, the Netherlands and Denmark both rank within the top 5.

I recently visited the Netherlands and Denmark to study bicycle infrastructure. What I observed was that the Netherlands and Denmark are much safer, healthier, and happier due to the implementation of effective bicycle infrastructure. What the infrastructure provides for a city is the ability for its citizens of any age and ability to navigate space: “And in the Netherlands, it turns out, happiness starts young. A 2013 UNICEF report rated Dutch children the happiest in the world, based on several metrics related to educational well-being, safety, and health” (World Happiness Report, 2022). It is important for a city to measure how happy its citizens are. Working to better the conditions that affect happiness would be quite effective in creating more equitable communities and encouraging trust between the government and general public.

HAPPINESS DESIGN SOLUTIONS

While in Denmark and the Netherlands, there were many observable design solutions that worked to create a more accessible, equitable, and enjoyable city. I call these ‘Happiness Design Solutions.’

Effective use of space, zoning, and planning

- Designers and planners must ensure that a space has been designed effectively. Users must be able to use a space for its intended purpose. For example, a park should be usable for what it was intended for, and if that space adapts overtime, then designers must address the space’s new need. If dogs start coming to the park, then the park should have a separate dog park with dog water fountains. Space should be given back to the public when it is deemed no longer effective and usable. Former traffic medians can be turned into places of gathering, streets can become parks and gardens.

- A space should be usable for much of the day

and for all types of weather. If it rains, a park should have a covered patio. During summer, trees should provide shade. Furthermore, there should be an opportunity for the space to be changed or adapted based on if a community wants to make a change on their own or if the space is changed to address new community needs. A space should be well lit in the evening and early morning and accessible to its user group. For example, in the U.S. many parks are only designed for children, yet are not made to be accessible for children to walk or bike to. Often parks are located away from homes and along busy roads. How young children are supposed to navigate their way to a park is unknown to me. There should be protected bike paths, bike lights at intersections, and bicycle parking around and in parks for its users. Lastly, spaces should be located near ‘like’ activities; parks and schools should be in and around residential areas.

Proximity to and accessibility of critical resources

- As stated previously, spaces should be located near ‘like’ activities. People should be able to access their day to day needs within a short walk, bike ride, bus ride, etc. Providing alternative routes and modes of transportation to get places is required of a city. There should be no gaps in transportation networks in order to increase accessibility and most importantly safety. Building an effective transportation network encourages individual freedom and independence. Designers should seek to create a network that reduces people’s time spent commuting to work, school, and accessing critical resources.

Public Health

- Planners are supposed to prioritize public health, both mental and physical. To improve the public’s overall health, there are many things that designers can do. Just increasing a community’s access to green spaces, hiking, biking and walking trails, and public parks is just the start. Diversifying transportation modes can lead to less pollution. When cars are taken off the road and people choose to take trains, buses, trams, and their bikes, less traffic exists and fewer byproducts of cars are emitted. Access to safe recreational opportunities can not only increase physical wellbeing, but also mental wellbeing. These recreational places can be parks, swimming pools, climbing walls, etc.



Exhibit 2.4: Park in Copenhagen | Source: Bridgette Bottinelli

Safety

- There are many factors that make a community feel safe. People have the right to navigate their communities without fear of losing their life or their children. They should trust that all has been done to make a space safe to travel through. Roads should be safe to cross with implementation of pedestrian crosswalks and yield lights. Reducing road speeds should be pursued in order to increase safety for pedestrians and cyclists. The installation of protected bike and pedestrian lanes should be considered on highly trafficked roads.

Engagement and connectivity with a community

- There should be public transit offered to residents when city council meetings take place. Furthermore, there should be a virtual option provided. Public transportation should connect residents with public resources such as schools, libraries, and community centers. Public resources should be located near neighborhoods and be accessible by walking and biking.

PUBLIC VS. PRIVATE SOLUTIONS

Happiness solutions should either be free, or close to free. Yet often they are not. Navigating life comes at a price. Owning a car is expensive, but it is often essential to own one to live your life. Traveling from city to city is not easy due to the lack of rail infrastructure in the U.S. If there is a train option, the network is not effective, and the

ticket is quite expensive. The only option to travel within the U.S. is via car or airplane. Cities are too far away from each other not to provide public transit from each other. Yet currently there is little to no infrastructure connecting cities and people to each other. Furthermore, in the U.S. happiness has been privatized because free or cheap recreational opportunities are not available to the public. Recreational parks like Disneyland% and Six Flags% are destination places and are not intended to be accessed only by the communities they reside in. Communities should seek to provide low-cost activities that are accessible to its residents.

SUMMARY

The Happiness Solutions listed above illustrate all the ways in which a community's wellbeing can be improved. People deserve to be happy and we have the ability to make that happen, to make lives better. Cities are meant to be changed, and these design solutions, if effectively implemented, will make community members more happy and better off.



Exhibit 2.5: Park trampolines | Source: Bridgette Bottinelli



Exhibit 2.6: Bike parking in Copenhagen | Source: Bridgette Bottinelli

STREETS ARE PUBLIC SPACES

AUTHOR: Rachel Hess

Talking to planners in the U.S. is different than talking to planners in Denmark and the Netherlands. The word “street” means something different to the respective parties. When an American refers to the “street,” they generally mean the space between buildings that stores and moves cars. When Danes or Dutch planners say street, they mean the space between buildings where people move, gather, play, rest, etc. At the end of our bike program, one thing is clear to me. When talking about streets, we must explicitly speak of them as public spaces, as how the Danish and Dutch see them. The word “street” means something different to both parties because in the U.S., our streets are not public spaces, although they are technically the largest public asset in any municipality. We should avoid any ambiguity when talking with other American planners and define “street” right off the bat. Without reframing what a street is supposed to be and how it serves the public, people may have different conceptions of what a street means to them.

Our streets used to be public spaces. Prior to the widespread adoption of the automobile, streets were shared spaces, used equally by all people using different transportation modes. Today, most space in the public right-of-way is dedicated to the movement and storage of cars. Our communities have adapted streets’ design by most households buying cars in order to comfortably navigate from their homes to meet their needs (Hess, 2022).



BEFORE
Exhibit 2.7: S.W. 3rd Ave. and Washington St., Portland, OR., 1905
Source: Vintage Everyday



AFTER
Exhibit 2.8: S.W. 3rd Ave. and Washington St., Portland, OR., 2019
Source: Google Maps Street View

At the street level, the public right-of-way that had once been equally shared by transport modes, became dominated by private automobiles (Exhibits 2.7 and 2.8). Shifting the allocation of public space

from shared space to car dominant was no accident. Between 1910 and 1920, over 200,000 deaths were attributed to automobiles, where a majority of the deaths were pedestrians struck by automobiles and half were children (Norton, 2008). Cars were feared and despised by most people during this period. Community members banded together in response to protect the street for shared use by all. However, drivers and automobile manufacturers waged a swift and comprehensive campaign to commandeer the public right-of-way for automobile use. The American Automobile Association called the movement "Motordom." The campaign aimed to convince U.S. society that to achieve street safety, pedestrians, not cars, needed to be controlled. Charles Hayes, President of the Chicago Motor Club, told friends that the solution to allocating more space to cars was to persuade people that "the streets are made for vehicles to run upon" (Thompson, 2014). Increasingly, when accidents occurred, the blame was placed on pedestrians not car drivers. "Jaywalking" became a crime in 1923 when the Automobile Club of Southern California paid police to erect signs prohibiting it, and by 1925, "jaywalkers" could be arrested in Washington State and sentenced to join a "Careful Walkers Club." Throughout the next century, cities made room for cars, turning public rights-of-way (which had once been truly public and shared by all mode users) into spaces where cars were superior and other modes were infrequent guests. This car dominant public right-of-way allocation puts a financial and social burden on lower-income individuals, people living with disabilities, those who are too young to drive, and those who may no longer be able to drive.

Speakers from the companies Copenhagenize and Gehl spoke of streets differently, although subtly. They first declared a hierarchy of street users that they identify when designing a public right-of-way. First they think of pedestrians. Who is a pedestrian? What does a pedestrian need from their street to make walking along the street an enjoyable experience? Next, they think of cyclists. What does a cyclist need to make biking easy, quick, cheap, and enjoyable? Then, they think of ambulances and fire trucks. What do these agencies need to be able to access the right-of-way? How can a consultant best work with these agencies to make sure their needs are met while protecting the

beneficial experience of pedestrians and cyclists? Finally, wayyyyyyy down the line... the agency may think about private car access. The best experience for the pedestrian and cyclist ultimately will be the best experience for the car driver. More people biking and walking will mean fewer private cars on the road, less congestion, and all around better accessibility for every mode.

EXAMPLES OF EUROPEAN STREETS SERVING THE PUBLIC

COPENHAGEN

Copenhagen shut down many streets to cars altogether. The decision effectively created places where people could travel through and gather. Walking and biking and simply being on streets in this city feels comfortable and welcoming. People of all incomes, abilities and ages can use this street independently and inexpensively (Exhibits 2.9 and 2.10).



Exhibit 2.9: Strøget, Central Copenhagen
Source: Global Designing Cities Initiative



Exhibit 2.10: Strøget, Central Copenhagen
Source: Global Designing Cities Initiative

Another great instance of reclaiming the public right-of-way for the public from Copenhagen is a park I came across (shown in Exhibit 2.15). Sønder Boulevard used to be a thoroughfare for cars but the city transformed it into a park with so many different kinds of amenities. There is a kids park and picnic table area where on weekends the neighborhood holds yard sales (see Exhibit 2.11 and 2.12). There were ping pong tables, soccer and basketball courts, and pedestrian paths, and so much more packed into this skinny park that stretched for over five blocks! This is just really simple but impressive, people first, public right-of-way allocation.



Exhibit 2.11: Kids park | Source: Rachel Hess



Exhibit 2.12: Weekly neighborhood yard sale in the park | Source: Rachel Hess



Exhibit 2.13: Ping pong table and basketball court | Source: Rachel Hess



Exhibit 2.14: Soccer pitch | Source: Rachel Hess



Exhibit 2.15: Sønder Boulevard | Source: Tony Webster

ODENSE

Odense really impressed me in how they used social infrastructure to reclaim the right-of-way for the public. Over 40 years, the city rebuilt a neighborhood over a huge road that they built during the peak of the automobile era. Odense built slender winding streets with bricks and cobblestones, trees, and plenty of benches for people to sit, relax, and enjoy being in public. I loved how the city constructed an open plaza atop a site that once had existed as a giant road for only cars. And they provide purposeful places for people to enjoy public and cultural events, which has to be amazing for local businesses enjoying the extensive activity around the city!

My favorite example in Odense was how this elementary school claimed the street in front of their building as a playground simply by putting social infrastructure in it like ping pong tables, paint on the ground, and play structures (See Exhibit 2.16).



Exhibit 2.16: Elementary school in Odense reclaiming the public right-of-way as a playground | Source: Rachel Hess



Exhibit 2.17: Street near H.C. Andersen Museum
Source: Rachel Hess



Exhibit 2.18: Neighborhood by H. C. Andersen Museum | Source: Rachel Hess

UTRECHT

Finally in Utrecht, you'll see a "before" picture (Exhibit 2.19) of a large car intersection which the neighborhood petitioned to be redesigned into a more easily navigable area by bikes and pedestrians (Exhibit 2.20). The city did so by removing car space and installing a plaza. They used brick to signal that pedestrians have more space and naturally cars move more slowly. They used strategically placed trees and planter boxes to calm car traffic and reclaim this space for public use instead of for car use and storage.

All of these examples show how streets can serve a greater purpose than just moving and storing cars. Through talking and thinking about the "street" as the "public right-of-way," we can start to reframe what a street's function should truly be.



Exhibit 2.19: Utrecht car-friendly street
Source: Bridgette Bottinelli



Exhibit 2.20: Utrecht pedestrian-friendly street | Source: Bridgette Bottinelli



Exhibit 2.21: Protected bike path in the Netherlands | Source: Bridgette Bottinelli

(CYCLE) USER-CENTERED DESIGN

AUTHOR: Anisha Govindankutty

Living in a dense city can be overwhelming for most people. The ease of getting from one place to another can make or break the decision of continuing to live there. Public transportation is a luxury in most American cities. Owning a car can be expensive and add stress and anxiety to a cost-burdened household. Most often people don't have a choice – they are either waiting half their day for a bus to come and take them to places or pay exorbitant prices for fuel, maintenance, and insurance of a car. Not to mention, insurance and other additional costs. Being a student, it makes a lot more sense for me to bike to places. Sometimes when the bike routes disappear abruptly or start back up in the middle of nowhere, I wonder how these routes were designed. Did someone run out of white paint to draw the demarcating line? Did someone decide that that stretch of road did not deserve a bike lane? Many such questions bothered me until I had a chance to bike around in Denmark and the Netherlands.

The difference was glaringly obvious. I could easily bike around in these countries without worrying about the lane abruptly ending, traffic lights or signage suddenly stopping for the bike lanes, or speed limits increasing. I did not have to worry about how to get through a roundabout or how to take a left turn. It was already built into the design of the space. Things were clearly laid for all traffic

users at all times. What made these experiences different? Why was the urban design different on this side of the world? These are the questions I tried to answer and explain through this report. The most critical aspect that set these countries apart was that they focused on the 'who' rather than the 'what'. They are designed for the users (people) on the street and their needs rather than designed for a machine. I want to shine a light on the everyday person's experience riding a bike on a route. The ease with which someone can get their daily tasks done without compromising their time, energy, or money in an urban setting adds to the quality of life.

This chapter looks at how the streets and the urban fabric are designed for the user and their natural intuition. In the following sections, I elaborate on User-Centered Design, its importance, and the framework behind how it is implemented and measured. I also look at a few examples from both Denmark and the Netherlands to compare, draw similarities, and talk about my experience as a fellow user. I conclude with discussions and other takeaways that can help shift our thinking to making the urban fabric fit the people using it and meet their short- and long-term needs.

INTRODUCTION TO DENMARK AND THE NETHERLANDS BIKING CULTURE

BICYCLE TRANSPORTATION IN DENMARK

In Denmark, bicycles are used for pleasure, commuting, transportation of goods, and family travel. It is often easier to commute by bike than by car in big cities. People bike in all types of weather and at all times of the day. With its flat terrain, the country offers favorable cycling conditions. It is a socially accepted mode of daily transportation to work and is woven into every part of city life. This is portrayed in how drivers are constantly aware of cyclists, especially on roads without bike lanes. Bikes are not an afterthought; they are integrated into urban planning. Biking is for everyone. There is no divide when people share a lane to bike from one place to another. An unbiased political will to make biking accessible to all is driven by the need to make biking comfortable, and secure, and most importantly to create a climate where people would want to bike. Over the past decade the focus areas for the Cycling Embassy of Denmark have been:

- Increase cycling to work
- Decrease the risk of being injured
- Increase the feeling of security and satisfaction
- Increase cycling traveling speed
- Improve cycle track comfort (least number of surfaces as unsatisfactory)

BICYCLE TRANSPORTATION IN THE NETHERLANDS

With striking red asphalt pavements, the bike paths in the Netherlands play a significant role in connecting the 41.5 km² of land. There are 23 million bikes in the Netherlands, 1.3 bikes per capita! One of the main reasons is that the country has made cycling incredibly easy and accessible with 32,000 km of dedicated bike lanes even on highways and roundabouts. The bike lanes in the Netherlands are explicitly built to connect to destinations that people need to get to. They are

the fastest and most convenient option to travel across the country. They are always designed and built to the highest standards - 2 meters wide in each direction without any barriers or sharp turns. This makes them extremely safe to use. Bicycle-only roads in the country make it worthwhile to ride a bike and enjoy the view. These are safe and protected from busy traffic - a famous Dutch approach to separate car routes from bike routes. A will to change came from citizens, decision-makers, and planners to change car-centric policies to alternative transport. Cycling is now an integral part of the transportation policies in the country.

"There are 23 million bikes in the Netherlands ... with 32,000 km of dedicated bike lanes."

One of the main differences in the biking culture in both these countries is the bike lane. In Denmark, the lanes are separated with curbs and there are rules and regulations that need to be thoroughly followed. But in the Netherlands, anything goes. There are mixed streets where cars and bikes share the space, there are no strict rules to be followed (just be respectful to others), and often any bike lane is two-way. This can seem chaotic and unsafe to outsiders, but the Dutch seem to find order and sense in that chaos.



Exhibit 2.22: Shared bike and car lane in the Netherlands
Source: Bridgette Bottinelli

USER-CENTERED DESIGN

User-centered design in an iterative design process in which designers focus on the users and their needs in each phase of the process. User-centered design tries to optimize the spaces with how users can, want to, and need to use these spaces rather than forcing the users to change their behavior to accommodate architectural spaces or designing dysfunctional spaces (El-Halawany, 2018). Spatial layout planning, especially circulation and traffic planning designed for better and safer user experience is one of the most complicated and challenging design problems. It has various parameters that should be tried and tested before implementation. Designers usually involve users throughout the entire design process to ensure that the product or the experience will meet the user’s objectives, requirements, and take into account user’s feedback on the product (Viebrock, 2022). The designers regularly adjust and adapt the product to meet the continually changing needs of the user. Thus, the end-users can use the product over the course of their life knowing it is meant for meeting their needs and designed for them.

For this chapter, I have limited user-centered design to apply to cyclists and everyday residents using the bike lanes to get to places. In that case, the **USER** is the everyday cyclist, the **INTERFACE** is the bike/cycle lane, the **PRODUCT** is the bicycle user experience, and the **USABILITY** is looking at the effectiveness, efficiency, and satisfaction in people carrying out their daily tasks as desired.

WHY IS IT IMPORTANT?

*"Good design is actually a lot harder to notice than poor design, in part because good design fit our needs so well that the design is invisible."
(Norman, 2013)*

The goal of this design process is to ensure that the end-users do not have to change their behaviors, intuition, or expectations to fit the product in their daily lives. It is a reliable tool to help them achieve their daily tasks. User-centered design can save time, and effort and can greatly determine the success or failure of a project (Saskatchewan, 2022). From the user’s perspective, it is the difference between completing a task and not. From the designer’s perspective, it is the success or failure of a project. From the sponsor’s perspective, it saves time, cuts down costs, improves satisfaction, and ultimately saves money.

WHY THE USER?

Thinking from the user’s perspective means researching, designing, building, and iterating designs that never make the user think about what they need to do next. Humanizing the design process helps gain a better understanding and empathy for the end user. It requires the designer to put aside their biases and opinions to solve the user’s needs at each step. In most cases, the users already know what their needs are, and utilizing that to save time on the research ultimately benefits the project. User-centered design is often interchangeably used with human-centered design,

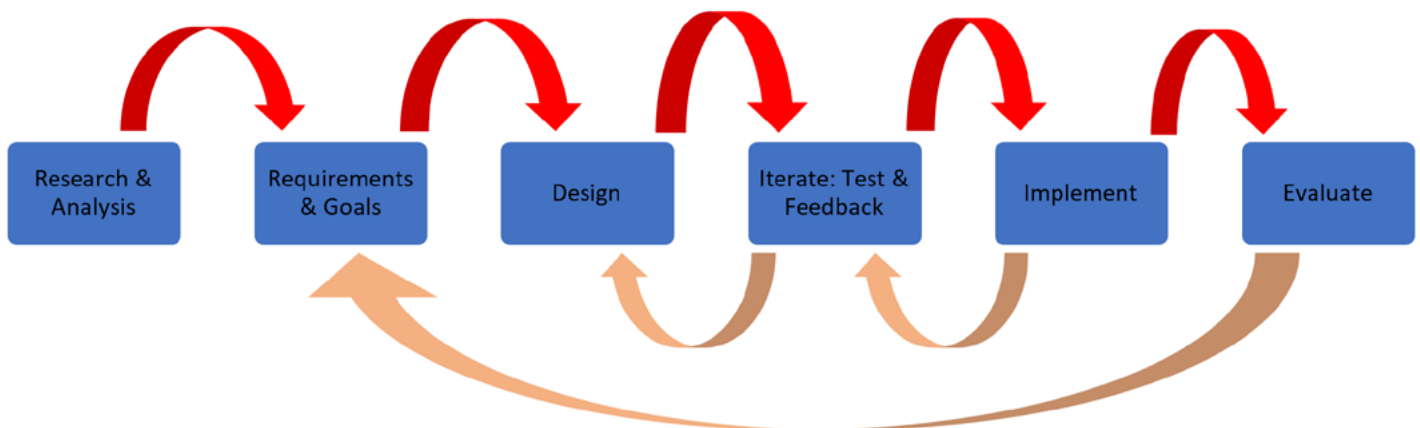


Exhibit 2.23: User-centered design process | Source: Anisha Govindankutty

but there is a subtle difference between the two. All users are humans here, but not all humans are users. User-centered design requires deeper analysis of users – their particular interests, habits, requirements, and needs. It takes into account age, gender, social status, professional background, expectations, demands, and various other important things that vary from project to project. It is about deep research on users' habits, from their interactions with the product to their vision of how the product should look and behave (Novoselteva, 2022). This is implemented through the personas' method of conceptualizing. User personas are fictitious but realistic representations of users that are created for the designer and the project team to visualize better. But to create such personas, real data is collected from people which is then analyzed to fit the end user. Each persona has a different personality and usually represents a user group. They are usually someone you can relate to from everyday life – a mother, father, friend, sister, grandpa, or grandma – someone who is always getting to places trying to get their daily tasks done with a relatable schedule. The more specific the personas, the more effective they are as a design tool (Zerlinda, 2019).

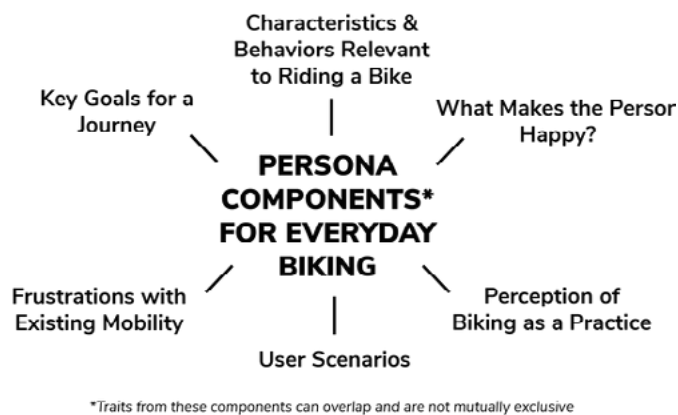


Exhibit 2.24 Persona Components for Everyday Biking
Source: BUX

HOW?

User-centered design is **empathetic** (understanding the user and their needs), **iterative** (combination of research, brainstorming ideas, adapting), and **interdisciplinary** (stakeholders and users, planners, designers, sociologists, economists).

Design Prototypes: Use simple sketches, mock-ups, trails for the design. Don't make the user think. Collect feedback from the users early and

continuously. Brainstorm with the users until requirements are met.

Adapt: Improve the design based on user feedback. The iterative design includes a process of design, evaluation, and redesign. Evaluation should be early and frequent.

Measure: Metrics are crucial to an effective and long-lasting design. It is about understanding what needs to be improved, where to focus resources, and what to redesign to meet maximum user needs. Here, it is figuring out how the experience of riding a bike on the street fits into the daily lives of the users.

The end goal of this process is to design a street that takes into account people's backgrounds, needs, and desires and seamlessly weaving into their lives.

*"An everyday person should be able to ride a bike on the street without modifications to his/her normal life."
(BUX, 2022)*

The essential elements of user-centered design are:

Visibility: High-contrast, color-blind friendly; users should be able to see what and how they can use it

Accessibility: Users should be able to find information easily and quickly

Legibility: Text and images should be easy to read

Language: Short sentences and phrases; universal language – infographics are preferred

The user requirements are defined through methods like focus groups, prototyping, testing, research, participatory design, questionnaires, interviews, experience mapping, and so on.

What is user-centered design?

User-centered design is an iterative design process in which designers focus on the users and their needs in each phase of the process.

EXAMPLES FROM DENMARK

The bike lanes are separated from motorways and pedestrian sidewalks through different paving materials (See Exhibit 2.27). These are **visually consistent** and **accessible** for all ages. It is **easy to use** and gives space for all types of users. There is no disruption to their daily lives by using this bike lane. There is enough space for two cyclists to pass by – someone who is slowing down is on the right and someone else who is biking fast can pass by without stopping. The users need not adjust themselves to the street – there is no need for them to wear reflective clothing or alter anything about their riding experience to survive being around motor vehicles – ultimate **user control**.

The 'Green Path' that starts from the city center and radially goes out to the outskirts is a great example of user-centered design (See Exhibit 2.25). These are daily commuter routes and to welcome and increase the efficiency of getting to the city from the suburbs, these green routes were created. If the rider maintains a speed of 20km/h, they get the green light to their destination. This means the rider does not have to stop for motor vehicles and get to their destination faster than someone in a car. These

routes sometimes run past gardens, parks, and housing blocks to **enrich the user experience**.

The Kissing Bridge in Exhibit 2.27 was **redesigned to meet the user's needs** of enjoying the view of the canal and leisurely strolling through with friends and family. As an added bonus it also attracts tourists. The bike lane here is wide enough for slow cyclists looking to enjoy the view as well as accommodate daily commuters biking to their destination.

The shared use of space between the daily bike commuters and passengers boarding and deboarding the bus is not an ideal situation in any sense, but the design of the bike lane and the pedestrian sidewalk allows **space for forgiveness** (See Exhibit 2.26). The passengers don't have to worry about being run over by cars or being yelled at by a racing cyclist to get out of the way. The cyclists use a bell to let the passengers on the lane know and they moved to make space for them to pass. This design **supports various needs and activities** happening simultaneously and takes care of them efficiently. The clear communication between users makes the method and practice work.



Exhibit 2.25: Green path



Exhibit 2.26: Crowded bike lane



Exhibit 2.27: Kissing Bridge bike path

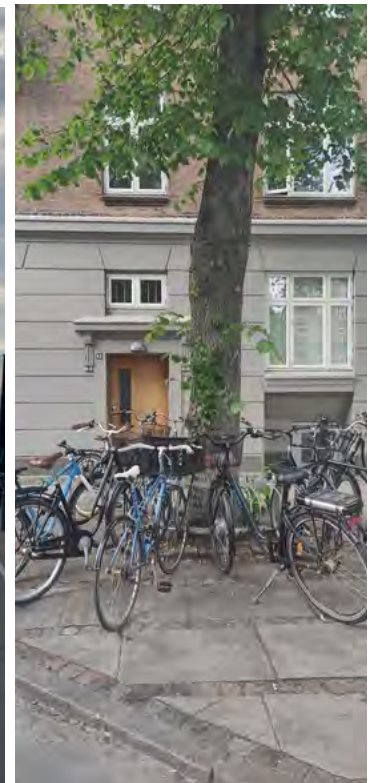


Exhibit 2.28: Bike parking
Source: Anisha Govindankutty



Exhibit 2.29: Bikeway | Source: Bridgette Bottinelli

Bike parking in Copenhagen is designed to meet the number of users at any given time and most often the officials had to get creative to increase the number of parking spaces. This parking around the tree is an example of a **cost-benefit** aspect of user-centered design (See Exhibit 2.28). Space around the existing tree is used to have a radial parking space. This caters to the people coming to the park nearby and is a fun attraction for the neighborhood and kids. It is **safe, functional, and reliable** – meeting people’s basic lower needs and goes on to provide **enjoyment** in the activity (BUX, 2022).

Often when smaller roads meet with a bigger road (usually shared between cars and bikes), there is a significant difference in pavement and levels to alert the car driver to slow down. This is **consistent** with

visual cues of bollards on either side to make sure the driver knows where they are going and not just blindly speeding past. These pavers show this is a space for slower-moving traffic like pedestrians and cyclists and the cars should give them a priority. No extra signals or signage are necessary to convey this message – the design simply speaks for itself. Trees lining either side of the road are also a visual cue to slow down or to notify people that you are entering a residential area. Along with the different pavers to highlight the difference in roads meeting, this is a good example of user-centered design.

One of the best ways to heighten the bike riding experience is the slip-lanes – free right turns for bikes (as compared to the free right turn for cars). This was designed to reduce the bike traffic at the intersection. Those turning right could easily ‘slip and ride through’ intersections without worrying for their **safety**. Meanwhile, the cars have to take ninety-degree turns and stop the traffic. These bike lanes are also additionally **protected** with curbs and levels.

Another design element for the bike users is the inclined trashcans as seen in Exhibit 2.30. This makes it **easy** for someone on their bikes to throw trash without stopping and getting off the bike to dispose of any trash.

Exhibit 2.30: Bike trash can
Source: Anisha GovindankuttyExhibit 2.31: Tree-lined road
Source: Anisha Govindankutty

Exhibit 2.32: Bikeway | Source: Anisha Govindankutty

EXAMPLES FROM THE NETHERLANDS

A prominent and famous sign in the Netherlands where cyclists get priority on shared roads (See Exhibit 2.33). This is designed to be **visible** (with enough contrast), **accessible, legible, consistent, and easy to understand** even with a language barrier (infographics). This helps users better understand how they fit into the street system and helps them **shape their experience** on the street – giving them more **user control**.



Exhibit 2.33: Cyclist priority
Source: Anisha Govindankutty

The Netherlands is known for using red color to demarcate the bike lanes from other paths. Yet, in some other cases, they also follow user patterns or look at how users move through space. This is important in navigating intersections and crossings. It may seem a little chaotic and unsafe at first, but the locals swear by it – the Dutch are known for their sense of calm in the chaos. It is an example of how the users' needs change with culture and location. I rarely saw this design in Denmark.

I believe that the Danes would feel unprotected in the chaos. But the Dutch find it **safe, secure, functional, and reliable**.

Another Dutch feature is the Dutch roundabout (See Exhibit 2.34). [This video](#) captures a usual roundabout with various traffic. It is designed to reduce traffic speed much more than a traditional roundabout to create a safer environment for biking and walking. It is also efficient and functional. Cyclists have priority and no unnecessary signage will distract the user from riding.

The traffic signals for cyclists are different from the ones for cars and other vehicles. This means the buttons are closer in height to someone on a bike. There is usually a countdown timer for signal change which helps users get ready to be on the move. These signals often switch a few seconds ahead of the motor vehicle signals allowing cyclists to move first and get them out of the blind spots of drivers. This feature makes signaling easy to use, convenient, legible, and safe.

The bike lanes in the Netherlands are paved red with white markings on them, which makes them legible and accessible to all. The concrete tiles create a barrier between the bike lanes and pedestrian sidewalks. These are cobblestoned consistent with the charm of the rest of the country's built environment. The red paved bike lanes are consistent which makes users never feel lost even when signs are not present.



Exhibit 2.34: Dutch roundabout with bi-directional cycling lanes | Source: Frank van Caspel

(CYCLE) USER-CENTERED DESIGN SUMMARY

So why does user-centered design matter?

Simply put, it enhances and improves the quality of life. Living in a city designed and built for the people matters a lot when it comes to the smallest of details. Not having to think at every step and trying to be safe at all times can take a toll on mental health. Who should pay attention? Students, designers, planners, policy-makers, and frankly, everyone! We all have a part in promoting user-centered design in our urban setting. It is not a cultural or political issue. It is a humanity issue, an everyday life issue. This chapter aims to help people to start the conversation about user-centered design in their cities. Every problem is different and unique and will need a collaborative spirit in people to come together and tackle the current issues most U.S. cities face. It is time to shift our thinking and think of sustainable long-term solutions. The sooner people in power realize that fact, the sooner our lives will change for the better. Because if not for the people, who are we designing and planning it all for?



Exhibit 2.35: Dutch bike lane | Source: Bridgette Bottinelli



Exhibit 2.36: Pedestrian street | Source: Ann Moorhead

UNIVERSAL DESIGN, ACCESSIBLE URBAN SPACES, AND TRANSPORTATION

AUTHOR: Ann Moorhead

Many things can inhibit someone's ability to move about their world. Impaired or lost hearing and/or vision, poor balance or muscle control, the need for an assisting apparatus such as a wheelchair or cane, along with other barriers can diminish how a person experiences the space around them. Urban and transportation planners should design for all people, a perspective often called universal design, which is the design of buildings, spaces, or things that allow people of all ages and abilities to use them. Perhaps not every private residence needs universal design, but a city should be accessible enough that a person with any level of ability would be able to meet their daily needs and participate in civic and social society both as comfortably and independently as possible. For example, if someone is capable of living on their own, they should also be capable of traveling to work, purchasing affordable food options, and participating in recreational and social activities on their own. In an ideal world, every person would enjoy a high level of accessibility from their home to any destination they are visiting and back. Furthermore, the issue cannot just be pushed aside as a problem for a minority population to solve and advocate for solutions all on their own. Disabled is a label anyone could gain at any time, and which many people will naturally receive as they age.

A LOOK AT POLICY

Many countries have implemented policies and objectives that include goals to make cities inclusive for people of all abilities. In fact, most disability policies also focus heavily on discrimination, legal rights, and other important aspects of increasing equality for people living with disabilities. However, this chapter will focus on physical requirements, such as building codes, transportation requirements, and other aspects that directly impact mobility and related autonomy. Policies applied to building codes are important because even if transportation is accessible, just one step up in front of the grocery store or bakery can make life difficult for someone in a wheelchair; one rotating door entrance to scare a person with balance issues; one unnavigable floor plan to complicate moving for someone who is blind. Small details matter. The first and last step of the trip matter. The good news is those barriers are not too hard to fix.

THE UNITED STATES

The U.S. Congress passed the Americans with Disabilities Act (ADA) in 1990 which, among other things, declared that people living with disabilities would be guaranteed equal opportunity to "participate in the mainstream of American life" (United States Department of Justice Civil Rights

Division). The ADA is very strict on enforcing building codes, which ensure a minimum standard of accessibility to all places of employment, places offering goods and/or services, and public places for any new or significantly renovated buildings and spaces. That means ramps and elevators, braille, and many other accommodations are built into the urban fabric. The ADA is far from perfect, but it is nonetheless quite a strong policy when it comes to physical requirements.

DENMARK

Denmark produces a disability policy action plan. Last published in 2013, the plan is based on the requirements set forth by the United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD), which Denmark ratified in 2009. The CRPD similarly describes goals for equality. For example, Vision 2 of Denmark's action plan states, "the government will work for a society that supports people with disabilities in achieving increased autonomy and responsibility for their own lives" and explicitly refers to reasonable accommodation and universal design in transportation solutions and new construction (Disability Policy Action Plan, 2013, p. 7). Their plan includes goals to increase accessibility in and around social housing, increased accessibility to buildings (including a greater focus on building regulations), and accessible solutions to offer optimum mobility for all users, with an emphasis on trains, infrastructure, metro, and light rails (Disability Action Plan, 2013, p. 54-58). Despite the benefits, the plan still contains several weaknesses. First, it was only enacted nine years ago and building codes created due to this policy would have only taken effect on development built after that time. Denmark is an old country, with a lot of old cities and old buildings built far before any concept of universal design existed. Retrofitting these buildings would often be difficult. And second, Denmark, probably because of all these historic areas, has placed an emphasis on preserving historic character and aesthetics in their buildings. It shows in the policy that the emphasis often falls at odds with promoting building codes addressing accessibility.

THE NETHERLANDS

The Netherlands' disability policy is much more scattered (in that locating any disability-focused

policy has proved difficult and locating any comprehensive policy impossible). The Netherlands also ratified the UN CRPD, though later in the summer of 2016, nine years after signing (Nwanazia, 2021). While the Netherlands has a track record for supporting people with disabilities (for example, people with disabilities can apply for "an equipment or support allowance" (Ministerie van Algemene Zaken, 2022) it lacks inclusivity. Providing "special" options for those with disabilities or providing monetary support falls short of the autonomy and independence given by universal design and accessible cities.

CONCLUSIONS ABOUT POLICY

As far as building accessibility goes, the U.S. is still the most successful but owes it to the extra two decades of having an explicit disability-related policy and the fact that everything in the U.S. is newer, so more buildings have been built that follow the accessibility regulations. Additionally, more recently constructed buildings and lack of a strong historic character in many large U.S. cities may have helped as it relates to some changes such as retrofitting streets or adding elevators. Those idyllic cobblestone sidewalks are a bit harder to make accessible and the tall buildings with barely one cramped staircase do not have much room for an elevator. Time, however, will allow these countries to add quite a bit of universal design. Denmark already has a direction, and the Netherlands is looking toward such a future as well, having ratified the UN CRPD. Transportation accessibility, however, has already been a focus of all three countries, and to a fair amount of success.

TRANSPORTATION ACCESSIBILITY: CAR, TRANSIT, BIKE, AND PEDESTRIANS

Cars have often been considered the most accessible form of transportation, especially in the United States. After all, you can get in a car from home and drive it clear up to an accessible parking spot at your destination. Driving requires no physical fitness, and many alterations can be made to the vehicle to accommodate physical disabilities. Despite the fact that many people cannot drive due to age or certain disabilities, both physical and

mental, in my opinion, the high use of cars and their cultural popularity causes many prevailing arguments around transportation accessibility advocate for protecting space for cars.

Biking in Denmark and the Netherlands is a lot more popular than in the U.S. and reveals different challenges and possibilities for accessibility than can be seen in the U.S. Bikes require a level of physical fitness and mobility that cars do not, but modern technology is changing that. More available and affordable electric bikes, or electric-assisted bikes, are becoming available which could allow people to go great distances without requiring the physical ability. Bikes, like cars, can also be made accessible in many ways and there are many, many bikes that would allow someone with various physical disabilities or fitness levels to ride them. Furthermore, anywhere a bike could go, a regular or motorized wheelchair could go, too. In a space where bike infrastructure is the most common, the bike infrastructure is also going to be the most comfortable and the most front and center. This means that folks using mobility assistance such as a wheelchair get to benefit from also using facilities central to the design of public spaces. While the U.S. may, perhaps, make more sidewalks wheelchair accessible than the Netherlands, it would be unable to beat the sheer amount of bike infrastructure in the Netherlands that wheelchairs can use.



Exhibit 2.37: Motorized scooter in bike lane
Source: Ann Moorhead

Sharing space can be a concern in the U.S., since bikes often move much faster than a wheelchair, would they have issues sharing the space? The Dutch do not seem to share such concerns though. Shared spaces are everywhere throughout the Netherlands. Navigating shared spaces is based on eye contact and body language rather than strict rules and rights of way; it is very fluid and flexible.



Exhibit 2.38: Shared uses | Source: Ann Moorhead

Maintaining this approach requires high levels of situational awareness and also allows those in this space to be accommodating of others using it, including someone using a wheelchair or someone who is blind. Shared spaces are fascinating, but they can also be terrifying.

Disabilities can also impact your ability to interact with other users. Being in a wheelchair may not be as fast as a bike while also being much wider, requiring others to move around you. Having balance issues or moving at a slow speed can reduce your reflex time and prevent you from responding properly to a bike coming your way. Vision loss would make it impossible for you to participate in the eye-contact-based communication shared spaces depend on. One speaker from the Netherlands explained that people can see the wheelchair or the white cane and can respond accordingly. I have seen disabled people use the spaces in Netherlands without apparent fear or discomfort, so it appears to work. One reason for this may be a cultural aspect: the strong concept of trust in both Denmark and the Netherlands. People

are so trusting as to leave a baby unattended to get some fresh air. In these countries, trust is part of the culture. That trust may also be what allows disabled people to feel comfortable relying on others for their safety.

Ultimately shared spaces are fascinating for the possibilities they open for people using different modes since they can adapt exceedingly well to universal design based on the concept that, in them, all people use the space freely and as they require while keeping an eye on everyone else, especially on the less protected users. However, I expect shared spaces would serve a limited function in the U.S. due to the absence of cultural trust. Gradually working toward building situational awareness among road users and sharing space between bikes and other ramp users are both very valuable and implementable in the U.S. today. But if we wish to emulate other aspects of the Netherlands shared space, we would be quite a ways from being able to do so effectively from this perspective.

Denmark (and more specifically Copenhagen) may have a style of bike infrastructure that is more applicable to the U.S. since it separates the modes of travel and is based on easier fixes that build off basic road configurations. As far as shared spaces go, however, I rarely saw non-bike users on the bikes, particularly on busy roads and the bike lanes are smaller and less useful as a shared space for disabilities. In Denmark's case, where the modes are separated, disabled people seem to keep to pedestrian areas, which were less comfortable to use than in the U.S. due to the uneven ground, rough cobblestone, and historical sidewalks that did not meet accessibility standards. Additionally, while the restaurants and parked bikes lining the sidewalks are cool to see, they would make it difficult for anyone with visual impairment or mobility and balance issues to navigate and they often did not leave good clearance for a wheelchair to get by around them.

Still, increasing bike infrastructure and biking to reduce road traffic could benefit people with disabilities who use a car. For the U.S., reducing car traffic by diverting people to biking could similarly help those people who require a car to move around. One other thing that Denmark

was very creative with was outdoor navigation features for the blind and vision impaired. While the Netherlands used standard white pavers similar to the U.S., Denmark had a number of creative and attractive additions to their cityscape. Two of the most interesting were the patterns along all the sidewalks in Copenhagen, especially where it shifted into the pedestrian mall, and in Odense in front of driveways and alleyways where the brick pattern would change to show the possible presence of car traffic (Exhibit 2.39).



Exhibit 2.39: Change in brick pattern | Source: Ann Moorhead

TAKEAWAYS FOR THE U.S.

Increase biking and biking infrastructure

- Biking is very accessible and a more healthy, affordable, and environmentally friendly option than cars.
- Moving people from cars to bikes will reduce driving competition for people who need to drive and would not remove this accessible option in the U.S. for those who need it.

Shared space

- Making bike lanes and ramps synonymous to increase the number of accessible pathways.
- Introduce shared spaces in low-speed, low-risk areas to increase situational awareness of road users and encourage people to become comfortable with watching out for other users, regardless of transportation mode or physical ability.
- Creative integration of universal design: Interesting and useful navigation features, fascinating ramps, and many other universal design features can elevate a space while providing accommodation for people living with disabilities.

03

Exhibit 3.1: The Netherlands bike map | Source: Bridgette Bottinelli



COMMUNICATION



Exhibit 3.2: Bike parking | Source: Bridgette Bottinelli

CONVINCING THE PUBLIC TO BIKE: A COMMUNICATION STRATEGY

AUTHOR: Vivian Shepard

When people hear the words “city planning,” they may initially think of terms like sustainability, convenience, and politics. They often don’t consider the underlying, but crucial role of communication. Copenhagen and Amsterdam possess the highest number of cyclists in the world. Such a feat would not have been possible without effective communication. Dutch and Danish planners have curated communication strategies that target people’s wants and needs in a way that motivates them to cycle. They have figured out how to communicate the functionality of existing cycling infrastructure. They also know how to explain the attractiveness of future policy and design implementations.

A key factor in persuading people to cycle is telling them how they will directly benefit. Planners in these cities tell the public how cycling can be curated to their specific needs, lifestyles, or limitations. Communication is used in everything planning related from marketing campaigns, grant proposals, design presentations, and council meetings. All of these approaches work in tandem to secure national support and funding for future proposals. Communication acts as the buffer between organizations and their publics to ensure that each group’s objectives are reached. Effective communication in planning ensures that all parties are benefiting and satisfied with results.

One of the first steps for achieving effective communication is the use of appropriate language. This means that planners have thoroughly researched their target audience and methods of communication. Language should always depend on the audience and situational context. Different groups have different mobility needs and accommodation requirements. Proposals and messages from planners should address each group’s needs, expectations, and concerns. Planners should also address each group separately. Addressing different groups at distinct times lets the public know that planners acknowledge and understand their specific needs. More attention is also drawn from the target groups because people feel like they’re being directly spoken to, rather than generalized.

Planners must also communicate how an end goal will fix an existing problem within the target area. Some of these goals may include reducing traffic congestion, addressing climate change, and limiting vehicle-related costs, while increasing convenience, accessibility, wellbeing, independence, and inclusivity. Planners must tell people how cycling can be modified to fit their lifestyle. Solutions may look like promoting three and four-wheeled bikes, two-seater bikes, motorized bikes, cargo bikes, and bikes with a child seat. Language has the power to make biking attractive to everyone. To do this, planners must tell people how they will personally benefit. People don’t want to hear how

others will be positively impacted. The end goal of an organization can benefit different groups simultaneously, but planners must rephrase the language when addressing each group to meet that group's frame. Adjusting language and delivery is sometimes all that it takes to convey the appeal of a policy change. Effective communication is always consistent, informative, motivating, and research-based. Planners must always base their messages to the public on fact-based information to ensure that the organization won't get into trouble for misleading the audience. Upholding that standard also creates a community of increased support and trust. If the language of an organization encompasses all of these requirements, mutually beneficial relationships can be formed and maintained.



Exhibit 3.3: Bicycle campaign | Source: Connie Juel Clausen

Effective communication builds interdependent relationships between all stakeholders. As planners work to reach the organization's goals, everyone involved should be positively affected during the process. Stakeholders may include other organizations, politicians, traffic engineers, employees, investors, residents, commuters, tourists, etc. Ensuring mutual benefit is especially important in neighborhoods that have fewer existing cyclists, such as lower socioeconomic areas where residents live with more health and stress issues. As previously discussed, sometimes all it takes to influence these areas is rephrasing to emphasize how changes will increase the quality of life for that specific group.

In an article titled "Cycling in the Netherlands," The National Institute for Public Health and the Environment, an independent agency of The Ministry of Health, Welfare, and Sport, describes how effective communication creates mutually beneficial relationships. This institution works to promote public health and sustainable living environments. The article specifically discusses how The Municipality of Rotterdam wanted to improve air quality and increase general bike use in the area. To meet these goals, planners developed a program called "Cycling on the South Bank of Rotterdam." This program communicates cycling as "fun" and "cool" rather than "sustainable" and "environmentally friendly." The messaging helped increase the number of children who bike to school from 25 to 35 percent. Planners who developed the program met their goal, while the children of Rotterdam reaped the benefits of cycling.

Planners made sure to communicate with parents from the area to help them understand safety concerns and the presence of bike-friendly routes within the area. That engagement created trusting and supportive relationships between stakeholders. Planners understood their audience and the target group knew that the planners were genuinely motivated to improve the group's well-being. Effective communication allows residents to find it easier to implement cycling because they can envision how owning a bicycle results in positive lifestyle changes. Once the target group understands how they benefit, all other parties involved in the process start to benefit as well. Mutually beneficial relationships are created through all types of communication.

Not only is effective communication used within in-person interactions, but also in digital marketing. Digital marketing includes videos, writing, photographs, and outdoor/online advertisements. Digital marketing can be just as effective as in-person interactions, if not more. Oftentimes, digital marketing (especially advertisements) affects people subconsciously by altering consumers' perspectives. This results in extreme lifestyle changes. Cycling advertisements can make people want to implement cycling into their daily life while erasing any doubts or hesitations. Advertisements persuade the general public and targeted groups by making

cycling attractive to everyone. In an article titled “One year in review- 2021: the year of expansion for The Donkey Republic,” Vincent B. explains how The Donkey Republic, a bike share system, uses advertisements to increase the number of users. The company’s mission is to offer affordable and convenient transportation to increase urban mobility and sustainability around the world. The Donkey Republic’s target areas began with Copenhagen and Rotterdam where the company created campaigns throughout the area and online. Within just two weeks, they gained a 40% increase in awareness of the program. Within a month they observed a 45% gain in new users. These efforts enabled The Donkey Republic to expand to eight countries and to raise 110 million DKK (approximately 15.5 million USD) in funding for further development. This growth demonstrates how effective communication creates a mass change in actions for the benefit of citizens, the agency behind the mission, and the environment all at the same time. Communication in advertisements plays a critical role in increasing the number of cyclists in any given area. Strategic public information campaigns are partly what has led Amsterdam and Copenhagen to boast the highest number of cyclists in the world.



Exhibit 3.4: Donkey Republic imagery
Source: Donkey Republic

To increase the number of cyclists in the United States, planners must implement effective communication strategies, especially in urban areas with dense populations and lower-income areas. Planners in the U.S. must rephrase their language according to the target audience. Tailoring language to the audience is important in both

person-to-person interactions and advertisements. Planners must understand their audience's needs before implementing a policy change. Reflecting on interactions with the people they hope to reach allows planners to better communicate how the public will benefit. Planners must communicate how cycling can be a convenient option for all, especially since cities in the U.S. are less bike-friendly. The high number of cars on the road, the absence of bike lanes, and the lack of respect for cyclists all pose safety threats. Many people in the U.S. also think of biking more as a sport rather than a daily mode of travel. Successful communication must acknowledge these concerns while showing people how cycling will improve their lifestyle. After acknowledging U.S.-specific concerns while showing the benefits of cycling, mutually beneficial relationships based on trust can then be made. Organizations can then pool resources to reach their goals of increasing the number of cyclists (for any underlying reason), while the target group will benefit from a positive lifestyle change. If planners use effective communication to build trust within their community, then people could be more likely to try cycling and form new habits. Demonstrating successful public messaging campaigns can result in organizations attracting more funding, which increases their capacity to promote campaigns that spread awareness and educate the public about cycling.

Cities like Copenhagen and Amsterdam that have the best cycling infrastructure in the world still need effective communication to maintain and grow public trust and support for cycling. This is done through rephrasing the issue in all interactions towards stakeholder groups, which creates mutually beneficial relationships. Both communication and planning strive to eliminate conflicts among their publics by offering equally beneficial and attractive solutions for all. The U.S. must implement effective communication strategies about cycling and policy implementation to create a greener and more bike-friendly future.

04

Exhibit 4.1: Utrecht shared street | Source: Bridgette Bottinelli



CREATING SPACE



Exhibit 4.2: Mixed use paths | Source: Bridgette Bottinelli

BIKING AS A DEGROWTH TOOL: PRACTICAL EXAMPLES FROM EUROPE

AUTHOR: Brendan Irsfeld

The climate crisis continues to pervade the conversation about how to best support people's needs across the globe. For the past four decades, the ideal of creating "sustainable societies" has grown alongside the widespread use of automobiles. Sustainability emerged as part of the modern environmental movement and transformed from ideal to policy objective for countries around the world after the publication of the UN's Brundtland Commission report *Our Common Future* (WCED, 1987). Sustainability shifted to 'sustainable development' as the means for how to solve the climate crisis and achieve truly sustainable societies for decades thereafter.

Yet in recent years, a growing number of people have questioned sustainable development as a viable approach to effectively address the drivers of climate change. Take the example of electric vehicles. "Greening" personal transportation by creating vehicles that operate without producing pollutants would likely lower the volume of carbon emissions if adopted en masse. To build the cars along the entire supply chain, however, often remains a fossil-fuel intensive process. Heightened demand for electric vehicles along with the expenditure of resources necessary to maintain the roadway infrastructure only keeps the economy operating on finite resources contained in fossil fuels. As this example suggests, what 'sustainable

development' has meant in practice often reflects a 'net zero emissions' outcome rather than achieving a truly, perpetual model for daily life.

In response, several alternatives to 'sustainable development' have recently emerged from policy circles and academics alike. One that has gained some attention is called degrowth. The idea entails the "planned and democratic reduction of production and consumption as a solution to the social-ecological crises" (Fitzpatrick et al., 2022). It is only within the last decade that the conceptual elements of degrowth have begun to materialize into policy proposals, some of which are well outlined while others are simply labeled without much further exploration of their application in practice. Serge Latouche presented a framework for how to achieve degrowth titled the 8Rs (Latouche 2009 via Lopez, 2018). Together, the 8Rs outline a process for asking the question of how we get there. The 8Rs consist of these actions: reevaluate, reconceptualize, redistribute, relocate, restructure, reduce, reuse, and recycle.

Using Latouche's 8Rs framework and examples from five of the cities our group visited, this chapter explores how the transition of these cities to a more multi-modal, less car prioritized transportation system demonstrates one effective model for applying degrowth in action. I describe how bicycle

transportation, and more broadly encouraging active transportation modes, becomes a driving force for “prioritizing small, highly self-sufficient communities” as well as meeting the goal of “just mobility” (as identified in the study via Fitzpatrick et al., 2022). The transformation that occurred in these cities created safer, more vibrant, efficient, and healthier places to live. It is achievable and it can be done here in the United States. I start with the first R: reevaluate.

REEVALUATING HOW THE TRANSPORTATION SYSTEM OPERATES

Often, one specific problem created by the existing transportation system resulted in transformational change. In Copenhagen, it was the local government’s finances facing pressure from events globally. In Amsterdam, the safety of its citizens, notably children, spurred people to demand a change. Each problem grew to a point where the people felt compelled to act and push for a different approach to operate transportation in these cities. To do so, they needed to reevaluate how the system operated.

THE CITY COULD NO LONGER AFFORD IT: COPENHAGEN, DENMARK

In the case of Copenhagen, the oil shocks of the 1970s put a strain on both the city and its residents when oil imports disappeared. The city’s response was to declare a brief moratorium on driving and gasoline consumption through “gas-free Sundays”. Over the years, the city’s residents grew favorable of traveling by bike as a substitute. The decades later expanded the habit throughout the city as the government backed new infrastructure projects to build a complete biking network. It was a network that delivered residents efficiently, safely, and quickly to their destinations. It was a network that today moves more people in less space compared to the automobile (City of Copenhagen 2011). Investing in the infrastructure has financially rewarded the city on two fronts: the infrastructure is cheaper to build and maintain while also contributing economic value to the city. During a presentation with the firm Copenhagenize Design

Co., results from a study presented data that estimated that every cyclist contributes \$0.64 to the city’s general fund in economic value while every driver generates a net loss of \$0.71. The calculation included estimates of how cycling reduced commute times, promoted better public health outcomes leading to fewer worker sick days, the increased productivity of the workforce and participation among the population, and the cost to build and maintain the biking network infrastructure, among other inputs.

TRANSPORT FORM	COST EXAMPLES	
BICYCLE	1 km cycle track (both sides)	DKK 16 mio. (€2.2M)
	Network of bicycle super-highways (300 km) in the capital region.	DKK 900 mio. (€2.2M)
CAR	Nordhavnsvej	DKK 1.8 billion (€242.2M)
	Motorway expansion from Roskilde-Flang	DKK 2 billion (€269.1M)
METRO	1 km of the Metro City Ring	DKK 1 billion (€134.5M)
TRAIN	Extra track for overtaking between Holte-Bernstorffsvej	DKK 1.5 billion (€201.8M)
BUS	City of Copenhagen’s annual bus subsidy	DKK 400 mio. (€53.8M)

Exhibit 4.3: Cost examples for specific traffic measures
Source: The City of Copenhagen

Another example demonstrating the significantly lower cost of biking infrastructure includes Copenhagen’s cost to build 300 kilometers of cycle tracks within the capital region for approximately 2.2 million euro (about \$2.24 million at 2022 exchange rate). For comparison, to build Nordhavnsvej, a 3 kilometer bypass road in the Northern Harbor District, Copenhagen spent an equivalent of \$352 million for 297 kilometers of fewer travel space at more than 157 times the cost of the region’s biking network (City of Copenhagen 2011).

SAFETY AS A CATALYST FOR REFORM: AMSTERDAM, THE NETHERLANDS

The oil shocks of the 1970s also impacted residents in Amsterdam, though the turn away from cars also resulted due to another prevalent social problem: pedestrian safety. Residents faced a dangerous, high-risk environment in the city center created by a glut of automobiles. In 1971, 3300 people died as a result of traffic fatalities, which included 400 children (Han 2018). The backlash from the public ignited social protests throughout the city

as advocates launched the Stop de Kindermoord movement (“Stop the Child Murder”) as a way to engage city officials in a discussion about how the transportation system operated.

Over the next several decades, Amsterdam turned away from designing streets that prioritized cars over people and cyclists. A key element in this effort was for the local government to recognize the road prioritization must elevate the active modes over the automotive modes in order to be successful. Reevaluating the system, Amsterdam, similar to Copenhagen, also recognized that a multimodal system could deliver greater safety for its riders without giving up efficiency in moving people from place to place. Once Amsterdam and Copenhagen reevaluated how the transportation system functioned, they needed to re-conceptualize how to design it.

RE-CONCEPTUALIZE MODES IN HARMONY AND NOT COMPETITION

Many of these cities shifted their thinking to view multiple transport modes operating in harmony with each other as opposed to in competition with each other. Evidence exists in two Dutch cities: Utrecht and Amsterdam. What is visibly apparent in both cities is how space is shared between bikes, pedestrians, and vehicles. Using the built environment in tandem with speeding regulations to lower speeds enhances both the safety and utility of the other modes, further encouraging people to bike and walk.

The Dutch cities also recognized the specific role that each mode best served for a particular travel need. It is unreasonable to design a network to allow for 20 or 25 miles of safe bike commuting and then expect that an individual wishes to bike that entire distance every day to reach their family, job, grocer, or any other reason. However, people regularly bike the one to three miles to a train station in the Netherlands and complete the next segment of their trip, which is often the 20 mile segment in their commute, via a regional train service.

Utrecht Centraal is the country’s busiest train station accommodating more passengers per day than the country’s largest airport, Schiphol (Tamse 2022). Underneath the plaza just outside the train station is currently the world’s largest bicycle parking garage providing 12,500 spaces. This is just one example of how the Dutch envision modes working in harmony with each other within the same space rather than in competition. A cyclist is a potential transit rider who will turn back to a cyclist once they reach their departing station and complete the last segment of the trip.

After reevaluating the transportation systems’ operation and then reconceptualizing how different modes should function in that system, action is needed to create the required conditions to make a multimodal, bike-friendly system function. Here, these cities restructured the street, redistributed the



Exhibit 4.4: 12,500 biking parking spaces in Utrecht
Source: CitiesToday

routes and vehicles, and relocated amenities (such as bike parking) along the new routes and most important destinations.

RESTRUCTURING THE STREET: KNOWING YOUR LANE

Denmark's approach to restructuring the street space is the most visible. The strategy is to build the most suitable bicycling infrastructure appropriate to the context of the environment. Where car speeds are set higher, more separation is needed between the space where vehicles and bikes travel to ensure the safety of cyclists. In some areas of Copenhagen and Odense where one is unlikely to encounter fast moving cars, bikes share the same space as automobiles. As car speeds rise to 20 or 30 kilometers per hour (12 - 18 miles per



Exhibit 4.5: Car speeds and pedestrian safety
Source: Copenhagenize

hour), a separated, raised cycle track is needed to safely provide cyclists space to travel along the road alongside moving vehicles. Where automobiles travel at higher speeds, a physical barrier should separate any bicycle infrastructure and the roadway. The faster the car is moving, the greater the chance of the cyclist sustaining a serious injury or death as a result of a collision (See Exhibit 4.5). Restructuring street space to give automobiles, bikes, and pedestrians their own lanes facilitates the efficiency and safety of the transportation system for both modes, cars and bikes. Because of its effect, residents and visitors alike opt to travel by bike throughout the entire city. After the street is transformed, where you can allow people to bike in

REDISTRIBUTING ROUTES AND PEOPLE

An important aspect of the transformation that took place in these cities includes redistributing the available routes and as a result, where people traveled in the network.

KEEP GOING PATHS: NIJMEGEN

One strategy used by the Dutch city Nijmegen and the surrounding municipalities recognized the value in creating routes that were entirely separate from the automotive traffic. Creating new, accessible routes throughout the region allowed both existing and new cyclists to choose a different means of navigating to their destination regionally.

The RijnWaalpad in Nijmegen offers such an example. The bike route functions as an inter-regional pathway between Nijmegen (approximately 170,000 residents) and Arnhem (150,000 residents) (Buczynski, 2017) two of the Netherlands' smaller but populated cities (comparable to the population of Eugene, OR). From one city center to the other, the path is 18 kilometers (approximately 11 miles) long. Notably, the entire route is designed for cyclists to stop and yield to traffic only twice. Since its opening in 2015, studies of the road's usage suggest that the uninterrupted ride may be a driving factor in attracting people to commute by cycling along the route. Further analysis of people's use of the RijnWaalpad appeared to confirm this theory, as researchers documented how people often detoured onto the pathway to use the route during their commutes (Buczynski, 2017). Directing the pathway away from established road traffic while also limiting the stoppages effectively redistributed regional commuter traffic. Through providing another option, expanding choice in the network by enhancing the usefulness of the bike for travel, the region succeeded in reducing car volume by delivering value in the option to use a bike for routine and important trips.

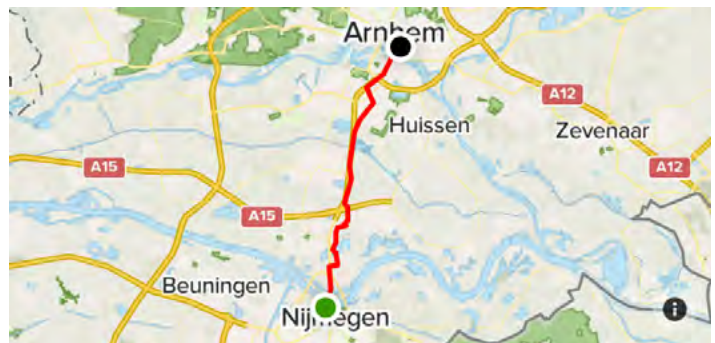


Exhibit 4.6: RijnWaalpad route
Source: AllTrails

TAKING CARS OFF ROADS AND OPENING NEW PATHWAYS: THE NETHERLANDS

A similar effect has taken place in other Dutch cities. Early in the Netherlands' transformation from a car-centric to more bike friendly country, some notable failures stalled progress due to the isolation of the project from the broader transportation network. The lessons from these early failures influenced officials in the city of Delft in 1979 to develop an entire biking network at once rather than focus exclusively on a single segment or localized project (Brunlett, 2022). In planning the route network, cities needed to account for not just where bike routes would travel, but where cars would travel, if the space should be shared or segregated between the modes, and how to account for pedestrians within the network.

Shifting the planning approach from examining individual segments to complete network design, Dutch cities built extensive bicycle networks that created dozens of smaller pathways linking multiple streets that served as larger, high-traffic corridors in the system. Providing a variety of pathways where cyclists can mostly weave between buildings, continuing along their route, expanded people's choices and made cycling more convenient for travel. With more routes, cyclists spread out throughout smaller pockets of the network. Maintaining this usefulness for the bike is what can remove cars from the roads due to fewer people choosing to drive, which would help reduce traffic congestion. Essentially, the biking networks decentralize the usable space to travel and multiply the number of routes that will get you to where you need to go and quickly. As the infrastructure was built and the network connected, the mode share of cycling in Dutch cities has consistently increased over the last 30 years (Brunlett, 2022).

RELOCATE AMENITIES: MAKING THE MOST OF THE LAND

Cycling is a personally-powered transport mode dependent on a vehicle and therefore, requires parking. Although bikes require less space to park compared to cars, an influx of users looking for parking can overwhelm an area. When faced with this problem, the Dutch turned back to layering the uses of space land could provide. The previously

referenced area beneath Utrecht Centraal Station contains 12,500 bicycle parking spaces within one facility. Smaller but spacious parking facilities exist all over the city, often underneath surface streets where pedestrians and cyclists dominate compared to vehicles. By burying the parking of a smaller object, the bike, it provides the parking travelers require and the land is preserved for another use. Often, development, commercial or mixed-use buildings, and public squares dot the neighborhoods of the city, creating more people friendly spaces and facilitating commerce. Even in smaller cities, such as one example found in a building in Nijmegen, a bike parking facility often functions as a bottom-floor use, where housing and public spaces exist above. Underground or bottom-floor bike parking garages can offer hundreds to thousands of spaces to store bikes. Most often, the spaces are free for the first 24 hours and cost less than the equivalent of a dollar for every 24 hours after.

Witnessing how infrastructure and design meant to support cycling drove a reduction in the amount of land used for roadways demonstrated the immense potential for cities to create more attractive places for people to travel. Less land devoted to supporting cars, such as multi-lane roads and parking spaces, freed land for other uses. Whatever the reason, basic needs, business, entertainment, employment, whatever, places need to be destinations and offer something worth traveling for. With many spread out across a city, more activity follows throughout the entire space available and increases the volume of activity accessible to people.

After restructuring streets, redistributing routes and people, and relocating amenities, reducing land consumption needed for transportation, reusing space for multiple purposes, and recycling the materials of existing roads provides the means for which to drive lasting change in how a place functions.

REDUCE THE LAND CONSUMPTION AND TIME NEEDED FOR TRANSPORTATION

In every city we visited, the bicycle network and infrastructure narrowed streets and allowed

surrounding land to be claimed for other purposes. Most often, that land was used for green space in the form of public parks or to provide housing. The overall surface area of transportation routes reduced the amount of land required for the transportation infrastructure. Using other strategies, such as how intersections are designed, land use patterns can slow cars down and enhance safety for pedestrians and cyclists.

Another aspect of a built out biking network is a reduction in time needed to travel between destinations. Direct route connections designed within the network make biking the quickest and most convenient transport mode (Tamse, 2022). Dutch and Danish individuals alike cite the convenience as one of the primary reasons for cycling so much in their daily lives. A growing usage of e-bikes could further expand the potential range of cycling uses and the people that can use them. People that face both physical and mobility challenges benefit from electronic models.

REUSE THE EXISTING SPACE AND BUILT ENVIRONMENT

The space and land reclaimed from reducing the land consumption needed for transportation creates additional opportunities for other purposes. When building the RijnWaalpad in the region, the limited amount of land required to create the pathway allowed for the installation of one of the country's greenports (Wagenbuur, 2015). These areas are

concentrated throughout the country where the environment is tailored to support horticultural systems and natural plant life. The low ecological impact of the bicycle path frees the surrounding land to be reused for environmental stewardship supporting the health of the surrounding ecosystem.

In another Dutch example, bicycle routes are integrated with built environment features, such as existing buildings. One innovative solution found in Utrecht involved building a bike path to climb on top of an elementary school roof in order to connect to an important bridge crossing a canal, linking neighborhoods in the western area of the city with the city center. Rather than built additional bike path and bridges to bypass the school, building on top of the airspace and supported by the building's rooftop allowed a reuse of the existing space to limit the amount of built pathway needed to connect the entire route to the canal bridge (See Exhibit 4.7).

RECYCLE EXISTING MATERIALS

During many of the street redesigns in these cities, an abundance of concrete became available when reducing the width of roads, retrofitting vehicular roadways to directly support building cycle tracks. Recycling, in this instance, entails recycling the usefulness and application of the material. Recycling concrete during road work is one strategy notable in the City of Odense in Denmark. From 2009 to



Exhibit 4.7: Bike path on school roof | Source: Bridgette Bottinelli

2019, the city transformed its surface streets to create more bike friendly routes, resulting in a system of 550 kilometers of bicycle paths (about 341 miles), 65 cycling tunnels, and 125 cyclist bridges (Clausen, 2022). As part of this work, much of the concrete extracted from the construction became available for sale by the city to developers, creating a short-term revenue stream to further support the city's budget as the work continued. There is plenty of concrete available in such redesigns within the existing roads of the United States. Recycling this material, along with materials used for manufacturing bicycles, can economically benefit local governments while a redesign of the transportation network's streets is underway.

SUMMARY: BICYCLE TRANSPORTATION AS A "TOOL" FOR A DEGROWTH SOCIETY

It is beyond this chapter to explore the entirety of the degrowth movement and its policy objectives. However, in four weeks, I witnessed how urban societies could be designed, built, and function in ways consistent with degrowth principles, objectives, and goals. Some connections are direct, such as a pursuit of the goal "just mobility", which entails objectives of, "reduce fossil and motorized mobility", "promote modal shift to active transport (e.g., walking, cycling)", and "promote modal shift to public transport (e.g., bus, trolley, metro, rail) (Fitzpatrick et al., 2022). Indirectly though, bicycle transportation networks also push communities towards other goals, such as "re-localize economic

activity", "restrict the commodification of property", or "reduce the level of urban built environment" (Ibid).

The 8Rs presented by Latouche provide just one framework for how to understand what both the Danish and Dutch cities accomplished in a pivot to multimodal transportation systems. The result is that cities became healthier, safer, and wealthier in the course of one to two generations. That is a long time and requires enormous investment, perhaps more so culturally than financially. Yet, when an automobile dominant system emerged in these two countries, a system that reflects the current extractive and consumptive economic system that dominates the global economy and is largely driving the effects of climate change, many cities rejected a car-only system and pivoted to create more choices in how people move from point A to point B. Whether they were aware of it or not, many strategies employed followed this framework associated with the degrowth movement and may be best suited for helping the United States and other countries around the world accomplish the same transformation.

Exhibit 4.8 below lists 18 metropolitan statistical areas in the United States with comparable populations to the two largest cities we visited as part of the course: Copenhagen in Denmark and Amsterdam in the Netherlands. These could be the laboratories to begin experimenting with constructing bicycle networks through supportive infrastructure and begin exporting successful strategies and approaches throughout the country.

Metropolitan Statistical Area	Est. 2021 Pop.	Metropolitan Statistical Area	Est. 2021 Pop.
Raleigh-Cary, NC Metro Area	1,448,411	Hartford-East Hartford-Middletown, CT Metro Area	1,211,906
Oklahoma City, OK Metro Area	1,441,647	Buffalo-Cheektowaga, NY Metro Area	1,162,336
Memphis, TN-MS-AR Metro Area	1,336,103	Birmingham-Hoover, AL Metro Area	1,114,262
Frederick-Gaithersburg-Rockville, MD Metro Division	1,334,662	Grand Rapids-Kentwood, MI Metro Area	1,091,620
Richmond, VA Metro Area	1,324,062	Rochester, NY Metro Area	1,084,973
Camden, NJ Metro Division	1,292,517	Tucson, AZ Metro Area	1,052,030
Louisville/Jefferson County, KY-IN Metro Area	1,284,566	Tulsa, OK Metro Area	1,023,988
Salt Lake City, UT Metro Area	1,263,061	Fresno, CA Metro Area	1,013,581
New Orleans-Metairie, LA Metro Area	1,261,726	Urban Honolulu, HI Metro Area	1,000,890

Exhibit 4.8: MSA with under 1.4M and above 1M residents, comparable to populations of Copenhagen, Denmark and Amsterdam, the Netherlands | Source: American Community Survey, 1-Yr Estimates, 2021, Table B01003



Exhibit 4.9: Biking in Houten | Source: Bridgette Bottinelli

BIKE SUBURBS

AUTHOR: Abby McFeeters-Krone

The city center is usually where all the action is. From jobs, to entertainment, food, and shopping, much of what life is all about takes place at the core of an urban environment. However, not everyone can live in the heart of a vibrant city. Not everyone wants to, and many more people cannot afford it. So, what's the solution? So far what we have come up with is suburbs, where people commute daily from a neighborhood on the outskirts of a city, into the core, for work, schooling, shopping, and other activities.

In the United States, the most favored mode of transportation (especially for suburbs) is the private car. With wide, winding streets, large driveways, and long treks on foot, our suburbs are designed so that the car is the most efficient and often times only viable option for getting from your home to where

you want to go. You can see in Exhibit 4.10 that the streets in U.S. suburbs are roundabout at best and lead to a dead end at worst. There are most likely no pedestrian or bike cut-throughs, so in the event that you don't have access to a car, you are severely limited in the places you can go.

However, suburbs do not have to be like this. In the Netherlands, they value the bicycle much more as a mode of transportation, and as a result they have designed their cities and suburbs to accommodate the bike as the main way people travel. In fact, many Dutch cities and suburbs even strive to make driving a car an inconvenience, restricting the areas they are allowed to be in and creating longer commute times for those who wish to travel by car. This is a strategy that the U.S. is loath to attempt. In our country, it seems we have to reassure car drivers that even if a bikeway is established, it will not affect the drivability of a street or a city. This is a major cultural hurdle that we will have to tackle if we hope to truly have a well-connected bike network.

The city of Houten is located right outside of Utrecht in the Netherlands and is a prime example of what a bike suburb can be. In Exhibit 4.11, you can see all the different tracks for a variety of modes of travel, the most well connected being cycling. In order to get around by car, you must use the surrounding ring road (pictured as the grey lines).



Exhibit 4.10: "Sprawling Vision of the Past: American Suburbs from Above" | Source: WebUrbanist



Exhibit 4.11: Transportation network in Houten | Source: Bloomberg

You use the ring road to get to your section of the city, and then use the interspersed car “spokes” to get to your destination. Then when you want to go somewhere else in the city, you have to go back out onto the ring road and find another spoke to enter through. Going by car in this area is highly inefficient.

On the other hand, inside the ring road is a well-connected web of bikeways. All paths except for the ring road are bike accessible, making it the most versatile tool in a person’s transportation arsenal when in Houten. You can get anywhere you need by bike. You can go to school, the store, work, and there is even a bike highway to the bigger city of Utrecht.

The whole suburb is designed so that the bike will be the most convenient way to get around. Something that I heard a lot while in the Netherlands is that people do not bike because it is good for the environment, or because they hate cars; they bike because the country is designed for the bike to be the easiest way to get around. After all, as humans we always want to do what will take

the least amount of effort to meet our goals. In Houten, and many other Dutch suburbs, the lots for the houses do not include space for a garage or a driveway for a car, so you end up parking your car down the street, sometimes blocks from your front door. This is where the ease of access of your bike comes in. You can park your bike right outside your front door, so immediately as you step out of your home, it is easier to hop right on your bike than it is to walk down the street to your car.

Lots of people who live in Houten have jobs in the neighboring and much larger city of Utrecht, making Houten a sort of bedroom community (following the same pattern of commuting as many U.S. cities and suburbs have), meaning that they must commute daily into the city. The way Americans do this is with cars, but the city of Houten is well connected to Utrecht with a bike superhighway. The bike superhighway is what makes communities like Houten possible. It connects Houten and Utrecht with a safe and direct route meant only for bikes (and other micro-mobility options).

The route from Houten into Utrecht has virtually no stops, which makes it a much more enjoyable experience to ride your bike than to drive. On average, it takes about 25-30 minutes to bike from Houten to Utrecht, and 20 minutes to drive there in a car. We all know that a car commute can fluctuate quite a bit depending on what traffic is like on a day-to-day basis, but a biking commute always stays the same, so on some days it would actually be faster to commute by bike than by car. This kind of comparability between bike commute times and car commute times is hard to find in any other part of the world, and that is because nowhere else prioritizes biking like the Netherlands does.

The Dutch word for these superhighways roughly translates to a “keep on going road”, meaning that they prioritize nonstop travel for bikes (See an example in Exhibit 4.12). This means that along the way you might encounter roundabouts with a special track for bikes, or underpasses to cross busy roadways, anything to make sure that as a cyclist, your route is as easy as possible. All of this is well and good for a country like the Netherlands, but now the question remains, can we create our own bikeable suburb in the United States, where we value the car so much? I think yes. One of the biggest draws for a place like Houten, is that it is not all that different from what U.S. suburbs are today. Even in Houten, you can have a car and get all the amenities of living in a suburban environment (minus the large yards). If there are two things that we can all agree that Americans hate, it is change and being told what to do. A bike suburb would not change too much about what a suburb is, and it would merely be a suggestion that biking might be the more convenient option when it comes to commuting or moving around within the suburb.



Exhibit 4.12: Bike underpass in Utrecht | Source: Bicycle Dutch

We already have all the tools we need to make a Houten-like suburb surface in the United States. All we need is a ring road for cars, and a connecting bikeway to get people in and out of the main city center.



Exhibit 4.13: Biking in Houten | Source: Bridgette Bottinelli

We already do something like this with most college campuses. On a college campus, if you look around, everyone is either walking or biking. This is because there are no cars allowed on most parts of campus. One of the reasons why people love college life so much is because for the most part, everything you need on a daily basis is within walking distance. What people don't realize in the U.S. is that this kind of accessibility does not need to be relegated solely to college students living on or near their university campus.

In many U.S. cities, there is a strong desire to create a more bike-friendly core. The focus right now is not on suburban commuting by bike, instead it is simply about making the network within the main hub of the city more connected. Once we have established a solid foundation with a well-connected bike network in the busiest parts of our city, we can begin to think about how we can serve those who live on the outskirts of our communities. It might be a few years down the road until we can begin to think about suburban bike commuting as a real option, but we have all the tools we will need to achieve anything that the Netherlands have built.

05

Exhibit 5.1: Bikeway on Ærø Island | Source: Bridgette Bottinelli



NATURE AND RECREATION



Exhibit 5.2: Flower field | Source: Bridgette Bottinelli

NATURE IN CYCLING AND CITY PLANNING

AUTHOR: Macy Patel

After spending a month in Denmark and the Netherlands, I left with many takeaways from their amazing cycling infrastructure and culture. From bike lanes to bike to train connections to health and happiness to traffic calming to bridges, there were endless things to learn from the Danish and Dutch! However, from the lens of an environmental studies and biology student, what was so eye-opening about the experience is how these countries incorporated nature into their cities and planned with a deliberate focus on promoting greenspaces. Throughout my time there, I saw wonderful recreational cycling routes, greenspace within big cities, pleasant commuting, and much more! For this chapter, I will focus on the observations and values I recognized within the investment in nature and greenspace in bicycle and city planning. I will start by briefing the background on this topic within both the Netherlands and Denmark's national strategies. I will then discuss my observations about big cities and small cities in both countries, as well

as research that explores the value of greenspace in urban planning. I will propose a policy and advocacy plan to implement similar ideas in the United States and finally, I will shortly discuss my personal reflections and conclusion.

BACKGROUND

THE NETHERLANDS

The Netherlands is arguably the most developed cycling nation in the world; it was the first country to ever establish a national cycling strategy. In the 1970s, as the Netherlands first began transitioning to being a car dependent society, with some highways already being built, the public reacted against supporting the construction of these major highways (Dutch Cycling Embassy, 2018). Encouraging a car-centric system also resulted in a higher number of deaths from car accidents, including children. The number of children dying from cars paired with the lack of oil supply and high prices during the 1970s oil crisis acted to raise public disapproval about designing cities around car use.

In addition to the activism for the children of their country, the Dutch also quickly realized that a decrease in cars can lead to an increase in quality of life. This increase in the quality of life includes recreational cycling. The Dutch make a point to separate their concept of recreational cycling to the idea of sport cycling, which I found very interesting and beneficial to cycling culture. It is reported that around 70 percent of the Dutch population utilizes their bicycles for a recreational day trip occasionally (Ministerie van Verkeer en Waterstaat, 2007). The Dutch have created a numbered junction network where people can compose their own routes; There are 6,500 kilometers of national bike routes, 4,500 of which are signed (Ministerie van Verkeer en Waterstaat, 2007). The network allows for round trips or day trip routes to encourage the people of the Netherlands to use their bicycles to get out of town.

DENMARK

The Danish have a similar background to the Dutch in that public movements emerged to increase cycling as a means of improving quality of life. The National Bike Strategy of Denmark contains

three pillars: everyday cycling, active holidays and recreation, and new and safe cyclists. It is impressive that the Danish have created an entire section of their national strategy for recreational cycling. The strategy describes recreational cycling as a “convenient and inexpensive way to get out and experience Denmark during your leisure time” (Ministry of Transport, 2014, pg. 11). The characteristics of good recreational cycling routes are safety and security, tourism, service, comfort, signage, and meaningfulness (Ministry of Transport, 2014). It is smart of the Danish to set these principles within their strategy to ensure that during the planning stage, there are best practices and ideas to ensure a successful cycling route is built. The strategy points out the correlation between initiatives for Danish recreational cyclists and tourist cyclists; encouraging Danish cyclists especially in urban areas to use recreational cycling to see nature and promoting bike tourism to boost rural communities’ economies and sightseeing can go hand in hand. There are approximately 12,000 kilometers of signposted cycle routes that exist within forests, wilderness, coast, cultural attractions, and more (Ministry of Transport, 2014). The Danish prove to have a solid foundation for recreational cycling in their strategy and best practices and mention that they hope to expand their cycling network, signage, and directions on rural paths.



Exhibit 5.3: National biking routes of Denmark | Source: metrhispanic

RESEARCH

BIG CITIES IN THE NETHERLANDS

Some of the larger cities in the Netherlands that we visited were Utrecht and Amsterdam. These two cities are two of the most advanced cycling cities in the world and it truly shows. There was a lot to



Exhibit 5.4: Pleasant commuting | Source: Bridgette Bottinelli

observe in these cities in terms of green space and cycling; I split my findings into three sections: pleasant commuting, spatial planning and land use, and the cycling network. This idea of pleasant commuting is something I noticed in many cities abroad and involved an effort by city planners to create many path options for commuters, many of which incorporate greenery and nature. The paths allow for more enjoyable and quieter routes away from cars and traffic, something very appealing in larger cities, and forms the cycling network, which provides cyclists the choice for which biking paths or trails they want to use, whether for commuting or recreation. Choices restore autonomy to cyclists and ensure cycling is the most pleasant transportation option. Finally, big cities in the Netherlands displayed clever spatial planning. In Amsterdam, many of the roads next to canals supported mostly cyclists and pedestrians, which is

a great incorporation of their environment. We also explored a beautiful rail-trail in Utrecht which had lots of greenery and led to many parks and open spaces right outside of the city (See Exhibit 5.5).

SMALL CITIES IN THE NETHERLANDS

The main smaller city we visited in the Netherlands was Nijmegen, which possessed the most notable cycling highways. Nijmegen is a hub for many suburban and rural areas around it, with a central train station leading to the other larger cities as well as its own attractions. These cycling highways were surrounded by beautiful trees, greenery, farms, and the river. This purposeful path planning and placement creates cycling highways which are useful for both commuters and recreational cyclists. We visited on a weekend and saw many groups of cyclists utilizing the roads for recreation! This cycling highway contributes to pleasant commuting as well as a major sense of community. There is great value in connecting these rural and suburban areas with city centers. We saw groups of children cycling to and from school together, older couples on a sunset ride, many teenage girls on one bike, and more! Our hostel was located about a 30-minute bike ride

outside of Nijmegen, so we got to experience the beautiful commute on this cycling highway during sunset one night. Notably, our hostel was virtually only accessible by bike and is a popular vacation destination for the Dutch, an example of a cycling focused vacation.

BIG CITIES IN DENMARK

The bigger cities in Denmark we visited included Copenhagen and Odense. I noticed in Denmark, there is an extremely advanced park system. These cities dedicate quite a lot of city space to parks, from staffed children's playgrounds to skate parks to botanical gardens to just open grassy areas. The parks in both cities were extremely well maintained, large, and widely used by urban residents. However, unlike the Netherlands, bikes were not allowed in these parks. Despite this, I do see importance in the ability to bike right up to parks and the dedication to green space and nature within the city. Cemeteries in Denmark have been converted into public spaces with bike paths running through them, providing pleasant and quiet shortcuts through the city. There were also a few pleasant bike paths by rivers and through forested areas.



Exhibit 5.5: Rails to trails conversion in Utrecht | Source: Bicycle Dutch

SMALL CITIES IN DENMARK

We experienced recreational and cycling tourism biking from Svendborg to Odense and taking a day trip to Ærø Island, a popular vacation spot within the country. On Ærø Island, we brought our bikes onto a ferry and rode a loop around the island for the day. We saw the beautiful Danish countryside and many cultural attractions. The trails all throughout the island were incredibly well marked and I found this an amazing way to see another part of Denmark. We also biked from Svendborg to Korinth and then to Odense via the advanced cycling network and trail markings. I found the trip to be a major learning experience for me personally and an enjoyable way to see Denmark biking from city to city. The trails varied from winding right next to the ocean to through the forest, to by a castle and windmills, and so much more! Denmark's recreational cycling network is in excellent shape and plans suggest the country will continue to develop the network for both recreation and tourism.



Exhibit 5.6: Biking on Ærø Island | Source: Bridgette Bottinelli

IMPORTANCE OF GREENSPACE

There is plenty of evidence to demonstrate the importance of greenspace and incorporating natural landscapes in city planning. The benefits range from improved visual aesthetics, fostering

community and social connections, supporting overall well-being, promoting environmental stewardship, providing physical activity, and more. To start, something I saw within the cities I visited, and further backed by scientific research, is the social and community benefits of greenspace and even more so, cycling to these greenspaces. Dinnie, Brown, and Morris (2013) take a deeper dive into this idea in their paper by conducting a study in various parks in the United Kingdom, interviewing participants and gathering information. They explain that the “potential of different spaces to support or close down different forms of social interaction, demonstrate the intertwining of social and physical processes to produce and reproduce greenspace as social and cultural experiences” (Dinnie et al. 2013, p. 109). The finding here is that greenspaces serve as not necessarily an ‘escape’ within the city, but a place in which social and cultural interactions are fostered and created. Ambrey (2016) also points out that residents may find more value in walking, running, or cycling through nature, feeling visually stimulated, and becoming more observant of nature.

“The finding here is that greenspaces serve as not necessarily an ‘escape’ within the city, but a place in which social and cultural interactions are fostered and created.”

When cycling for recreation in the countryside of Denmark I was getting similar physical benefits as cycling on an elliptical bike in the gym, but doing so while also better noticing and enjoying the nature around me. The book “Pathways to Well-Being in Design: examples from the arts, humanities, and the built environment” looks at this concept of planning for human well-being. One chapter describes the benefits of greenspace over an entire life course; the benefits range from decreased cardiovascular conditions, decreased stress and mental disorders, social engagements, places for sport engagement, safe spaces for younger teens and kids, physical movement in young children, and more (Coles et al., 2019). It is clear that greenspace and nature could contribute to human well-being in many ways and I saw it first hand through my time in the Netherlands and Denmark. Further, I think the

combination of cycling with these greenspaces and nature only enhance these benefits.

SUMMARY

This was an unforgettable experience which I will value for the rest of my life. I was able to learn about not only city planning and cycling skills, but also about myself and how to engage others in a professional field. Cycling in the Netherlands and Denmark was extremely liberating. I felt like I could cycle just about anywhere and enjoy myself while doing that. While curating this project, I was able to reflect upon how I feel on a bike; many emotions came to mind such as relaxed, productive, social, proud, and happy. I found I noticed my surroundings far more while on my bike and overall, just felt better. I truly see the Dutch and Danish way of life as the future of our world, and it must be for the sake of our environment, happiness, and health. Intuitive design and the ability to adapt planning to the people and environment is something planners all over the world must be thinking about. There is a change in thinking and planning necessary and I hope to be a part of that change. I feel hopeful being surrounded by my outstanding classmates, all of us coming together through this experience and sharing our takeaways and ideas.



Exhibit 5.7: Æro Island biking | Source: Bridgette Bottinelli



Exhibit 5.8: Bouldering wall in Copenhagen | Source: Bridgette Bottinelli

BRINGING OUTDOOR RECREATION INTO THE CITY

AUTHOR: Bridgette Bottinelli

Copenhagen is known as the bicycle utopia and planners look to the city for case studies and inspiration to bring back home, just as we did! But biking here is more than the physical infrastructure; it is a cultural movement encompassing the Danish way of life. From a technical standpoint, the infrastructure, like protected lanes from cars and properly timed traffic signals, make biking work. But the biking lanes wouldn't be as successful if they didn't have a destination. About 50% of Copenhageners take their bicycle to work or educational institutions (Visit Copenhagen, 2022). The Danes have a generous work-life balance, so where do they go when they aren't working? This chapter explores how Copenhagen has created outdoor recreation destinations in the city that are easily accessible by biking.

To understand the approach to recreation, we must take a step backwards and talk about Copenhagen's urban planning and design philosophy. Jan Gehl, a famous Danish architect and urban planner, practices designing people-friendly cities on a human-scale. The City of Copenhagen used Gehl's research and studies to design urban policies and implement improvements in public space and pedestrian spaces within the city (Gehl, 2022). The city grew around the experience of the user, resulting in a more inclusive and connected place to live. In 2009, Copenhagen adopted a

"Metropolis for People" report that contains visions and goals for urban life within the city. A report entirely dedicated to how people use their city is leaps and bounds ahead of the planning we do in the United States. We all know that we should create places that enhance the human experience, but our network is disjointed. Culturally, people like their private space and things to be orderly and organized, which is reflected in our zoning codes. The urban planning of Copenhagen moves past buildings and infrastructure and shapes the environment on a micro approach for people. The city isn't just a shell, it's a public space for everyone to enjoy, and if designed with the user in mind, people will actively choose to take part in all it has to offer. Even if you can't visit Copenhagen, the awards the city has earned speak for itself. Over the years, Copenhagen has won awards for being the best city, best quality of life, and most livable city in the world.

The Metropolis for People report outlines three goals for the city; more urban life for all, more people to walk more, and more people to stay longer. Copenhagen defines urban life as the following, "urban life is not only cafe life and tourists. Urban life is what happens when people walk around and hang out in public space. Urban life happens on the squares, on streets and in parks, on playgrounds or on a cycle trip through

the city” (City of Copenhagen, 2009, p. 4). Creating more urban life means having a variety of urban spaces and activities that are open twenty-four hours a day year-round. Being able to bike or walk throughout the city is a form of urban life. Both modes of transport allow you to experience the city on a discovery level and easily interact with others. Getting people to stay longer in the city means there must be places to explore outside of work, education, and shopping. To achieve this goal, “all the fun things, recreational life in the city, the experiences and our personal enjoyment and expressions will only happen if it is a pleasurable place to be” (City of Copenhagen, 2009, p. 7). Thus, I will highlight the history of two recreational destinations along with a personal anecdote of my recreation experience.

Using a philosophy around urban life and the infrastructure for biking, Copenhagen has created unique recreation destinations that connect both of those goals. I am defining recreation destinations as unique places to visit. Recreation destinations differ

from typical parks and green space. Each city has a park with picnic tables where you know beforehand what you might experience. I’m highlighting recreational placemaking that attracts both tourists and residents to participate in a special experience.

Our group spent about eight days at a hostel in Copenhagen’s city center. We had bicycles for the duration of our time and were encouraged to explore the city. Personally, I’m not someone who enjoys museums or shopping. I appreciate the activities for what they are but don’t seek them out. I spent a lot of my free time using the biking facilities to explore each neighborhood of the city. Within a 1.25-mile radius I was able to visit six recreational destinations; Kalvebod Bolge, Islands Brygge, canal kayaking and stand-up paddle boarding, a bouldering wall, and CopenHill (See Exhibit 5.9). These recreational places exist in addition to the many acres of green space dispersed throughout the city. Each recreation destination is an example of how Copenhagen has used public space to foster a vibrant and active urban life.

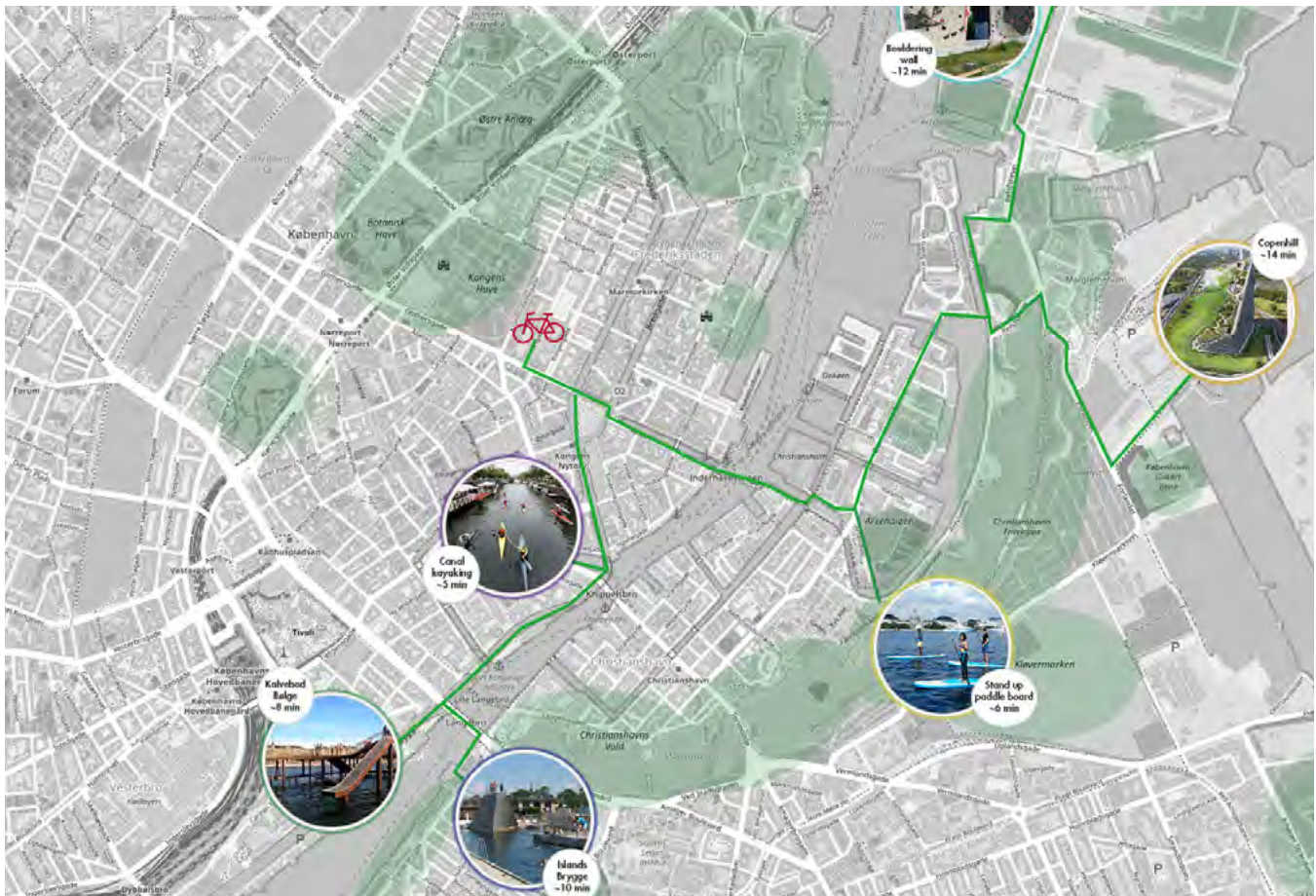


Exhibit 5.9: Recreation destinations and green space within 1.25 mile radius | Source: Bridgette Bottinelli



Exhibit 5.10: Copenhagen Harbor Bath | Source: ArchDaily

ISLANDS BRYGGE HARBOR BATH

MICRO CASE STUDY

LOCATION: Island Brygge 14 | **COMPLETED:** 2002 | **VISITORS:** Unknown (Capacity: 600 people)

Copenhagen is located on the islands of Zealand and Amager, about three hours away from mainland Europe and less than an hour from Malmö, Sweden. The capital city's strategic geographic location between Scandinavia and the Baltic Region made it a commercial hub for many modes of transportation. Being an island, Copenhagen naturally has easy access to water, but during the 1600's the King commissioned the construction of new canals. Much of the architecture was influenced by the proximity to waterways. For example, the location of the Kronborg Castle was selected because of the "ideal position to collect Sound Duties from ships entering the narrow Strait between Sweden and Denmark to secure state taxes and revenue" (Copenhagen Portal, 2022). Another example is the canals in Christianshavn

and Nyhavn. Both areas have artificial canals that were constructed to expand the waterway network to increase access, trading, and taxes for cargo and goods.

Like many other cities, in the 1980's, Copenhagen began to see a decline in their port activity, specifically in the southern port of Sydhavnen. The Sydhavnen port area is just south of Islands Brygge. The port activity was moved to the outermost edges of the city or elsewhere in the country, meaning that ships no longer needed to drive deep into the city canals (See Exhibit 5.11). The city viewed this as a new opportunity for development of residential, commercial, and office buildings. In 1992, the City of Copenhagen made its objective for Sydhavnen to "make it possible to bathe and fish...and to vary animal and plant life as much as possible in a culturally created port" (Danish Ministry of the Environment, 2022, p. 1).

As one can imagine, the port water was extremely affected by pollution from the shipping industry. The water had "harmful micro-organisms, large amounts of organic material...various types of toxic and persistent chemicals" (Danish Ministry of the Environment, 2022, p. 1). There was no visibility in the water and the sludge was polluted with mercury. The first step to tackle the water quality was to address sewage and rainwater discharge from the city's paved areas. The sewage system often overflowed when it was raining, prompting the City of Copenhagen to improve their infrastructure. Next, the city worked to improve the quality of sediment in the water. At the time, the City of Copenhagen invested 55 million euros

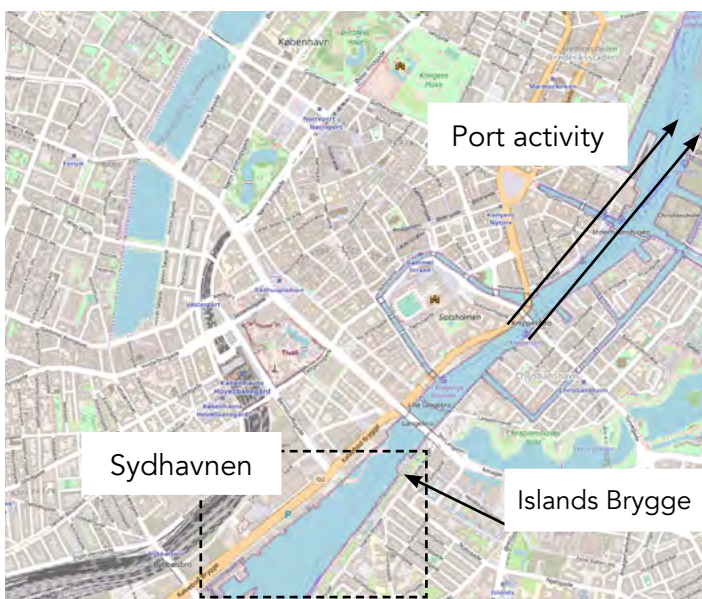


Exhibit 5.11: Copenhagen map | Source: OpenStreetMap



Exhibit 5.12: Copenhagen Harbor Bath | Source: ArchDaily

to modernize the port's specific sewage system and 30 million euros to the sewage system as a whole (Danish Ministry of the Environment, 2022, p. 2). Not only did this massive infrastructure improvement benefit the Copenhagen residents, but it improved city hygiene, health, and the environment. To continue to keep people safe while swimming, the city also constructed a warning system to assess water quality. The warning system cost 86,000 EUR to construct and 16,000 annually to operate and maintain. All these environmental achievements and improvements have allowed Copenhageners a new place to recreate!

Islands Brygge is one of four harbor baths on the canals of Copenhagen. It was constructed to improve public spaces in the Islands Brygge neighborhood and create more recreation opportunities. Being part of the Sydhavnen port, the area was undergoing transformation and the harbor path serves as an icon for the area. The structure was built by two architecture firms, BIG and JDS, with a budget of 520,000 EUR. The structure, which is free to visit, has a lap pool, diving platforms, children's pool, toddler pool, public toilets, and lifeguard staffing in season. Lounging space is available on the structure itself or on the adjacent public park. The bath was designed to support accessibility and safety with radial lines of sight and ramps to all pools. The culture of the harbor baths is different from an indoor swimming pool. Copenhageners stop by the harbor bath on their way home from work or in between errands to socialize, play, and enjoy the outdoors. A woman I sat with was just taking a quick dip before going off to meet up with her friends. The harbor bath is special in that it creates unique and varied opportunities for recreation in a metropolitan city in an area that was once polluted.

The City of Copenhagen reclaimed public space, making it usable once again for the people. Islands Brygge is something that could be replicated across the United States. Many of our metropolitan cities are built with water access for the same reason as Copenhagen: shipping and trading. We could follow the same path as Copenhagen and reconnect our waterways with public life.

LESSONS LEARNED

CITED FROM THE DANISH MINISTRY OF THE ENVIRONMENT AND THE CITY OF COPENHAGEN

1. Reconstruction of old industrial ports in the centre of the city holds a great potential for improving the quality of life in the city, and create
2. It is possible to create an attractive and varying aquatic environment in ports that have been heavily polluted.
3. A lively atmosphere by the port helps generate new jobs within the service sector in the form of cafes, restaurants, renting boats, kayak instruction etc. and a clean aquatic environment by the port helps raise the prices of real estate.



Exhibit 5.13: Rooftop view from CopenHill | Source: CopenHill

COPENHILL

MICRO CASE STUDY

LOCATION: Vindmøllevej 6 | **COMPLETED:** 2019 | **VISITORS:** Expected 300,000 annually

Another recreation destination within the city is CopenHill, a waste-to-energy plant that doubles as a ski slope. The building was designed by the architecture firm BIG, embracing “hedonistic sustainability” while aligning with Copenhagen’s goal of becoming the world’s first carbon-neutral city by 2025 (Baldwin, 2019). CopenHill is situated on the outskirts of the city with factories and housing and has been noted as “a place you know from afar, but where few people ever go” (Jordana, 2011). The project hoped to build CopenHill as a destination people would want to travel to. The architectural inspiration was that the “main function of the facade is to hide the fact that factories are having serious image/branding problem. We want to do more than just create a beautiful skin around the factory. We want to add functionality...

*“The ski slope design seeks to ‘reclaim a typically unused element of a building for the public through the introduction of nature-filled programming’”
(Baldwin, 2019)*

functionality does not stand in contrast to the ambition to create beauty... it can be both!” (Ibid, 2019). The ski slope design seeks to “reclaim a typically unused element of a building for the public through the introduction of nature-filled programming” (Baldwin, 2019). This building is a prime example of the Copenhagen philosophy on fostering urban life through public spaces. In the U.S., typically industrial uses are separate and would never attract tourism. In Copenhagen, they have

combined uses, allowing people to recreate and physically connect with their environmental impact.

On the environmental side, CopenHill provides “waste management services for 645,000 citizens and 68,000 businesses while providing electricity to 80,000 households and district heating to 90,000 apartments” and in 2020, converted 599,000 tonnes of waste into heat and electricity (Edo, 2021, p.3). All of that operates smoothly below patrons who visit for recreation! When you visit CopenHill you can ski/snowboard on 500 meters of slopes, run, walk or hike up to the top along landscaped paths, rock climb or rappel to the top, or enjoy refreshments at the rooftop cafe (CopenHill, 2022). Although it’s not a ski resort, CopenHill gives winter sports enthusiasts a way to enjoy their sport throughout all seasons in their city. Copenhagen, and the rest of Denmark, does not possess land elevated above 300 ft., making it hard to impossible to find outdoor climbing or skiing. Not only is the



Exhibit 5.14: CopenHill multi-use roof | Source: CopenHill

building the first of its kind, the rock wall is the tallest artificial one in the world, and the first place to ski in Denmark. The slope is made of a green plastic that requires lubrication on the bottom of your snowboard. Our group visited the building as a class activity. Again, because of the value of public spaces, you can just walk up to the building and use the facilities. There are no tickets (unless you are skiing), and you would never know you are visiting a waste-to-energy plant!

TRANSIT OPTIONS TO COPENHILL

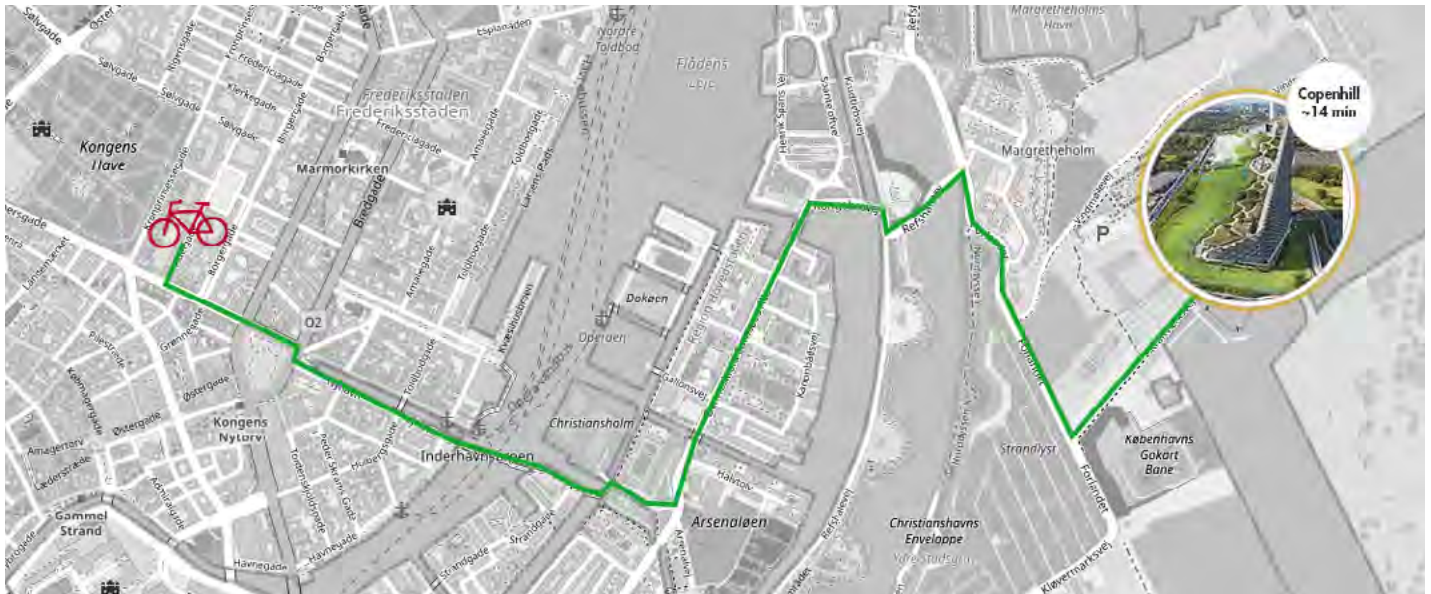


Exhibit 5.15: Bike route to CopenHill | Source: Bridgette Bottinelli

Below is a list of all the transit options available to get to CopenHill. The times and mileage are calculated from my accommodation in the city center.



----- 46 MINUTES | FREE



----- 14 MINUTES | FREE



----- 25 MINUTES | FREE*

**I was surprised to see that there is free parking. This is not the norm in Copenhagen. Typically parking is around \$25.00/hour.*

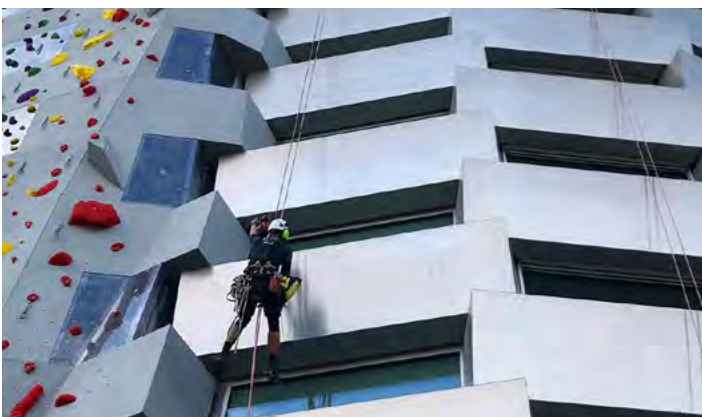


Exhibit 5.16: CopenHill rock climbing wall | Source: CopenHill



Exhibit 5.17: CopenHill ski slope | Source: CopenHill

RECREATION SUMMARY

The recreation destinations that Copenhagen has created within the city are unique, but easily replicated. In both case studies, we have seen how private uses, such as the canal for shipping and industrial centers, were turned into public spaces with recreational opportunities. Additionally, both examples highlight sustainability excellence. Copenhagen revitalized their sewage system and today creates clean energy for 645,000 residents (they only have a population of 805,402!). During my visit, I was able to visit both sites without any hassle by bicycle. Once at my destination, I then participated in another physical activity, such as swimming or hiking, keeping me active my entire trip. The thoughtful design of both places represents the value of a people first approach. Islands Brygge was extremely busy every time I biked by and visited. People were socializing,

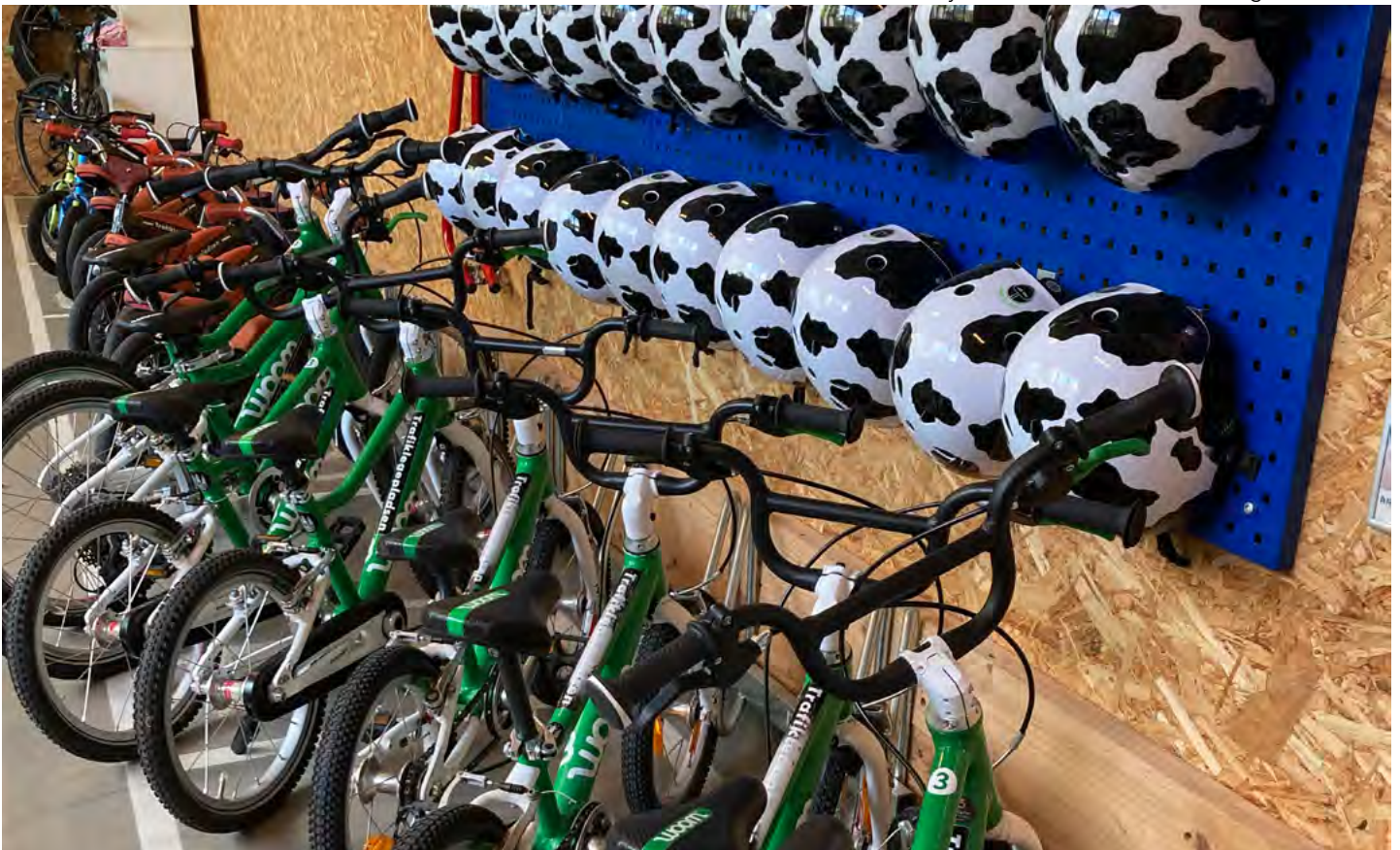
swimming, picnicking, the full experience of urban life. These concepts would serve us well in any size city in the U.S, especially Oregon where there is a strong value of outdoor recreation. Oregon has recreation destinations throughout the state, such as Blue Pool, Multnomah Falls, and Crater Lake. Multnomah Falls is incredibly busy now with permits and special transportation restrictions. If we had smaller scale recreation destinations within our neighborhoods or cities, maybe we could reduce usage of the over-populated places that are primarily accessible by car. Living in Eugene, I often desire to drive at least an hour to any sort of recreation destination. If Eugene had more recreational destinations that were connected by bicycle infrastructure, I think government officials, business owners, and neighbors would all be pleasantly surprised with the results.



Exhibit 5.18: People jumping into the harbor | Source: Visit Copenhagen

06

Exhibit 6.1: Youth bicycles and helmets | Source: Bridgette Bottinelli



YOUTH CYCLING



Exhibit 6.2: Youth cyclers | Source: Connie Juel Clausen

CYCLING AND SAFETY FOR CHILDREN

AUTHOR: Lucy Partridge

For my topic, I chose to focus on how cycling helps families and benefits children. I looked at data from different cities throughout Denmark and the Netherlands, but mostly focused on Amsterdam and Copenhagen. I spent a lot of time in these two cities learning about bike infrastructure. Each city has a large population to draw comparisons to larger cities in the United States. I am specifically interested in biking for children, as many parents in the U.S. would argue that allowing their kids to go off and bike alone is dangerous. However, with the right infrastructure and culture, this does not have to be the case. Allowing children to bike to school and for fun gives them a sense of independence and autonomy, is better for their health and happiness, and allows parents (especially women) to enjoy more free time. This topic is important to me because I work with kids and know how dangerous it is when there are speeding cars in school zones.

It is important to realize that the Netherlands was not always the safe bike haven it is today. For example, in 1971, children deaths on the road due to cars and unsafe infrastructure in Amsterdam were more than 400, which was an all-time high in the city. Children deaths were not the only concern, as there were 3,300 vehicle deaths in total that year (van der Zee, 2015). The ensuing reaction from the public led to the creation of the “Stop de Kindermoord” (stop the child murder) campaign.

The group started as a street safety movement after the record number of road deaths in the 1970s and advocated for infrastructure changes to make streets safer. It was important to reduce road danger starting at the source, which meant changing the streets themselves. Protests that the “Stop de Kindermoord” group held included: having dinners in the street, bicycle demonstrations, and occupying accident blackspots. These accident blackspots were places where road accidents had historically been concentrated. The Dutch government also introduced car free Sundays as these protests occurred (Dutch Reach Project, 2011). All of these activities and changes contributed to creating a safer and better bike culture for children in the Netherlands.



Exhibit 6.3: Stop de Kindermoord | Source: NOS

Another aspect of better cycling that the United States could learn from is the Dutch traffic safety test. All Dutch children between ages 10-12 take this required traffic exam. Most Dutch children bike independently to school by their teens. The first part of the exam tests children's knowledge of road safety rules. There is also an optional second part of the exam where children show what they learned while being tested on their bikes. In the practical portion of the exam, students practice yielding, using hand signals, crossing priorities, and following red lights. The United States has a similar exam for driving, so why not replicate the practice for biking? Traffic education has also been taught in Dutch schools since 1959, starting at age six (Staples, 2018). Everything I learned about traffic as a child came from my parents, driver's education classes, or learning on my own. I was never taught about bike safety in school. Because of this, I think it is important to replicate Dutch traffic safety in U.S. elementary schools as a way to encourage more kids to travel safely on bikes.

Another reason why cycling is so easy and safe for kids in the Netherlands and Denmark is because of "traffic gardens", themed playgrounds centered around cycling and traffic safety. The child-sized towns teach kids about sharing road space with pedestrians and vehicles (Lam, 2018). One traffic garden we visited was the Children's Traffic Playground in Copenhagen (See Exhibit 6.4). The area is designed for children ages two and up and is free for anyone to use. It also has bikes available for kids to borrow and ride on. The playground has staff to supervise, which allows both more freedom for kids to move and parents with busy schedules to come and go. It is also important to introduce children to bikes and traffic safety from a young age because it is more likely to make cycling an everyday habit (VisitCopenhagen, 2022). Examples of traffic gardens in the Netherlands include Linnaeushof in Amsterdam and Utrecht Traffic Garden. Traffic gardens were first planned there in the 1950s, showing how established their cycle culture is (Lam, 2018). Altogether, if we are getting more children on bikes, it is important that they feel safe and know the rules of the road first.



Exhibit 6.4: Traffic Playground in Fælledparken, Copenhagen | Source: Copenhagen Magazine

Another way we can make biking more accessible for children is through better infrastructure. When I biked around Copenhagen and Utrecht, I was separated from the cars, knew where I was going due to adequate signage, and never fought with cars for space. One example of bike infrastructure that could easily be replicated in the United States is bright red, blue, or green painted bike lanes. However, just having painted lanes is not enough. These lanes work so well in Denmark and the Netherlands because they are combined with other complex infrastructure. Other bike infrastructure in these countries include separated bike paths and a connected network of cycle paths that makes navigating commutes easier (van der Zee, 2015).

Copenhagen also boasts some of the best bike infrastructure in the world. So much so that 62% of locals use a bike for their daily commute (Thoem, 2022) (See Exhibit 6.5). Infrastructure in Copenhagen for bikes is safe, simple, and connected. This means that anyone can bike, from the most vulnerable populations to the most experienced. You can easily ride for recreation or for transportation to work and school. Copenhagen also uses traffic calming methods such as narrow lanes and planter boxes to make it safer for cyclists. Exhibit 6.6 shows a typical residential street in Copenhagen that uses traffic calming methods.

Textured surfaces on the streets also force cars to slow down to 30 kilometers per hour (or 18 miles an hour, which is still slower than the 25 mph common of residential streets in the U.S.). Another traffic calming method is placing parked cars between



Exhibit 6.6: Street calming methods | Source: Lucy Partridge

bikes to have their own lane. This infrastructure also allows children to be more protected when biking, as they don't have to share the roadway with cars on busier streets. Other aspects of safe biking infrastructure I saw in Denmark were off-street paths through parks and the waterfront, separate traffic lights for cyclists, bicycle railing to rest on and pedestrian/bike only bridges. All of these pieces make it easier for children to bike to school.

So are safety methods like traffic tests, traffic playgrounds, and improved bike infrastructure working? One way to know is by seeing the amount of people biking. Amsterdam possesses 320 miles of dedicated bike lanes and 4.25 million people cycle to work every day in the Netherlands (AmsterdamTIPS, 2020). There are also 1.33 bikes per person and 38 percent of all trips in Amsterdam are done by bike. The positive impacts of biking are shown in Copenhagen too, as there are 237 miles of cycle tracks and 49 percent of all trips are done by bike. Locals also cycle 1.44 million kilometers daily! In relation to children and families, one fourth of families in Denmark with at least two kids own a cargo bike. These cargo bikes make it easier to transport small children and allow the whole family to stay together while cycling. Additionally, 25 percent of all school children in Copenhagen cycle to school (VisitCopenhagen, 2022). These numbers show the large impact cycling has in daily Dutch and Danish life.



Exhibit 6.5: Copenhagen commute | Source: Copenhagenize

cyclists and cars driving along the road. The parked cars add an extra level of protection (Thoem, 2020). Additionally, separated cycle tracks use curbs for

Biking makes a huge difference in children's lives. During our meeting with Chris Bruntlett from the Dutch Cycling Embassy in Utrecht, he mentioned there are lower levels of depression and obesity for children in the Netherlands. The Netherlands

ranks first in the world for child mental well-being and their physical health ranks as ninth (UNICEF, 2020). Seventy-five (75) percent of all Dutch children walk or cycle to school, which shows how they incorporate exercise into their daily routines. Cycling also gives the kids (as well as women who would often be transporting them) more freedom and independence. Additionally, better traffic safety education can lead to more community building. Community is shown in the Netherlands through volunteers helping lead the traffic exams. In regards to safety, traffic deaths in the Netherlands have decreased steadily since 1973. In 1973, there were around 3,300 vehicle deaths, whereas only 600 were recorded in 2016 (Dutch Reach Project, 2011). The history of traffic deaths is important here too, as “Stop de Kindermoord,” which was created in the 1970s, is still active and subsidized by the government today.

You cannot talk about cycling as a culture without realizing where cycling and traffic safety is first taught. That is why it is important to study how cycling impacts children. Through firsthand experiences and research, I have learned that Denmark and the Netherlands are two of the best countries in the world to cycle in, especially for children. Biking in these countries is safer, easier to understand, and education is more focused on traffic safety for multiple modes when compared to the United States’ approach. Children can practice their bike skills at traffic playgrounds and brush up on the rules of the road with the Dutch traffic safety exam. Biking also supports the physical health and happiness of Dutch and Danish children. We must first consider how our most vulnerable populations will be affected before we can build better bike infrastructure in the United States.

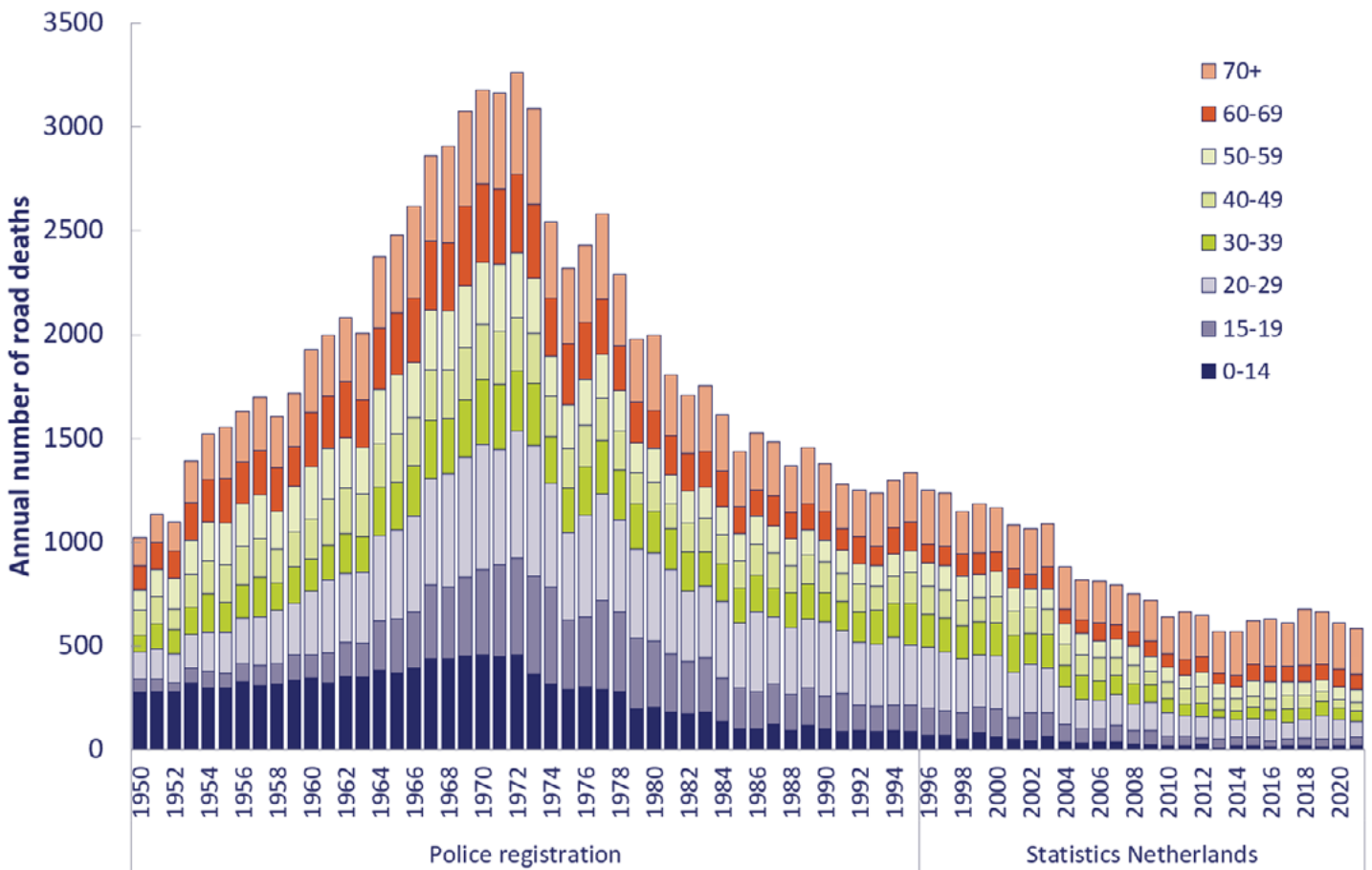


Exhibit 6.7: Road deaths by age in the Netherlands | Source: Institute for Road Safety Research



Exhibit 6.8: Bike-friendly street | Source: Abby Andrews

INVESTING IN YOUTH THROUGH SAFE BICYCLE INFRASTRUCTURE

AUTHOR: Abby Andrews

The sense of freedom I felt in unlocking my bicycle and quickly being on my way when I was in Denmark and the Netherlands is unlike anything I've experienced with transportation in the United States. Most Dutch and Danish parents trust the cycling infrastructure enough to allow their children to bike to and from school, their friend's houses, and around the city, allowing children to experience this same independence. For the Dutch and Danish people, riding a bicycle is not only limited to kids in suburban neighborhoods like it often is in the U.S.; it's become a part of their culture, their way of life, and something that has affected their children in positive and measurable ways. These benefits range from higher quality mental and physical health, improved confidence, a sense of autonomy, a connection to nature, and overall well-being and happiness.

Learning that these two countries were once car-centered and shifted to become more bicycle friendly is motivating to know that it is NOT too late for a car-centered country like the United States to also become more bicycle-friendly. Currently, the United States does not possess a connected, secure network of bicycle infrastructure, and I think it will be many decades before we can even begin to emulate what Denmark and the Netherlands have accomplished. There first needs to be a shift in the overall attitude regarding cycling in the U.S., and that shift must begin with open-minded, younger individuals. Providing opportunities that excite students about cycling will make coming generations more likely to advocate for building safe and efficient bicycle infrastructure.

I propose we provide elementary school students in the United States with bicycles and teach the basics of cycling as physical education, fostering environments where students naturally grow to desire bicycling as travel and thus support implementing safe cycling infrastructure to access these benefits. Many elementary schools already offer physical education programs focused on sports. If program support shifted to prioritize biking, attitudes would begin to change. In just the past year, I've already noticed many more kids exercising their freedom on electric bikes, which highlights the attainability of this goal and how the U.S. is capable of moving in the right direction.



Exhibit 6.9: Protected bike lane | Source: Abby Andrews

07

Exhibit 7.1: Bike superhighway | Source: Bridgette Bottinelli



INFRASTRUCTURE



Exhibit 7.2: Mixed use street | Source: Bridgette Bottinelli

WHY THE BIKE CITY MATTERS

AUTHOR: Claressa Davis

Only two days at home before not owning a car was starting to hinder me. I tried seeing my grandmother, less than a 15 minute drive away, without any other viable transportation options to get there. Before traveling to Denmark and the Netherlands, I had never realized how reliant I was on automobiles, and by extension, the people who drove them. After a month of travel never entering a car, it was intensely disorienting to rely on drivers for my transportation and mobility. While technically we can bike in the United States, the inconvenience, stress, long distances, and downright danger stop many people from riding. In Denmark and the Netherlands, physical infrastructure makes biking comfortable and accessible, both of which made it a viable option for commuting. Cyclists could get anywhere in the cities, quickly and easily, whether for work, school, play, or errands. This type of infrastructure and transportation system has the largest benefit for left behind user groups in the car oriented society: people with disabilities, youth, elderly, and those who can't afford cars. Within a car first system, left behind groups are forced to rely on others for transportation. *Cities that enable people to travel in a variety of different ways give car-less people real autonomy and accessibility to the places they need to go. To be able to easily and conveniently access places and engage in their community when they want to improve their quality of life.*

A huge part of what makes cycling accessible is the focus planners have on making it convenient, comfortable, and reliable. This strategy works; in Copenhagen, 41% of all commuter trips are made by bike (The Guardian, 2017). To make it comfortable, every street over a certain speed has a designated space for cyclists. In Denmark, the space looked like cycle tracks and in the Netherlands the space looked like more mixed streets. These pieces of infrastructure make it simple and intuitive to travel by bike, and ensure that riders feel comfortable and relaxed while biking anywhere in a city.

Another part of making cycling infrastructure convenient is ensuring that it is consistent all over the country. Standardization makes biking in new places a straightforward exercise. To create a reliable system, designers ensure that the infrastructure is always usable. People are able to commute all year round at any time of day, supported by good lighting and other safety measures. It is important to ensure that even in adverse conditions, bikes are no less dependable than cars, such as when Copenhagen plows the bike lanes first when it snows (See Exhibit 7.3). It gives people freedom to go where they want, when they want to, whether it's on a Monday afternoon or 3 AM on a Thursday. By prioritizing the comfort of cyclists, cities develop spaces that are more



Exhibit 7.3: Bike Lane Snowplough - Cycling in Winter in Copenhagen | Source: Mikael Colville-Anderson

enjoyable to ride through. One example of the strategy is how in both countries, infrastructure is built to keep cyclists moving and experience few, if any, stops. The Danish kept momentum rolling by concentrating on signal timing, the Dutch utilized yield signs and roundabouts (Curbing Traffic, 2021). Both countries did so many different things that made biking more comfortable, and other places can draw lessons from both countries on how to create a more comfortable biking environment.

The two cultures value helping people to access places and have a range of mobility choices, shining through wherever we visited. As a cyclist, I felt prioritized in a way that I have never felt in the States; I never worried about a car not seeing me, never had to watch for a bike lane ending in the middle of a road and never stressed about being hit by a car. Beyond safety, it felt comfortable to bike through the city, and it gave a beautiful vantage point for city life. I felt so much more connected to those around me when I saw them on their way to work, school, or a friend's house. I got to experience the outdoors and the weather. There was something so joyful about moving by my own energy.

The Dutch and the Danish recognize that humans are prone to make mistakes, and have designed the built environment to be as forgiving as possible, lowering the risk associated with biking. By designing safety into the system, the onus is not

on the cyclist to react and avoid being hit. Because cars pose the biggest threat to cyclists on the road, planners “untangle” the two modes by planning two distinct networks; one for cars and one for cyclists. In all instances possible, cars are redirected onto larger streets and out of neighborhoods. By using a mix of filtered permeability and one way streets, traveling through neighborhoods by car is very circuitous and more time intensive. The goal is to separate the space where cars and bikes travel, and therefore reduce competition for space. Recognizing user error leads planners to highlight key areas of heightened vulnerability using vibrant colored paint to “call out” a space where certain rules apply. In the Netherlands, safety is also enforced at a policy level. For example, the more dangerous group, cars, are always at fault when a collision occurs with a cyclist. This incentivizes drivers to be extra careful around cyclists. By creating a system where cyclists don’t have to compete with cars for space, so many more groups are able to bike, including children.

We will know we have succeeded at creating a cycling system when parents are comfortable sending their children out to travel by themselves. Using children, one of the most vulnerable sections of the population, as an indicator group will signify that most users feel supported and safe using the infrastructure. It was common in these countries to see young children biking alone, off to friend’s houses, school, errands, or after school activities. Children who bike to school in Denmark are measured to have higher self-esteem, concentrate better, are healthier, and handle stress better (The Guardian, 2017). In Denmark, children are allowed to ride alone when they turn seven (Copenhageneze, 2022). The average Dutch child starts riding to school by themselves when they turn eight (Easyasridingabike, n.d.). In car dependent cultures, such as the States, children are dependent on others for their travel needs, and this severely restricts their freedom and ability to connect with their communities. A biking culture drastically reduces the care labor still often shouldered by mothers; the soccer mom ceases to exist if a child can transport themselves to and from school and to their activities (Curbing Traffic, 2021). By comparison, Dutch and Danish children are much more independent at an earlier age, and we kept being surprised by how mature they were. In the

States, planners often tout 8-80 as an approach. The transportation system must suit both an 8 year old child and 80 year old adult. Yet this perspective might be too limiting, as exposure to a biking culture starts so much younger than 8, and lasts much longer than 80.

As we age, losing access to an automobile painfully limits the independence a person can enjoy. In the States, people often resist a loss of independence as it means a loss of autonomy and self-determination. Within Denmark and the Netherlands, older adults maintain their daily routines through cycling, far past when they would be able to if they were dependent on automobiles. Being able to travel farther distances allows them to access more services, allowing them to remain self-sufficient and autonomous, more so than if they were just walking. In the Netherlands, many older adults also utilized e-bikes to extend their travel range. Additionally, biking provides health benefits that can slow down the process of aging and prevent many health problems, including "diabetes, Alzheimer's, cardiovascular disease, high

"In the Netherlands, 25% of all trips taken by people 75 and older are on bicycle compared to less than half of one percent for Americans over the age of 65"
(AARP, 2022)

blood pressure and colon cancer" (AARP, 2022). Physical activity also has psychological benefits, and biking can actually increase the social life of older adults. Compared to cars, biking allows the rider to talk to those around them, and converse with friends they may pass. Loneliness, one of the great epidemics of our times, can be softened by "creating communities that facilitate robust and relevant support systems" through planning spaces for people to engage with each other and run into each other on the street (Curbing Traffic, 2021, p. 47). Both countries have successfully created spaces where older adults feel comfortable continuing on daily habits around biking, and in "the Netherlands, 25 percent of all trips taken by people 75 and older are on bicycle compared to less than half of one percent for Americans over the age of 65" (AARP, 2022). In Denmark, I talked with an elderly gentleman named Claude. As a 73 year old, Claude

felt comfortable and happy riding a three-wheeled cargo bike that was stable and didn't require him to balance the bike. For many older adults living on a fixed income, the costs associated with owning a car can be a tough barrier, which can cost upwards of \$9,666 a year, which doesn't include the purchase of the car. Bikes are much cheaper and present fewer financial barriers in comparison.

While a car centric model has been touted by auto enthusiasts as the best version of our cities for people living with disabilities, this model fails to account how unattainable driving is for so many people. Especially for people who need adaptive vehicles, car costs can be prohibitive. For example, installing "wheelchair accessibility equipment into a van can cost \$10,000-\$20,000 for the conversion equipment alone, never mind the cost of the gas, insurance, basic maintenance, and the car itself" (Strong Towns, 2022). Many people with a disability also live on a fixed income and are less likely to own a car as "only 60.4 percent of U.S. residents with disabilities drive a car, compared to 91.7 percent of people without them" (StreetsBlog, 2021). Additionally, driving isn't an option for people who have vision impairments, intellectual impairments, or neurological conditions like epilepsy. Many people who are disabled take fewer trips throughout their day than those without a disability, and have a harder time accessing their basic needs (Bureau of Transportation Statistics, 2022). Putting forth a car centric model severely limits the ability of people with disabilities to travel when they don't have access to a car. While people can incorrectly assume that bikes are unusable for many living with a disability, there are great adaptive bikes



Exhibit 7.4: Adaptive Bicycles | Source: Van Raam

for people with disabilities, from “hand cycles for those with lower limb impairments, to tricycles for those with balance issues, to tandem recumbent bicycles for visually impaired cyclists to ride with seeing friends, and so many more” (Strong Towns, 2022). Riding vastly expands the range people are able to travel, and “offers a way for individuals with disabilities to pursue a new level of independence” (StrongGo, 2022). In the Netherlands especially, we saw many people on electric wheelchairs using the bike lanes to get around. Bike infrastructure is versatile!

At the end of the day, the bicycle city is about giving people autonomy and freedom to travel when and how they want to. The design refocuses on the needs of those typically left out of car focused transportation planning, and imagines a world where all people are self determined in their transportation choices. Cycling not only keeps us moving and healthy, it also keeps us engaged and

connected to our communities. By reclaiming space from cars for people, the Dutch and the Danish have empowered people to bike, people to walk, people who want to enjoy the city without being so close to cars. The bike city is about enhancing people’s quality of life; the “more people... can move around without cars, the better cities are for the environment, public health, and even for our mental health” (ACB Consulting, 2022). Really, it’s not about the bike, it’s about everything the bike enables people to do and be.

“Car-first planning, at its essence, perpetuates the idea that transport networks are provided for those with motor vehicles, who are therefore freely mobile with their choices. It is exclusionary, overlooking the needs of portions of the population: children, the elderly, those living on limited income, and, importantly, individuals with a physical disability” (Curbing Traffic, 135)



Exhibit 7.5: Bicycle lanes | Source: Bridgette Bottinelli



Exhibit 7.6: Variety of bicycle users | Source: Bridgette Bottinelli



Exhibit 7.7: Bicycle street | Source: Bridgette Bottinelli



Exhibit 7.8: Bike lane in Copenhagen | Source: Bridgette Bottinelli

SELF EXPLANATORY CYCLE NETWORK

AUTHOR: Giselle Beld

I found myself very interested in analyzing transportation and bicycle infrastructure at the network level. Studying infrastructure that connects communities, bridges gaps in the cycle network, and offers solutions to improve system coherence for cyclists lives within what's considered the macro, network, or high level point of view.

In this chapter, I enthusiastically dive into important infrastructure considerations to keep in mind while designing an attractive, safe, convenient, and well connected cycle path network. Bicycle infrastructure must be planned where it logically and contextually makes sense to benefit all people. Bicycle infrastructure must also be self explanatory, human-centered, efficient, and adaptive within the surrounding built environment.

I also discuss this topic's relevance to the United States and explain how Danish and Dutch infrastructure strategies are useful for planners and policymakers in the United States to examine for inspiration. I conclude that these strategies can connect communities and create effective and attractive cycle path networks in the United States.

STUDY HUMAN BEHAVIOR TO CREATE SELF-EXPLANATORY INFRASTRUCTURE

Bicycle infrastructure must be designed and constructed based on where people need it most, as presented by Gehl Architects during an informative bicycle tour of Copenhagen. During this tour, architects focused on identifying examples of how bicycle infrastructure design functioned. This methodology for implementing bicycle infrastructure is the most effective way to ensure it remains "self-explanatory" and it improves the overall cycle path network (The City of Copenhagen, 2021, p. 43). Implementing sensible bicycle infrastructure requires planners to learn how people behave and where people want to go.

"Self-explanatory" infrastructure is intuitive, logical, consistent, systematic, and sensible.

When using a bike for door-to-door transportation, people simply want an efficient, straightforward, safe, and user-friendly route. According to the comprehensive planning document entitled "The City of Copenhagen's Bicycle Strategy 2011-2025", 48% of Copenhagen cyclists chose the bicycle because it's the fastest and easiest way

to get around. Achieving this type of bicycle network is essential for making biking an attractive option and the convenience is likely the difference between choosing to ride a bicycle or not riding. Additionally, to make cycling a competitive choice compared to other transportation options it is very important that bike infrastructure creates more direct routes and reduces travel times (The City of Copenhagen, 2011, p. 22).

Consequently, bike infrastructure must be constructed where it logically makes sense in relation to the behavior of individual users and the surrounding built environment. Bicycle infrastructure must also maximize efficiency for cyclists and benefit all people. Implemented, it should be receptive, suitable, and adapted to the environment.

CONSIDERATIONS AND THE IMPORTANCE OF BICYCLE INFRASTRUCTURE

Infrastructure is the backbone of a cycle path network. A successful network is well connected, offering cyclists choice when getting around. As stated by Ronald Tamse, a Utrecht traffic engineer, it's important cyclists can choose their preferred pace and which way they want to get there. The available choices of a complete bike network afford every cyclist more flexibility when choosing their route and comfort when cycling. Additionally, bicycle infrastructure is crucial for making Copenhagen safer and accessible to bike in, thus helping achieve the city's political goals in the area of cycling. (The City of Copenhagen, 2021, p. 54).

Additionally, bicycle infrastructure and regional routes help meet sustainability goals set by the government. In fact, a sustainability goal for Copenhagen is achieving 50% cycling to work and school in 2025 as stated in an analysis of the City of Copenhagen's Bicycle Track Priority Plan 2017-2025 (Cycling Embassy of Denmark, 2017).

A final important consideration to discuss while participating in any city planning effort, including creating self-explanatory infrastructure, is equity. For whom is this infrastructure benefiting? Is bicycle infrastructure self-explanatory for everyone or



Exhibit 7.9: Intersection of Queen Louise's Bridge at Frederiksborggade and Sørøvet St. | Source: Giselle Beld

just a select group? Planners must constantly ask themselves if planning efforts result in equitable outcomes. Planners must strive to achieve equity at all steps of the planning process and create infrastructure that's beneficial to all people.

CREATE CYCLE CONNECTIONS, ELIMINATE MISSING LINKS, AND IMPROVE ATTRACTIVENESS OF TRAVEL TIMES

Copenhagen's strategy is a comprehensive, forward-thinking, guiding framework with considerable influence on bicycle infrastructure investments. Copenhagen's 2011-2025 Bicycle Strategy focuses on improving network level infrastructure, eliminating missing links, and using shortcuts to provide direct routes without unnecessary stops (See Exhibit 7.11). Improving travel time is of utmost importance for an attractive cycle path network



Exhibit 7.10: Kissing Bridge, Copenhagen | Source: Thea Wiborg

and shortcuts, like bridges over water and large roads and routes through green areas give cyclists a considerable advantage in moving about the area (City of Copenhagen 2011 p. 23). Ensuring infrastructure supports how effective bicycle travel is, in that it is faster and more convenient, is very important for encouraging more people to chose biking as a way of getting around.

SNAKE CYCLE BRIDGE

While this state-of-the-art bridge is innovative, impressive, and highly effective at facilitating a net increase in bicycle use, it would not have been considered relevant, useful, nor a smart investment before a number of housing development projects were in the pipeline. This bridge demonstrates an important lesson in placing sensible and purposeful infrastructure when it is most needed, not simply for the sake of building.

With the addition of new housing, people living across the river needed a convenient connection to urban areas, thus activating the demand for this continuous bike bridge. The bridge is designed in relation to the behavior of individual users and the surrounding built environment, which is of primary importance. Infrastructure must be sensible, functional, based on human need, and self-explanatory regardless of its innovation and so called “bells and whistles.” Leading with the approach to prioritize this self-explanatory infrastructure is extremely important in creating a bicycle network that is well connected, effective, easy to ride, and frequently used.



Exhibit 7.11: Bicycle traffic light | Source: Giselle Beld

CONNECTING COMMUNITIES AND CREATING ATTRACTIVE CYCLE PATH NETWORKED IN THE UNITED STATES

We have studied and gained a first hand experience of bicycle transportation in Europe to better understand the intersection between bicycle transportation, policy, society, and the environment. There are many applicable lessons from Denmark and the Netherlands about bicycle transportation. Critical takeaways and best practices of Danish and Dutch cities that can be transferred to the United States include:

- Study bicycle infrastructure at the network level to understand how it can connect communities, bridge gaps in the cycle network, and offer solutions for better coherence for cyclists
- Focus on improving network level infrastructure and prioritize critical links
- Use infrastructure to give cyclists a considerable advantage in travel ease. It is very important that bike infrastructure contributes to more direct routes and reduced travel times. Bicycle infrastructure must maximize efficiency for cyclists and benefit all people. A successful network is well connected,

offering cyclists choice of routes when getting around

- Study human behavior to create self-explanatory infrastructure
- Infrastructure must be sensible, functional, based on human need, and self-explanatory regardless of its innovation and so called bells and whistles
- Bicycle infrastructure must be constructed where it logically makes sense in relation to the behavior of individual users and the surrounding built environment
- Cycling infrastructure is the backbone of a cycle path network

I am so excited to have explored bicycle infrastructure because it helps me to imagine cities in the United States that also have impressive cycle path networks. Though city planning and history allow cultural differences to persist in these European countries compared to the United States, reframing transportation to prioritize the bicycle and create bicycle friendly cities is possible and achievable. Political will must be strong for change, but all planners have an opportunity to influence greater bicycle mobility.

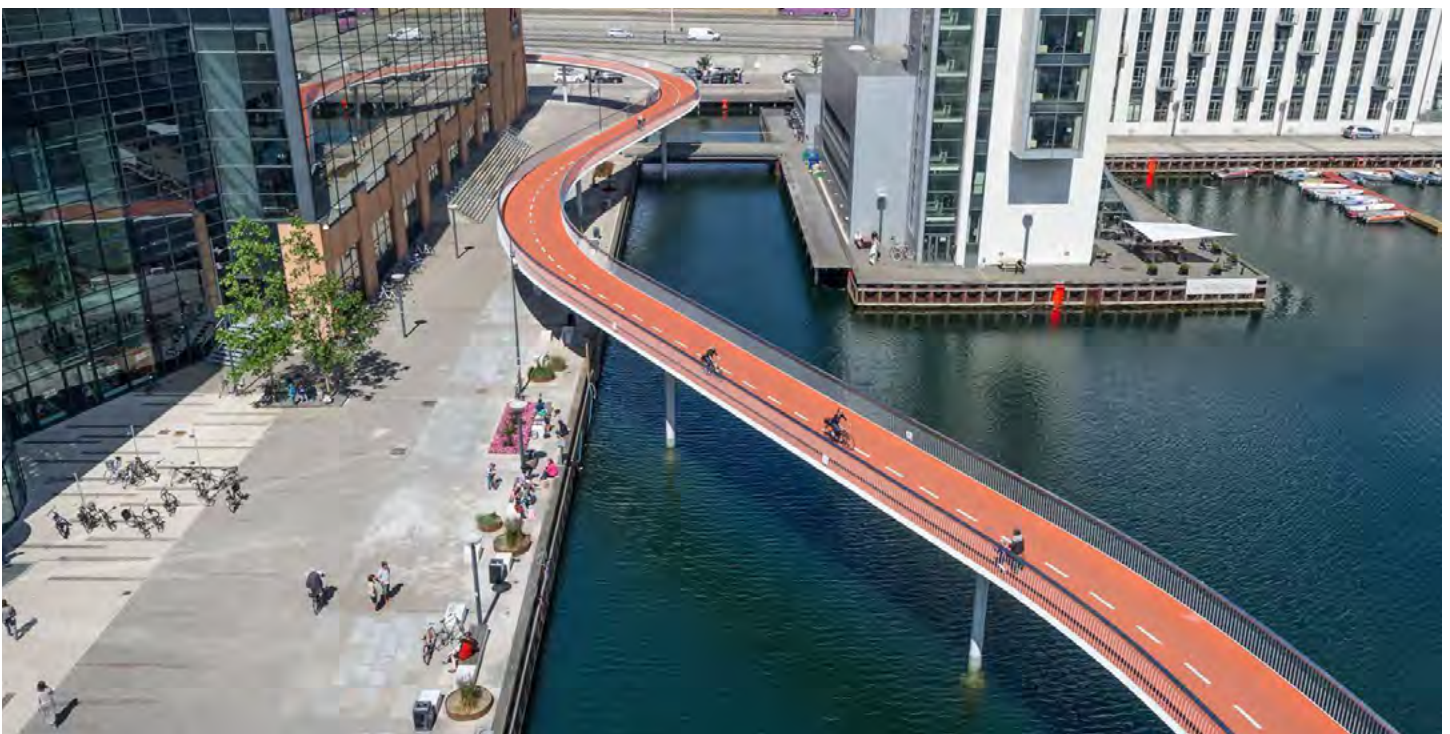


Exhibit 7.12: Snake Cycle Bridge in Copenhagen | Source: Metin Denmark



Exhibit 7.13: Oude Pijp street calming | Source: Google Earth

TRAFFIC CALMING: A KEY COMPONENT TO LIVABLE BICYCLE NETWORKS

AUTHOR: Nina Price

The Netherlands is a global leader in cycling in large part due to the high livability created by their bicycle networks. Cities in the Netherlands demonstrate why creating a dense network of cycling routes is so important, which incorporate more than simply protected bike lanes built on busy car corridors and includes alternative routes on quieter roads and neighborhood streets that bring the network to your front door. Rarely is there a street in a Dutch city where cyclists are not safe to travel despite the absence of dedicated bike lanes in many places. To create these vital network components, engineers and planners can use the most effective tool available to them: traffic calming. Traffic calming reduces the speed of cars to allow the safe mixing of bicycle and car traffic, which transforms streets into cycle routes. This chapter examines the use of traffic calming in the Netherlands as it pertains to the principles of sustainable safety and accomplishing sufficient network density. I also explore several examples of traffic calming applications in both the primary bicycle network and on neighborhood streets.

WHAT IS TRAFFIC CALMING AND WHY DOES IT MATTER?

Traffic calming describes specific infrastructure built to reduce vehicle travel speeds and the volume

of cars using the street. Features that slow traffic include speed humps, raised crosswalks, chicanes, narrow lane widths, and changes in road texture (such as from asphalt to cobblestone). Strategies to decrease car volumes include blocking off streets from cars, creating one-way roads, and “road diets” that reduce the number of travel lanes (Bunn et al., 2010).

Traffic calming provides an opportunity to increase the flexibility and density of bicycle networks by incorporating smaller neighborhood streets and parallel routes as safe and comfortable connections within the network. Protected bike lanes are expensive to implement and not always the appropriate solution for creating a safe cycling route. Cyclists can safely mix with car traffic on corridors where vehicle speeds are below 20 miles per hour (or 30 kilometers per hour) because the severity of an impact resulting from a collision is greatly reduced at lower speeds (SWOV, 2019). As speeds increase, the road design must change to incorporate physical separation that protects vulnerable road users in the case of a driver error. Implementing traffic calming allows a bicycle network to include safe, mixed-traffic streets and expands the types of streets that can function in a bicycle network.

SUSTAINABLE SAFETY

Transportation planning and infrastructure in the Netherlands is based upon the concept of sustainable safety. The core mission of sustainable safety is to create transportation systems that increase the safety of all road users by systematically eliminating the underlying risks present in the network. Central to this philosophy is recognizing the inherent human element characteristic of all transportation systems. By designing for the “demands, competencies, limitations and vulnerabilities of people, the traffic system can be realistically adapted to achieve maximum safety” (SWOV, 2019). The most recent iteration of the Netherlands’ sustainable safety approach is based on three design principles and two organizational principles. SWOV, the Institute for Road Safety Research in the Netherlands, defines these five principles in the 3rd Edition of the Sustainable Safety manual.

Design Principles

1. Functionality of roads: all roads should be designed to serve either a traffic flow or exchange purpose. Flow function is for travel only, whereas exchange function involves interactions between the traveler and surrounding services (i.e. shopping districts or neighborhoods). This principle divides streets into three categories with different relationships to their function: through roads, distributor roads, and access roads (See Exhibit 7.14).

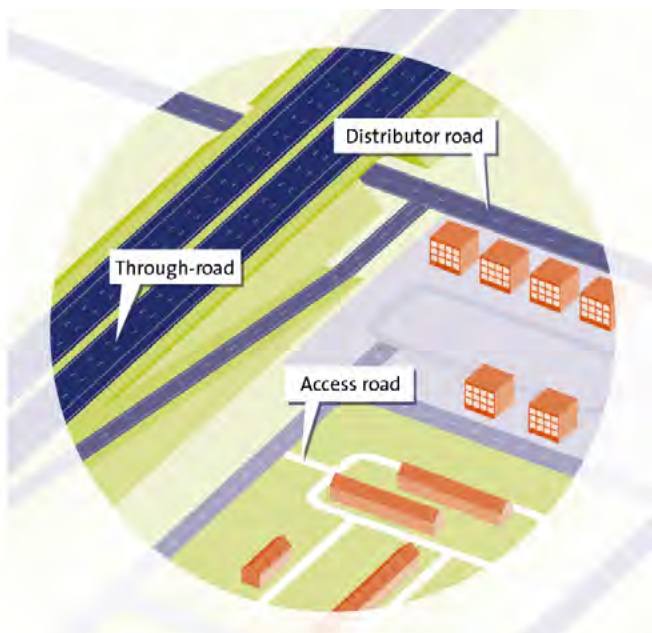


Exhibit 7.14: Road categories | Source: SWOV

2. (Bio)mechanics: infrastructure should support the desired speed, direction, mass, size, and degree of protection that is compatible with the road’s function. A traffic flow corridor requires a different design for safe travel than an exchange corridor.

3. Psychologies: infrastructure should meet the competency and needs of all users. This means that streets should be easy to understand, practical to use, and enforce the desired behavior in people’s use of the road through design.

Organizational Principles

4. Effectively allocate responsibility: transportation safety is the responsibility of the central government and operational traffic professionals rather than the users. The central government should prioritize safety projects and operational groups (e.g., planners and enforcement officers) should work to create effectively safe streets.

5. Learning and innovating in the traffic system: road safety should be an ongoing process, in which the performance of infrastructure is continuously monitored, evaluated, and adjusted to deliver more effective designs.

Traffic calming has evolved as a critical sustainable safety strategy by enforcing slower car traffic to increase the safety of other road users. First, it is one of the primary strategies for streets that have an exchange function; both access roads (like neighborhood streets) and distributor roads with access to goods and services are ideal locations for traffic calming measures. Second, traffic calming supports the (bio)mechanics of these road types by enforcing slower vehicle travel and decreasing traffic volumes on streets, which allows cyclists to safely mix with traffic. Lastly, the strategy introduces a psychological element of safety by designing for desired speed of travel rather than relying on users to choose to travel safely.

NETWORK MESHING AND "DISENTANGLEMENT"

A dense, but well-connected, bicycle network is crucial for encouraging people to cycle because it delivers two unique needs for users. It first ensures that safe cycling infrastructure is available regardless of origin and destination: as Marjolein from the Dutch Bicycle Union (Fiesterbond) explained, the network must start at your front door. Secondly, the network allows for the “disentanglement” of cycle infrastructure from car infrastructure by providing alternative, quieter routes. Ronald Tamse, a transportation engineer for the City of Utrecht, emphasized the importance of allowing cyclists to choose their route based on personal preference, whether that route is more direct via busy roads or less direct routes on calm side streets.

The bicycle network developed in the Dutch city of Delft is a relevant case-study of how increasing network density encourages cycling and attests to the power of traffic calming in fueling this mode shift (See Exhibit 7.15). In 1976, Delft’s transportation planners found that the lack of cohesion and directness of their network discouraged people from cycling. To address the obstacle, Delft planned a new network comprising three sub-networks with varying grid sizes. With

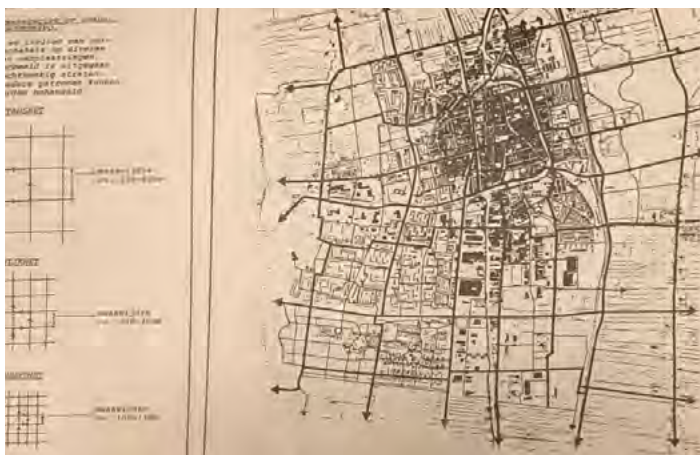


Exhibit 7.15: Delft Bicycle Network Plan, 1979 | Source: Bicycle Dutch

limited funding, planners sought to maximize the share of the network that could be served by inexpensive and less intrusive measures – namely, traffic calming (Bicycle Dutch, 2019).

The Urban Network (Stadsnet), with a mesh of 400-600 meters, was designed for longer trips across the city on flow-function streets. It required

the most elaborate and expensive infrastructure to carry high volumes of cyclists on protected bike lanes. The District Network (Wijknet) had a slightly tighter mesh of 200-300 meters for local trips. Its infrastructure included contraflow bike lanes and filtering car traffic away from designated bike routes. The Neighborhood Network (Buurnet) had the tightest mesh of 100-150 meters for short trips and to serve connections to the other networks. This mesh required the least expensive improvements, such as rerouting through car traffic or applying traffic calming to streets.

TRAFFIC CALMING IN ACTION

Now that the safety principles and network advantages associated with traffic calming have been established, we can look at its various applications in the Netherlands.

FIETSSTRAATS

One of the stand-out attributes of Dutch cycling is Cycle Streets (Fietsstraten), which are roads designed to prioritize cyclists outside of the neighborhood network. Dutch transportation planners created Fietsstraat for busy corridors where the number of cyclists could not be supported by separated cycle tracks. Instead, the whole street needed to be dedicated to bikes. In these cases, planners deployed traffic calming measures to establish bicycles as the prioritized, or dominant, mode both by encouraging cars to redirect onto alternative routes and reduce speeds enough on the street so cyclists can safely use the lane (Best Practices Dutch Cycling, 2021).

Burgemeester Reigerstraat is a prime example of traffic calming (See Exhibit 7.16). There are four key elements that collectively create a safe cycling route.

(1) The red pavement, which is the designated color for cycling infrastructure in the Netherlands, serves as a visual clue to drivers that they have entered a cycling space. (2) The cobblestone strip through the middle of the road effectively narrows the travel lanes, which requires cars to reduce travel speeds. (3) The raised crosswalk across a feeder street forces vehicles to slow down before turning onto the Fietsstraat and signals to drivers that they are entering a pedestrian space. (4) The white



Exhibit 7.16: Burgemeester Reigerstraat, Utrecht
Source: Google Earth

paint in the distance marks the location of a speed hump, which also slows cars without creating an inconvenient obstacle for cyclists.

Another characteristic of Burgemeester Reigerstraat is that it is a shopping corridor. Using traffic calming follows the (bio)mechanics principle of sustainable safety by ensuring that the volume and speed of traffic suits the purpose of the street. Low volumes of slow car traffic aligns with the street's primary function: shopping.

Sarphatistraat is another example of how traffic calming creates a Fietsstraat (See Exhibit 7.17). A raised island separates the Fietsstraat from a light rail line and serves both to narrow the lane and create a safe platform for people to wait for the tram. As on Burgemeester Reigerstaat, the pavement is red to signal that it is a cycling space. A raised crosswalk accessing the tram stop also works to slow traffic and signal to drivers that they are crossing a pedestrian space. Sarphatistraat is a great example of disentanglement. Unlike the previous example, Sarphatistraat is a flow function road that runs parallel to Stadhouderskade, a busy car corridor. Although Stadhouderskade has a protected bike lane in both directions, Sarphatistraat provides an alternative route for cyclists who, on a corridor used by fewer cars, prefer a quieter and more scenic route.

NEIGHBORHOOD STREETS

One of the best examples of neighborhood traffic calming is Oude Pijp, a residential neighborhood



Exhibit 7.17: Sarphatistraat, Amsterdam | Source: Google Earth

in Amsterdam. Exhibits 7.19 and 7.20 illustrate how chicanes, redirected traffic flow, and narrow travel lanes deliver a safe bicycle network to peoples' doorsteps. A key characteristic of this neighborhood is the removal of on-street parking. 600 spaces were removed and replaced with a centralized below-ground parking facility, making room for bicycle parking and chicanes that encourage people to slow down.

BRINGING IT HOME

Cities in the United States can learn a lot from the traffic calming practices in the Netherlands. One of the most evident applications is to improve the current use of "sharrows" to designate streets as bicycle routes, despite typically lacking additional safety measures and sufficient network density. One example is the Bicycle Boulevards in Berkeley, California, which create a gridded network of bike-friendly routes on low-traffic streets. However, the network plan only recommends traffic calming on these routes on an as-needed basis, which makes the routes difficult to distinguish from any other road in Berkeley aside from the pavement markings and signs. Additionally, the plan identifies routes 0.75 to 1.5 miles apart (City of Berkeley, 2000), neglecting the need for network access at the neighborhood level.

The current state of Bicycle Boulevards in Berkeley leaves cyclists vulnerable to speeding traffic and neglects significant network gaps that require them to navigate unsafe neighborhood streets. Exhibit 7.18 shows the Bicycle Boulevard on

Virginia Street in North Berkeley. Notably, there are no traffic calming features to prevent cars from traveling above the recommended speed of 20 mph. Following the examples seen in Dutch cities, Berkeley could implement traffic calming projects to ensure that their Bicycle Boulevards streets enforce a safe speed of traffic for cyclists to mix with cars, as established by sustainable safety principles. Traffic calming could also help expand the network to include smaller neighborhood streets that better connect people to the existing network of boulevards, as the case study from Delft demonstrated.

Traffic calming is an inexpensive and effective method to improve the livability offered through creating effective bicycle networks, increasing both the network's safety and access to the area. The Dutch have tapped into the value of traffic calming as a bicycle-friendly tool and embedded it as a critical element of their renowned infrastructure. Cities in the United States that want to grow their share of cyclists should use traffic calming to expand their bicycle networks and deliver to their residents the ability to move about their communities on a bike if they choose.



Exhibit 7.18: Virginia Street Bicycle Boulevard | Source: Google Earth



Exhibit 7.19: Oude Pijp intersection | Source: Google Earth



Exhibit 7.20: Oude Pijp street calming methods | Source: Google Earth

08

Exhibit 8.1: Students at Gehl Architecture | Source: Bridgette Bottinelli



CASE STUDY | EDITORIAL | WORKSHOP



Exhibit 8.2: Light rail in Odense | Source: VisitOdense

ODENSE AND EUGENE: A TALE OF TWO CITIES

AUTHOR: Delaney Thompson

Odense, a mid-size city in Denmark, should be recognized as a prime example of a successful bicycle and public transportation city for cities of similar size, such as Eugene, Oregon. The City of Odense has implemented many transportation infrastructure changes that proved to be successful for decreasing car usage, ranging from larger infrastructure projects, such as building bicycle bridges, to smaller but vital projects, such as installing rain sensors for cyclists.

time by train to a major city signals how certain infrastructure projects are treated differently between the two countries. Denmark has a strong focus on public transportation while the United States focuses on individual transportation options, such as personal car travel.

Bicycle infrastructure is something that Denmark does quite well. Odense has 383.64 miles of cycle lanes, with 65 cyclist tunnels, and 125 cycling bridges. Eugene, by comparison, has 304 miles of cycle lanes, yet only 7 cycling bridges. While the difference in mileage between the amount of cycle lanes in each city is not surprisingly large, the difference in other bicycle infrastructure paints a picture that Eugene provides less accessibility for cyclists throughout the city.

Pedestrian and cycling only streets are one key feature that Eugene should consider immediately implementing. Odense constructed several pedestrian and cyclist only streets in their downtown core, which contributes to increased commerce, better connectivity from one side of the city to the other, increased safety, and an increased sense of community. These outcomes are all positives that could greatly improve Eugene’s downtown core’s attractiveness for people living in the area. Delivery trucks are still allowed into these streets at certain times of the day, allowing local

	Odense	Eugene
Total Population (as of 2017)	200,703	170,457
University Population (as of 2016)	29,674	23,634
Land Area (square miles)	30.60	44.21
Travel Distance to Copenhagen/Portland (miles)	102.34	109.90
Travel Time by Train to Major Cities (total minutes)	71	166

Exhibit 8.3: Comparing cities | Source: Delaney Thompson

As seen in Exhibit 8.3, Odense and Eugene are similar in overall population, university population, and square mileage. The disparity in travel

businesses to operate as usual without any major restructuring of how to receive shipments. Streets are also freed from having to factor in car parking, allowing more space for public areas, or spaces for restaurants and cafes to create outdoor seating.

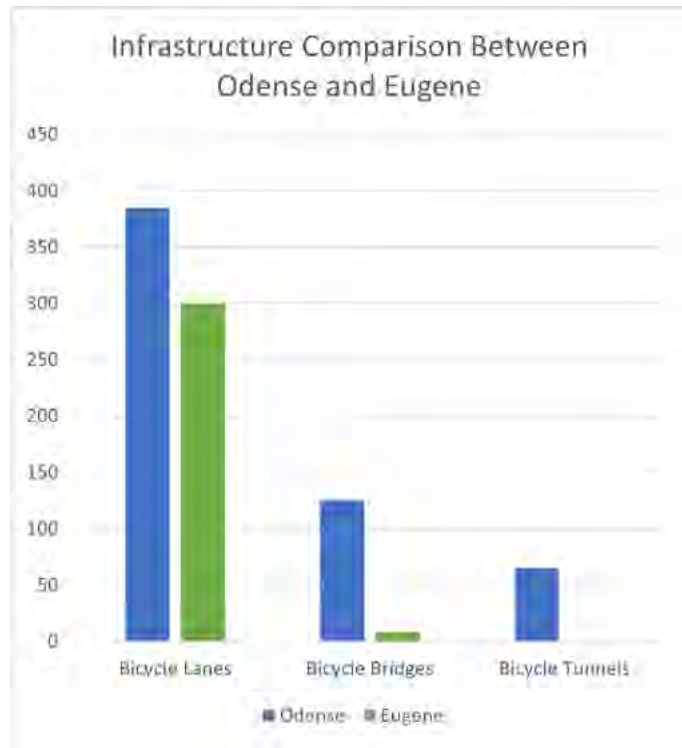


Exhibit 8.4: Comparing bicycle infrastructure
Source: Delaney Thompson

A street that could be a prime candidate for pedestrian and cyclist only usage in Eugene would be W. Broadway, from Charnelton to Pearl Street. W. Broadway has been designated for pedestrian and cyclist only use before, for months at a time, signaling the potential for such a move to remain permanent. More streets would become clear candidates after W. Broadway’s change and monitoring pedestrian and cyclist traffic flows would reveal the best roads for implementing future changes. W. Broadway is even classified as a “popular bike route” on the City of Eugene’s 2022 Official Bicycle Map.

Rain sensors are another great piece of infrastructure present in Odense. The city receives an average of 1.0 to 2.0 inches of rain throughout the year, while Eugene typically receives 0.4 inches of rain in the summer months, and up to 4.3 inches throughout the fall to spring. With Eugene’s large variation in weather, and heavy

rain seasons, rain sensors would be a wonderful addition to existing bicycle traffic signals as well as future signals installed. The sensors in Odense give cyclists approximately 20 more seconds to cross intersections and increase the radius of motion sensors detection to keep traffic lights green longer. As a result, stopping and starting will not deter would-be cyclists from traveling by bicycle in the rain. “The rain sensor interacts with two motion detectors also mounted on the traffic light, allowing the system to register when bikes are within 70 meters of the intersection and automatically maintain longer periods of green light for cyclists approaching the junction. A box mounted to the traffic light informs cyclists of the system, and will light up when the system kicks in.” (State of Green, n.d.).

Raised cycle paths are prevalent in both Denmark and the Netherlands. Raised cycle paths help create a sense of separation between cyclists and cars, which helps cyclists feel safer, while giving drivers an understanding of the clear divide between car space and cyclist space. Raised paths would likely be easier to implement than entire separated bicycle lanes because all that is required is extra concrete. The amount of space that raised paths take up would feel like it increased, even if it did little so, and therefore would feel like more space for those not traveling by car.



Exhibit 8.5: Rain sensor on traffic signal
Source: @Denmarkdotdk

Cyclist bridges are another piece of infrastructure Eugene should place a greater emphasis on building. Odense has 125 pedestrian/cyclist bridges, while Eugene has only seven. Eugene has significantly more water with the Willamette River passing through the city while Odense only has a harbor. Without easily accessible bicycle paths that are well connected, would-be cyclists can be easily discouraged from cycling in the first place.

The City of Eugene should consider looking to Odense as a successful blueprint for future ventures in building out the bicycle infrastructure within the

city. Odense could be considered a typical example of what Denmark has been able to accomplish in terms of transportation infrastructure. Eugene is currently considered to be a successful city in the United States when it comes to promoting bicycle transportation. The two cities are similar in population, university size, city size, and distance from major cities. By adopting key infrastructure, such as pedestrian and cyclist only streets, rain sensors, raised cycle tracks, and cyclist bridges, the City of Eugene could continue to rise as a successful mid-size bicycling city comparable to a city of similar size with thousands more cyclists.



Exhibit 8.6: 13th St. bike lane in Eugene | Source: City of Eugene



Exhibit 8.7: Shared road in Odense | Source: Connie Juel Clausen



Exhibit 8.8: Ticket machine at Driebergen-Zeist | Source: Nick Deshais

BLUE & YELLOW: WHY BICYCLES AND TRANSIT SHOULD BE MARRIED AS COMPLEMENTARY MODES, AND HOW BIKESHARE PROGRAMS CAN DO IT

AUTHOR: Nicholas Deshais

Blue and yellow. All around me, blue and yellow. As I sat viewing the commotion at the Driebergen-Zeist railway station in suburban Utrecht, I saw it everywhere. Blue and yellow trains. Blue and yellow bicycles. Even blue and yellow ticket machines, where I made my discovery. I suddenly knew why the Dutch rode bikes everywhere, telegraphed to me in those two simple colors. It was trains. And bikes. The two together, treated as one single mode.

I and a few of my cohort had ridden from our hostel in central Utrecht to this suburban station to meet Bradley Tollison, an Angeleno ex-pat and current transit scheduler in the Netherlands living in this suburb.

My plan was to pedal to the station and train back, bicycle in tow. Perhaps an exercise in laziness, I saw it more as a way to experience a Dutch train, something I had only done once, when we rode from Cuijk outside of Nijmegen to Utrecht. I enjoyed that journey immensely, watching the red bicycle path snake between the rails I was on and the canal we rode by. I even found interest in the woman berating some of my colleagues who occupied the sole, and little, space the train had for bikes with their luggage. I couldn't understand her, but when she shrugged and waved them off, I picked up her meaning: No matter, another train will be by soon, you obstructing tourists.

Back at the Driebergen-Zeist ticket machine, I considered my situation. It's 12 kilometers from where I was standing to our hostel, about a 45-minute bike ride. Or, it's an 11-minute train trip to Utrecht Centraal station, which itself is a short walk to our hostel. For me alone, a trip from the Driebergen-Zeist to Utrecht Centraal costs €2.30. To bring my bike, which I was completely barred from doing at all during peak commute hours, I would have to shell out an additional €7.50. I was a bit aghast, and told Floris Post, our Amsterdammer guide who'd been with us since beginning our trip in Copenhagen, of the cost. "A Dutch person would never pay that," he said, describing once again the frugality that he says defines his kin. Quadrupling the fare on thrifty people is quite the disincentive. I guess I've got some Dutch in me. I got back on my saddle, and saved myself €10.

As I rode back, seeing the frequent blue and yellow NS trains darting over the landscape in the distance, I wondered how it was that the Dutch ride trains and bikes everywhere, yet discourage them from going together. And there it was, flashing before my eyes. Blue and yellow.

To stretch a metaphor towards ridiculousness, the Dutch treat the modes like the colors blue and yellow. Next to each other, as a united blue-and-yellow, they symbolize each mode and work amazingly well together. When I saw them, I knew I was near a train station, or riding by one of their bikes. When combined, however, they curdle, turn green, and quadruple the price.

THE NETHERLANDS: BIKE NATION

The relationship between bikes and trains in the Netherlands marches back in history, to a time long before the automobile. These cities are old, and the streets of their central areas are skinny, built for walking, pushcarts, and horses - a trait more amenable to bicycles, even trams, but not traffic jams.

As detailed in the book "Bike City Amsterdam," co-written by Marjolein de Lange and Fred Feddes, the cities of the Netherlands are perfect in this way for bicycles. Mid-20th century planners were misguided, and overly smitten with automobile technology, when they tried to turn these medieval streets into thoroughfares for bulky, speedy vehicles with internal combustion engines. Thankfully, other plans had already been laid and fulfilled, and the small country - with an area that would make it the 42nd largest state in the U.S. - was ideal for a nationwide train network (See Exhibit 8.10). The Dutch National Railway Company, which has transformed into today's blue-and-yellow Nederlandse Spoorwegen (NS), was founded in 1837 and had the country entirely connected by rail before the end of the 19th century. Plans to motorize the country came and were



Exhibit 8.10: The Netherlands atop the contiguous U.S. Source: Nick Deshais

largely vanquished in the country's urban areas, a battle waged beginning in earnest in the 1970s, as detailed in "Bike City Amsterdam." The "Stop de Kindermoord" campaign and OPEC oil crises were major events during the fight to keep cars from dominating the streets, but de Lange and Feddes show that much more activism went into the effort over the course of decades. Regardless, by the mid-1990s NS had witnessed a phenomenon: a lot of its passengers rode their bikes to catch the train. This simple observation led to the creation of a 20-year plan to build 300,000 more bike parking spaces at the nation's train stations. When it built more parking, train ridership doubled.

Nowadays, 30 years after NS envisioned the harmony between bicycles and trains, half of all train passengers in the Netherlands cycle to the station, and a quarter of all kilometers cycled in the nation are either to or from a train station, according to Chris Bruntlett, marketing and communication manager at the Dutch Cycling Embassy. These statistics are aided by the fact that there are now 700,000 bike parking spaces at the nation's train stations. And more than 80 percent of the population lives within 7.5 kilometers of a train station - a comfortable cycling distance. This proximity and visible infrastructure marrying the two modes of travel has led to high levels of train use in the country. But as just a wayfaring traveler to this country, and believer that bicycles are the future of transportation, I wondered if and how such a system could work in the U.S. Of course, as everyone knows, the U.S. has paltry transit and bike use. Disregarding New York City, which accounts for 75 percent of transit trips in the entire country, Americans simply don't use transit in a significant way. You don't need comparisons to see this, but



Exhibit 8.9: Boarding a train in Utrecht | Source: Nick Deshais

when put against a country like the Netherlands, the paucity of transit use in the U.S. is striking.

The Netherlands is served by one principal passenger railway operator - the historic NS. It is the busiest railway in the European Union, and third busiest in the world, behind Japan and Switzerland. It covers most of the country, and runs four trains per hour between the five largest cities (Amsterdam, Rotterdam, The Hague, Utrecht, and Eindhoven), and at least two trains per hour everywhere else, for 20 hours a day (between 5 a.m. and 1 a.m.).

About 1.3 million Dutch take the train on a typical weekday, and board or alight the trains at one of the nation's 388 train stations. According to a recent report from the Netherlands Authority for Consumers and Markets, passengers in 2019 rode 19 billion kilometers on trains, and 25.1 billion on transit altogether.

U.S. transit riders tallied more than 87 billion passenger-kilometers during the same year, according to data from the U.S. Bureau of Transportation Statistics. This includes, rail, bus, ferries, and more. That's a lot more "mileage," it's true, but to put it in perspective the U.S. population is nearly 20 times larger than the Netherlands (331,894,000 to 17,340,000), and its area is almost 250 times its size (3,796,742 square miles to 16,164 square miles). So, if all other things were equal, the U.S. should have much higher transit use.

OV-FIETS: TRANSIT-BIKE

There are a lot of differences between our two countries, our histories, our cultures, and the way our transportation systems are designed, funded, and built. But the most obvious difference was right before my eyes: bikes and trains. Which brings me back to the Driebergen-Zeist train station. In fact, calling it a "train station" misses the point. It's a mobility hub. The station is suburban and simple. It doesn't compare to the beauty and majesty of Utrecht Centraal, with its cathedral-like spaciousness, glassy disposition, and the world's largest bike parking facility, with 12,500 spaces. Still, at Driebergen-Zeist, trains stop at the station every few minutes. A bike path courses below the rails, an airy space with ticket machines, a cafe, and plenty

of bike parking. A sizable bus station sits on one side of the tracks, where local transit riders board from elevated platforms. Opposite the tracks from the bus stops, a big parking structure looms in the distance, as does a lot for what the Dutch call "kiss and ride" drop-offs. In other words, Driebergen-



Exhibit 8.11: Floris' OV-fiets bike at Driebergen-Zeist
Source: Nick Deshais

Zeist has it all. But what it clearly prioritizes is the relationship between bikes and trains. Motorists have the longest distance to walk from their vehicle to a train. Then the bus riders, though it's much closer for them. Bikes are parked right below the tracks, mere steps from the stairs to the platform.

Something else it has are those blue-and-yellow bikes. In 2003, NS launched a nationwide bikeshare program called "OV-fiets," which translates to "public transport bike." These bikes, adorned in the railway's colors, are uniformly simple machines. They have step-through frames, giving them the "omafiets" style ubiquitous on Dutch roads. A sturdy back rack comes equipped with a strap. There is only one gear, and the chain is encased in an encompassing, leg-protecting guard. The lack of gear shifters on the handlebars is accompanied by a lack of a brake handle: coaster brakes bring these bikes to a stop. They have built-in lights and fenders, allowing people to ride them at any time of day and in any type of weather.

On our way back from Driebergen-Zeist, I asked Floris if I could ride his OV-fiets bike for a while. An "OV-chipkaart" can be used for transit and bike use, allowing NS customers to seamlessly ride the train and grab a bike, supplying the needed "last

mile" connection. In fact, a chipcard must be used to take a bike, and it is difficult to get one if you're not a resident of the country, which is why I had to borrow his. Floris was, as usual, amenable, and I rode his bike for a few kilometers. Though I'm tall, and the bike was a bit too small for me, it was a joyful ride. Perfectly geared for the flat country, the bike was spry and easy to maneuver. Probably not ideal for long rides, the bicycle would be more than good for trips around town. Currently, the program has 21,700 bikes located in 300 locations, primarily train stations. The cost to use a bike is \$0.15 per day, with an annual fee of \$0.01. In 2020, 3.1 million rides were taken on OV-fiets bikes, down from a pre-pandemic peak of 5.3 million in 2019. Despite the U.S.'s many differences it has with the Netherlands, it is here - bikeshare and its relationship to transit - where the U.S. could take a page from the Dutch playbook to encourage people to take bikes.

"In 2020, 3.1 million rides were taken on OV-fiets bikes. down from a pre-pandemic peak of 5.3 million in 2019."

BIKESHARE AMERICA: HOW LOS ANGELES AND THE NETHERLANDS COMPARE

As I noted earlier, it's unfair to compare the diminutive nation of the Netherlands to the sprawling disorder of the U.S. However, if the U.S. is akin to the European Union, than U.S. states are something similar to European nations. But what about cities?

As a current resident of Los Angeles, I'm familiar with the transportation system. I ride my bike here for nearly every purpose, because the city is ideal for people on bicycles, despite popular belief and in spite of how most people use the streets. I take the train when I can. I even have a car for those unavoidable trips in this auto-dominant metro. Therefore, I'll compare bikeshare programs run by transit systems in the Netherlands and in Los Angeles, the second-largest city in the U.S. While the metropolitan region of L.A. is a quarter of the size of the Netherlands (4,850 square miles to 16,164 square miles), their populations are

comparable, with 18.5 million and 17.5 million, respectively. Considering L.A.'s greater density and smaller size, the city and region should in theory be able to support a robust transit and bike network like that of the Netherlands. To its credit, L.A. has tried. Since 1990, but more so in the past two decades, the City of Los Angeles, with voter support, has invested hundreds of billions of dollars to expand transit and bicycle networks. In 2017, voters overwhelmingly passed Measure M, a \$120 billion sales tax measure devoted solely to transit. With that money, and funds from other previous voter-approved measures, the Los Angeles County Metropolitan Transportation Authority (Metro) is in the midst of an ambitious rail expansion program not seen since the days when transit systems were operated by private, for-profit companies a century ago. As part of the \$26.2 billion "28 by 28" program to vastly expand its transit network before the 2028 Olympics, the city is building an 8.5-mile light rail line to the Los Angeles International Airport (LAX), and is near completion of the long-proposed "Subway to the Sea" under Wilshire Boulevard that will connect downtown L.A. to downtown Santa Monica.

In addition, in 2015 the city approved its Mobility Plan 2035, which designated an extensive network of pedestrian-priority areas and protected bikeways, among other things. A recent effort to force the city to implement the mobility plan failed to gather enough signatures to reach the 2022 ballot. However, despite the efforts and investments,



Exhibit 8.12: Planned rail and rapid transit to be completed in L.A. by 2028 | Source: Gwynedd Stuart

transit ridership has gone down, and bicycle use remains dangerous and difficult, while car ownership in the city has only gone up. In 2011, total rail ridership for Metro was 50 million. In 2021, that number fell to 24 million passenger miles, a decrease that began years before the transit-punishing pandemic. The region has also seen increased car ownership, which jumped from 1.7 to 2.4 vehicles per household between 2000 and 2015, a worrying trend driven primarily by access to credit and debt, according to a recent analysis from the Institute of Transportation Studies at the University of California Los Angeles. It probably goes without saying that besides their populations, the Netherlands and the metro region of L.A. have little in common. Yet they both have bikeshare programs operated by their transit company.



Exhibit 8.13: Metro bike share at downtown Santa Monica station
Source: Nick Deshais

Metro Bike Share, as its name suggests, is a program of Metro, administered in partnership with the City of Los Angeles. However, it is run by the Philadelphia-based Bicycle Transit System. The program was launched in 2016, and currently has 1,400 bicycles located at 250 stations throughout the metropolitan area. Unlike the city's transit system, which is expansive and affordable, the bikeshare program is fairly limited and costly.

Many of the bike stations are at train or major bus stops, but not all of them. A map of the stations on the program's website shows the stations largely clustered in the central downtown district and Hollywood, North Hollywood, and on the city's westside in the area bounded by UCLA, Venice, and Culver City. A standard ride costs \$1.75 for every

30 minutes thereafter. However, there are various passes that can bring down the cost. A 24-hour pass is \$5, and the first half hour of every ride is free, but after that it's again \$1.75 for every 30 minutes. There is also a 30-day pass for \$17 and a 365-day pass for \$150, which also include a free first 30 minutes of riding. Like an OV-chipkaart, people can use a single TAP card to ride transit or grab a bike. Although using a single payment method for both services can make it easier to use transit, this model is still uncommon in most large U.S. cities.

As a former graduate student at UCLA, I live on the westside and have convenient access to these shared bikes, primarily at stations for Metro's light rail E Line, which connects downtown L.A. to Santa Monica on a repurposed route of the Santa Monica Airline interurban commuter train, which ran from 1908 to 1953. The bikes I've used have seven gears and are heavy, bulky, and difficult to ride. And, as some regional place names suggest (Beverly Hills, Hollywood Hills, Cheviot Hills, the California Incline), Los Angeles is not always flat. To aid in this situation, some of the bikes have pedal-assist motors capable of going 17 mph. But not all. Even just a slight headwind from the ocean can make these bikes a bear. The electric bikes cost \$1 to unlock a bike, but are the same price as standard models once riding.

WHAT THE DUTCH AND DANISH TELL US ABOUT AMERICANS

When I embarked on this trip, my main goal was to bring something home. Not a keepsake, but something useful. Knowledge. Something to help break the automobile's singular hold on the U.S. transportation system. It's impossible to transfer the insight and practicality from one nation to another. And it goes without saying that I'm no expert in anything Dutch or Danish. It would take something approximating a lifetime for that to occur, and though two weeks in each country is a privilege I won't forget, it's not enough for practical wisdom or insight. However, I did notice a few things about the two nations. However, before I get to my analysis and conclusion on what I think could move the U.S. toward a less car-dominated future, let me try to explain what I saw in regards to the Dutch and Danish.

The moment we left Copenhagen, I longed to be back on its streets. I felt welcome there, and safe on its bikeways. I quickly knew how to find my way back to the hostel, somehow oriented to the old city's directions. I took to the Danish way of cycling, and saw immediately how their streets could be replicated in the U.S. But, I knew I was in the blush of having newly arrived in Europe. Like the early days of love, I was perhaps too smitten, and waited for the other cities we were to planning to visit to shake me from my Copenhagen fixation.

It wasn't until Utrecht that something like that finally, almost occurred. Not in Svendborg and definitely not Korinth. Almost in Odense, not nearly in Nijmegen. No, it was Utrecht where I saw the true strength and joy in the Dutch model of cycling, and that was in large part due to the guidance of Ronald Thamse, a transportation engineer who's worked for the municipality for 25 years. He took us to the bicycle- and train-oriented suburb of Houten, where it's more of a pain to drive a car than not. He showed us the city's new bike bridge – the Dafne Schippers Bridge – and led us through Utrecht's, and the world's, biggest bicycle parking garage. And he gave us a pithy encapsulation of what it means to be Dutch. "Welcome to the Netherlands," he said the first day we met him. "Don't tell us what to do. If there's a red light, I will decide." In other words, rules will be ignored. As long as you feel safe and comfortable, that's all that matters if you're Dutch and on a bike.

I heard this a lot in the Netherlands: the Dutch don't follow rules, and the Danish do. The Dutch watch for subtle signs in cycling behavior for a signal of a turn, and the Dutch employ obvious hand signals for turning. The Dutch use feelings, the Danish use intellect. Maybe it's true. I don't know. It's true that the Danish are more obvious in their cycling intentions. And it's true that the Dutch aren't. It could be cultural, or just a matter that people in the Netherlands have biked as a matter of national policy since the 1970s, while the Danish have only focused on it for the last 20 or so years.

Culture aside, now that I've ridden on the bikeways in both countries, I can say I felt much safer in Denmark. Is that because the street scheme is more American, with the different modes – walking, biking, driving – clearly separated and

disentangled? Do I feel less safe on the Dutch streets because everyone here rides a bike and so they feel less of a need to separate everything and at times chaos seems to rule? Hard to say. Days, weeks, a lifetime before we cycled with Thamse, we heard from James Thoen, the director of the

"Now that I've ridden on the bikeways in both countries, I can say I felt much safer in Denmark."

urban design company Copenhagenize. He's from Toronto, but has been in Scandinavia for more than a decade. He told us he believes the design of Copenhagen is replicable anywhere in the world, and rattled off a list of cities on every continent across the globe where bikes are becoming more common. I agree. What's going on in Copenhagen can happen anywhere. Bikes have their own space. So do cars. It's safe, and riding bike is extremely convenient. Odense is showing that Copenhagen can happen in a smaller city. My eyes tell me the streets of the U.S. can be "Copenhagenized" with little effort or financial outlay.

But what's going on in the Netherlands seems particular to this country. When I first arrived in Amsterdam, I felt like it was Copenhagen but taken over by anarchists, the designers of Blade Runner, or worse. I've calmed since then, but the feeling remains. Copenhagen is for everyone. Amsterdam is for Amsterdammers.



Exhibit 8.14: World's largest bike parking garage
Source: Nick Deshais

SUMMARY AND RECOMMENDATION

So, given that its roads would surely overwhelm the typical American, what can the Netherlands provide? An exemplary model of how transit and bicycles should be married, happily ever after. While there are examples of U.S. transit operators running bikeshare programs, they remain remarkably rare despite the obvious synergy between bikes and transit that is exemplified by the Dutch model (See Exhibit 8.15). Aside from L.A.'s Metro Bike Share, there's Austin's MetroBike, RTC Bikeshare in Las Vegas, and RideKC Bike in Kansas City. A paltry five programs, out of the 298 cities that the North American Bikeshare and Scootershare Association estimates have a bikeshare or e-scooter system.

Why would it be good to offer more robust bikeshare programs linked with transit agencies? First, because transit agencies have deep experience operating and managing fleets. Second, and more to the point of this paper, transit agencies

could integrate bikeshare into their stations and stops and simplify intermodal transfers, allowing riders to book a single trip - solving the first- and last-mile obstacle.

Finally, and put simply, getting transit agencies to administer bikeshare would boost bike commuting numbers and enlarge the catchment area of each transit stop or station. A 2020 study done by Dafeng Xu, an assistant professor in the University of Washington's Evans School of Public Policy & Governance, found that bike commuting increased by 20% in cities that introduced bikeshare programs. According to NACTO, the typical bikeshare user rides for 1 to 1.5 miles - the very definition of first- and last-mile. What's more, NACTO found that nearly half of bikeshare trips are done to replace car trips. In short, bicycle and transit use should be seen as collaborators in replacing car trips.

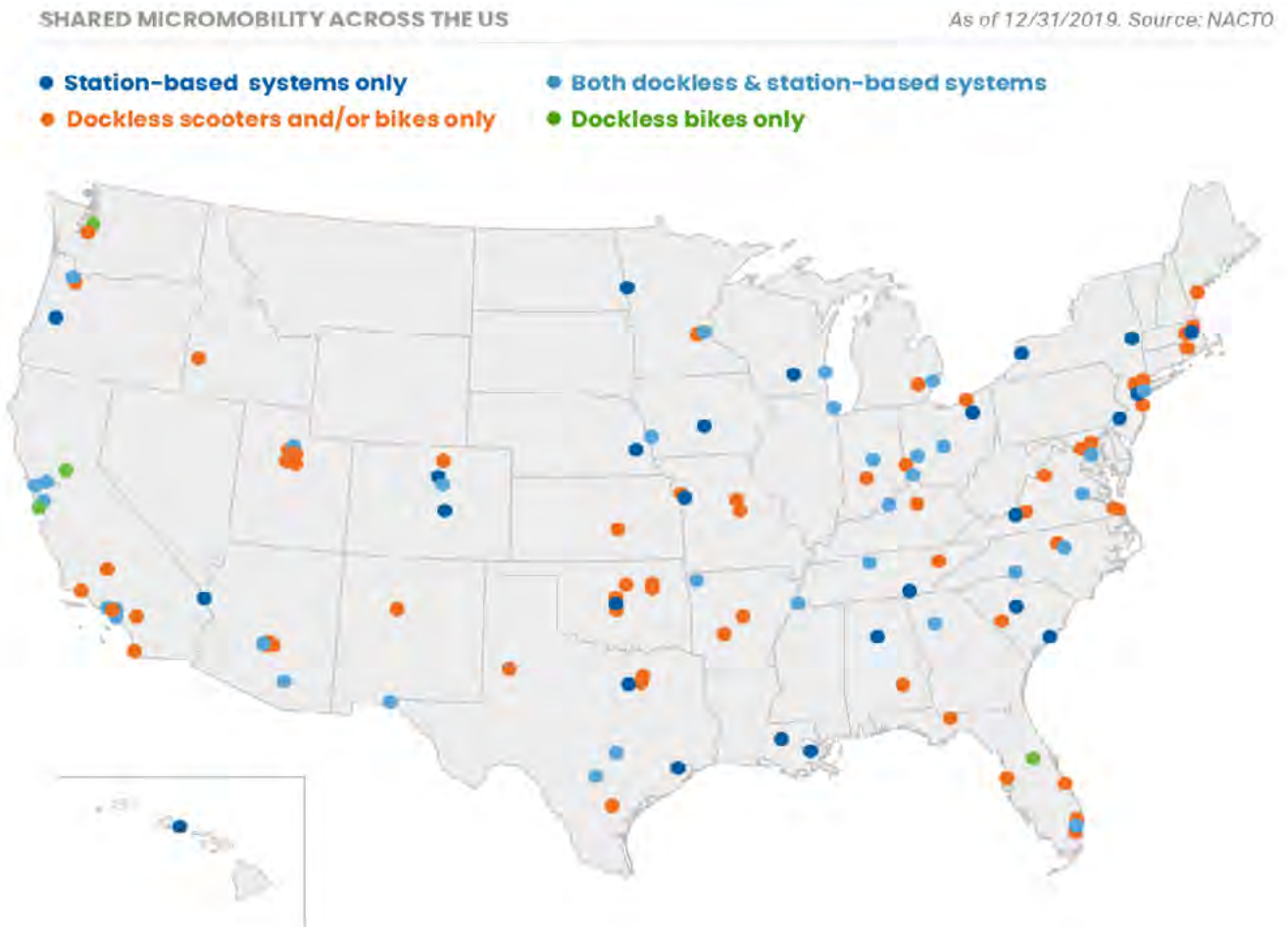


Exhibit 8.15: Shared Micromobility Across the U.S. | Source: NACTO

Los Angeles, despite its well-deserved reputation of gridlock and endless highways, has an opportunity to make it work. As previously noted, voters have time and again approved hefty tax measures to improve transit and get cars off the road. And though history is often and unwisely overlooked by planners and policy makers, L.A., like many cities, has a long history of bicyclism. Look no further than the California Cycleway. Opened in 1900, the nine-mile elevated bicycle tollway was built through the Arroyo Seco river drainage with plans to connect Pasadena to downtown Los Angeles (See Exhibit 8.16). When the Pacific Electric Railway built a line between L.A. and Pasadena, and the cycling craze of the 1890s petered out, the elevated cycleway was dismantled. Perhaps ironically, the cycleway's right-of-way was later used for the Arroyo Seco Parkway, also known as the Pasadena Freeway, which is one of the oldest freeways built in the U.S.



Exhibit 8.16: California cycleway in 1900
Source: Pasadena Museum of History

All of this is to say is that L.A. should continue its robust construction of light rail and bus lines, and match it with an equally robust expansion of its bikeshare program.

Compared to the Netherlands, L.A. currently has just 6% of bikeshare bikes (1,400 to 21,700) for a comparable number of stations (250 to 300). The number of bikes simply needs to increase, and in an exponential fashion. As does the frequency and dispersion of stations. More importantly, the cost of bikeshare needs to drop significantly for people to use it in L.A. With the Euro and dollar being on par as of this writing, it is easy to compare the costs. A full day of riding in the Netherlands costs as much as less than 90 minutes in L.A. (\$4.15 to \$5.25).

This is frankly ridiculous, especially considering the role of transit in providing fair and equitable transportation to its riders. I'm probably naive or idealistic, perhaps both. But I believe the bicycle is the future of transportation. And I believe places like Los Angeles can be bike cities along with Amsterdam and Copenhagen. Yes, the Dutch love biking. The nation has 23 million bikes for 17 million residents. They take 5 billion bike trips per year, pedaling about 1,000 kilometers per person per year. But can people on bicycles ever become as common in the U.S. as they are in the Netherlands? Yes, with effort and infrastructure, they sure can.



Exhibit 8.17: Bicycle parking | Source: Nick Deshais



Exhibit 8.18: Students at Gehl Architects | Source: Nick Meltzer

HOW TO PRESENT ON BICYCLE CULTURE

AUTHOR: Tam Guy

PRESENTATION CONCEPT

INTRODUCTION

Before leaving the USA for the program, each student provided statements on what we wanted to gain from this learning abroad course. We hope that you understand a bit more about the possibilities for your own towns and cities from our sharing the lessons we learned in person and through further research as shared in this final project. That said, while we strove to turn those lessons into this project as best as possible, no text, photo, audio, or video can fully convey three vital takeaways. The autonomy, safety, and convenience supported by designing cities for people on bikes can be learned best by personal experience.

AUTONOMY

One way to define autonomy is the ability to make decisions and act on those decisions. Or, as defined by Merriam-Webster, “self-directing freedom and especially moral independence”. We saw a wide range of people of varying ages and abilities experiencing the freedom of mobility in their cities, towns, and rural areas in both Denmark and the Netherlands. Groups of young teenagers rode together after school—socializing and physically exercising simultaneously while freeing up their parents from chauffeuring them. Elders met one another in the afternoon to do a bit of socializing

and shopping. Importantly, we as students experienced the independence of living day-to-day in their cities. We lived the challenge of figuring out answers to day-to-day questions. What do I need to do? What do I want to do? How can I get there to finish it all? Even in these new-to-us cities, we experienced the freedom of movement made

SAFETY

All of us in the course knew in general how to ride a bike, and received instructions on road rules and distinct biking customs in Denmark and the Netherlands. Yet, the ability to drop a group of college students into new cities with rented bikes and let them loose during rush hour commutes was safe because the cities designed their transportation infrastructure to be safe for people on bikes. We saw parents taking their toddlers to daycare in cargo bikes. We saw parents riding home from school with their primary school kids on their own bikes. People could move about their towns without fear of being maimed or killed by an automobile crash at any moment. All of the charts, photos, and videos available online fail to convey the sense of safety experienced in real time on our bikes. Truly, experiencing the milieu turned biking for daily life from something “they do over there” into a lived reality.

CONVENIENCE

In both Denmark and the Netherlands, planning enables the building of truly convenient transportation. The ease of getting from place to place highlighted the transportation network's connecting clusters of services (and other destinations). At a national scale, both countries possess intercity bike networks for long distance riding for holidays that span the entire country. At the regional scale, both countries possess intercity bike networks for basic suburban-to-urban commutes. At the local level, both countries offer intra-city bike networks as extensive or more extensive than car networks. People can do almost everything they require. As previously mentioned, children's school travel is largely by bike, especially for teenagers. People grocery shop by bike. People commute by bike. We saw window washers, construction workers, and cellists moving themselves and their tools on bikes. We attended discussion panels, went grocery shopping, and completed laundry all by bike. Words cannot convey how easy it was in the cities we visited simply to do what needs to get done in life on a bike. Designing cities for people on bikes enables a level of convenience unrivaled—yet completely possible—in U.S. cities.

CLOSING

Though we know nothing fully conveys the autonomy, safety, and convenience we experienced while biking in Denmark and the Netherlands, we hope our final project sparks your interest, imagination, and action for your own places' futures.

BICYCLE WORKSHOP CONCEPT

First, learn about the group that is participating and think of an introduction that engages an aspect of their community and/or daily life (i.e., student, practitioner, community member, politician, etc).

Transition to asking the attendees to think about their daily travel—a commute if it is applicable. Show a video from Copenhagen, Odense, Utrecht, or Amsterdam during the evening rush hour. When the video ends, begin explaining the instructions guiding the activity.

Activity:

1. Have each participant write down a list of all the destinations they need to travel to in a typical week (or month) as part of their daily lives.
2. Ask participants to choose the three most important trips. Instruct them on how to use a mapping app to calculate how much time it takes to make those trips by car, transit, and/or bike. Be sure participants write down the travel time for each type of mode.
3. Pick a hypothetical home place in Copenhagen, Odense, Utrecht, or Amsterdam.
4. Use a mapping app to calculate how much time it would take to complete the same three high priority trips by car, transit, and/or bike in the chosen city (in Step 3). Be sure participants write down the travel time for each type of mode.

Once all the travel times are written down, engage the group in a discussion about travel times by different types of modes. **Questions to consider asking participants:**

- What do you notice about the similarities and differences in total time spent between the two areas?
- What do you notice about the locations of the places you'd need to travel?
- What concerns would you have about driving, taking transit, or riding a bike to complete trips in your locality?
- What tasks are reduced or unnecessary if you use transit or ride a bike to complete these trips instead of driving a car (such as oil changes and tire rotations)?

Use the suggestions and create your own to prompt a discussion that compares how each place is oriented differently, where one favors car trips while another favors bike trips. Ask participants to think about how a different approach to transportation design can make other modes (especially bikes) more convenient for people and some of the benefits that result from reducing or eliminating car usage.

09

Exhibit 9.1: Amsterdam street | Source: Bridgette Bottinelli



APPENDIX



Exhibit 9.2: Student group | Source: Nick Meltzer

AUDIENCE NARRATIVES

In addition to a report, students crafted an argument in support of biking for different audiences. They were asked to take the gist of their topical reports presented in Chapters 2-9 and adapt the key message for different audiences of their choosing. We have included a selection of these audience narratives. This section is broken down by audience: community members, policy makers/public officials, and car enthusiasts.

COMMUNITY MEMBERS

BICYCLE TRANSPORTATION MAKES OUR COMMUNITIES SAFE AND MORE ENJOYABLE

AUTHOR: Brendan Irsfeld

If there is one detail visible while biking in Denmark or the Netherlands, it is this: there are plenty of children and younger residents biking too. In both countries, children may bike alongside their parents in traffic as young as five or six years old. Yet despite their presence, both countries possess extremely low rates of traffic fatalities. That feat is a result of a deliberate effort to make the act of riding a bike or walking down the street the safest possible method available for travel. The City of Amsterdam faced this question in the 1970s, when 3,000 people, 450 of them children, died in 1971 as a result of traffic fatalities. According to data published by the United States Department of

Transportation, nearly 20,000 children died from traffic fatalities in 2021, the leading cause of death among individuals aged 1 – 19. Much as the U.S. exists today, Amsterdam faced a social crisis within its community and chose to respond.

The resulting social movement brought the issue to local officials and for the next 40 years drove the construction of a transportation system centered around a simple idea: how do we best move people without more cars and how do we make it safe? The policy was plain: design streets and link them to form a network where biking is the best transport mode: best, as in more convenient, safer, cheaper, more enjoyable, just more useful. Turns out that people enjoy riding a bike, especially if you only have to travel a couple of miles on a path where there is not much in your way, so taking a trip is

relaxing and enjoyable. As roads existed in the 1970s, automobiles dominated space in both Dutch and Danish cities and the negative outcomes driven by the high use of cars tragically impacted people's lives. The situation forced people to examine what kind of system they built. Why was it so dangerous to move about the city?

Ultimately, cities in the Netherlands and Denmark prioritized the bike as an essential transportation mode that should be available and safe to all who choose to use it. To get people using the bike then, each city had to build the proper network for bikes to move freely and safely. The result is effective in its design.

Even in populated cities such as Amsterdam and Copenhagen, biking feels safe as a transportation mode and often separated from moving cars. The vehicles in these cities rarely move fast as there is little space to do so in the first place. Also embedded in the culture is an awareness of cyclists moving about the city and driving in such an environment; i.e., more cautiously. With such a network of bike lanes and traffic laws supporting cyclists, today these cities enjoy high rates of children biking to get around while still avoiding traffic fatalities. In the Netherlands, cycling independently is common to adolescents riding throughout the city, often with friends sitting on the back of a bike. The freedom this network built specifically for the bike provides children with greater autonomy in their lives and instills cycling as a habit from an early age. Children in Denmark often learn first about biking in traffic when they are as young as three or four. The Traffic Playground in Copenhagen is a multi-purpose park that also educates Danish children about how to safely bike in as if they were in the city: what hand signals to use, where to be on the road, what to be aware of when riding, the meaning of signals, and so on. By the time children reach eight to nine years, they are often biking along with their parents or at times on their own.

Biking in these cities and seeing the safety that exists, despite some highly active areas, shows how cyclists are prioritized. Infrastructure exists to support communities become much safer, becoming a place people want to live and be. The reason it remains dangerous in the United States

is because our streets do not exist to support people who want to bike but only cars to move about. Granting this independence to more people, but especially children, can be achieved through installing more bicycle infrastructure to build out a connected network. That effort requires local support and is in our collective interest for most of all, providing safer streets for everyone, driver, cyclist, and pedestrian alike.



Exhibit 9.3: Youth cargo bike | Source: Connie Juel Clausen

SUBURBIA FAMILIES AND CHILDREN

AUTHOR: Abby McFeeters-Krone

Before you were born, your parents moved to the suburbs so that you could enjoy your childhood with a large yard to play in and a quiet street to live on. However, you live too far from your friends to be able to walk to meet them without a car, and the streets that you live on are too confusing to be able to navigate on your own. So you are forced to ask your parents to take you everywhere. Unfortunately they work a regular job and are often busy when you would like them as your source of transportation.

Sometimes you ride your bike to go see your friends, but at a certain point, you run out of things to do and want to go explore the nearby city. You want to shop, buy food, and go to the movies but all these things are inaccessible to you. However, if there was a clear bike "highway" that you and your friends could use on your bikes to go do these things, the number of possibilities for you and your friends would be unmatched. You would learn to

be independent and how to manage your time without a parent being there. You might even meet new people in the city and you would definitely see things that you'd never seen before.

Being able to explore a city from a young age helps a person to grow up to have a better understanding of the world around them, and also more understanding of people who are different from them. Giving more young people the ability to access a city on their own without parental supervision can establish a new generation that has more empathy, understanding, and independence when they grow up.



Exhibit 9.4: Protected bike lane | Source: Bridgette Bottinelli

TRAFFIC CALMING IMPROVES NEIGHBORHOOD SAFETY AND COMMUNITY ACCESS

AUTHOR: Nina Price

When it comes to residential streets, cars pose a significant threat to safety for people cycling. It is important to ensure that cars are traveling slowly through neighborhoods to improve the safety of vulnerable road users and increase access to schools, shopping, and work. Traffic calming is a transportation design strategy that uses various measures to slow and reduce car traffic, making streets safe for cyclists. These measures include features that slow the speed of cars, like speed humps or raised crosswalks, and reduce traffic volumes by limiting street access for cars. Implementing traffic calming on neighborhood streets can improve safety and access for people cycling.

First, transportation safety researchers have determined that cyclists can safely mix with cars on streets where cars travel under 20 miles per hour. At this speed, collisions are significantly less likely to result in injury than at speeds above 20 mph. While establishing a speed limit can help keep travel speeds down, it is also vital that the infrastructure enforces the desired speed limit to prevent drivers from making mistakes or discourage non-compliance. Well-implemented traffic calming measures make it difficult for drivers to exceed 20 mph without risking damages to their vehicle or causing discomfort to the driver. Keeping cars speeds down supports a safe environment for cyclists to use the street.

Additionally, traffic calming helps to bring a bicycle network to the front doors of people living in residential areas. If a bicycle network only includes designated bike lanes on busy car corridors, people still must use neighborhood streets to access those routes. Traffic calming makes neighborhood streets safe for cyclists, which allows them to safely access the services within their neighborhood and connect to the rest of the network. This benefits all groups of people, from children going to school, to adults that need to work and shop outside of their neighborhood.

Decreasing the speed of cars on neighborhood streets is vital to increasing the safety of cyclists and increasing access to different areas in the community. Traffic calming is an effective tool to enforce slower speeds of travel that allow for cyclists to comfortably mix with traffic, and delivers safer streets for residential areas.



Exhibit 9.5: Street calming | Source: Google Earth

EUROPEAN ACCESSIBILITY TAKEAWAYS

AUTHOR: Ann Moorhead

I will be the first to tell you that European countries have major shortcomings when it comes to accessibility and inclusivity. As far as disability policy goes, the United States ADA is 20 years older than any comprehensive policy in Denmark and the Netherlands does not even have a comprehensive disability policy that I can find. However, that does not mean we can write them off entirely. Transportation in Denmark and the Netherlands looks very different from the U.S., so different that they often come at things from a very different perspective than here in the U.S. Disability policy has not left a strong mark on the cities in Denmark, and yet there are many accommodations that exist that the U.S. never would have done. One thing the ADA did was standardized disability accommodations. It built a toolbox and checklist that everyone had to use to meet a minimum standard. This is good for increasing accessibility but reduces creativity and innovation.

In Denmark, they got inventive with sidewalk design and added tactile pavers for the blind and vision impaired. In Copenhagen, these pavers and indicators are a part of the historic sidewalk and a beautiful part of the design of the space. They elevate both the aesthetic appeal and utility of the space, changing its function yet maintaining the character of the district. In historic districts, they look historic (in fact, I do not know if they were ever made with that intent at all) while in more modern districts they are more modern.

In the Netherlands, their focus on comfortable and safe bike infrastructure and shared spaces led to creating new spaces for anyone to use. From small kids and elderly on bikes, to pedestrians, to wheelchairs you can see just about everyone and anyone use the bike lanes and navigate the many, varied shared spaces. Once again, it is hard to tell how much of that was even intentional, though they definitely understand it is being used that way now. Looking past the obvious flaws and the things that feel impossible to replicate here in the U.S., there are still so many feasible and even easy lessons and new ideas we can take from these countries.



Exhibit 9.6: Elderly bike ride | Source: Connie Juel Clausen

BICYCLING IS GOOD FOR BUSINESS!

AUTHOR: Payton Lagomarsino

Businesses, more specifically larger companies or corporations, have the power to change things within the communities they establish themselves in. Just like how small businesses sponsor little league teams, larger companies can fund projects and engage with their communities. Companies should be invested in the places their employees reside in and do their best to ensure they have a way to get to work that is safe and equitable. Companies should invest in different forms of public transportation and incentivize employees to take them. Parking takes up a large amount of space and if less people drive to work, a company can save money by not needing to provide those spaces anymore. Paying employees to bike to work or even offering shuttles to different neighborhoods is a solution for businesses to offer their employees. Furthermore, businesses should seek to locate themselves near greenspaces for their employees to go to during lunch or for breaks. Green spaces are important for connecting a business to a town. Creating greenspaces near places of work can also inspire team building and a better sense of company morale. Companies should be brought into the discussion of making cities more enjoyable and sustainable given the resources private companies possess to assist cities in their efforts to improve people's quality of life.

POLICY MAKERS / PUBLIC OFFICIALS

SUPPORTING A BICYCLE CULTURE

AUTHOR: Claressa Davis

A biking culture is good for everyone. This type of infrastructure and transportation system has the largest benefit for people often forgotten in planning the car oriented society: people with disabilities, youth, elderly, and those who can't afford cars. We can help them reach the places they need to go by providing them great alternative transportation options. Counterintuitively, a biking culture is also good for drivers; when more people are on bikes, there is less car traffic to contend with for drivers. The benefits of a biking culture are numerous, and we need to focus on this style of development for the wellbeing of our communities.

While technically we have the opportunity to bike in the States, the inconvenience, stress, long distances, and downright danger stop many people from biking. In Denmark and the Netherlands, physical infrastructure made biking easy, comfortable, and accessible, all of which made it a viable commute option. A huge part of what makes cycling accessible is the focus planners have on making it convenient, comfortable, and reliable. This tactic works, in Copenhagen where 41% of all commuter trips are made by bike (Bondam, 2017). It was common to see young children biking by themselves in these countries, off to friend's houses, school, errands, or after school activities. Children who bike to school in Denmark are measured to have higher self-esteem, concentrate better, are more healthy, and manage stress better (Bondam, 2017). The biking city also helps us as we age, preventing older adults from losing autonomy and self-determination. Within Denmark and the Netherlands, they are able to maintain daily routines through cycling, far past when they would be able to if they were driving.

As a cyclist, I felt prioritized in a way that I have never felt in the States; I never worried about a car not seeing me, never had to watch for a bike lane ending in the middle of a road, never stressed about being hit by a car. At the end of the day, the bicycle city is about giving people autonomy

and freedom to travel when and how they want to. It refocuses on the needs of people typically left out of car focused transportation planning, and imagines a world where all people are self determined in their transportation choices.

BIKE INFRASTRUCTURE = ECONOMIC STRENGTH

AUTHOR: Rachel Hess

For too long the streets of Eugene have not lived up to their potential. Valuable public property has only been allocated to one use and serves one purpose. That is to move and store private vehicles. Occupying the public right-of-way for one singular purpose has repercussions for the local economy and quality of life for Eugene's residents. It is a fact that pedestrians and cyclists spend two to three times as much at local businesses per trip than car drivers do. Yet we intentionally allocate the right-of-way to car drivers and try to shove as many of them through an area as quickly as possible. To make our streets truly public places by allocating more of the right-of-way to pedestrians and cyclists would affect the local economy.

It would also contribute to the local economy by making Eugene a more attractive destination for visitors and families. Tourists would be able to travel and spend more at local businesses if they didn't have to rent a car to get around and could easily walk, bike, and take frequent public transit. They would also be incentivized to spend time in the public spaces.

If more of the public right-of-way were allocated to pedestrians and cyclists, quality of life would greatly improve for all residents. Children would be able to travel independently and free up their parents' time as parents wouldn't need to take time for driving their children around. People would have around 30 minutes of exercise built into their day automatically. This is scientifically proven to improve physical and mental health. People would save more money. They would be able to have the option to not own a car or own fewer cars. People would also have the option to spend more time outside.

It is proven that allocating more of the public right-of-way to pedestrians and cyclists compared to cars improves quality of life for all people and also boosts the economy of local businesses. Studies have shown that for every mile that one person drives, the public loses 71¢. For every mile a person bikes, the public stands to gain 65¢. Investing in a complete and connected biking and walking network will payoff ten times over in the long run. We can't be blind to the facts anymore and we can't keep investing in a car dominant network that we can't afford while actively degrading our local economy and quality of life.



Exhibit 9.7: Economic output between car and bike
Source: Copenhagenize

SUPPORT THE PHYSICAL AND MENTAL WELLBEING OF YOUTH

AUTHOR: Abby Andrews

Creating safer and more connected bicycle infrastructure will promote physical exercise and drastically improve U.S. children's physical health, particularly obesity, which has reached epidemic levels. In 2019, 19% of U.S. children were affected by obesity, which can also lead to other health problems like diabetes, heart disease, and some cancers (Sanyaolu, 2019). Safe cycling infrastructure protects riders. The safer the act, the more people will choose to use what is built. Biking will promote healthier lifestyles and lower health risks while prolonging life expectancy by 3 to 14 months (Dutch Cycling Vision, 2018). Additionally, if children were biking just 30 minutes a day, they would meet the weekly recommendation level of physical activity (Dutch Cycling Vision, 2018).

ADHD rates are also rising in youth, and an overall shorter attention span due to prolonged exposure to technology. Research provides extensive studies showing that physical exercise can immediately improve symptoms of ADHD and increase youth's attention span (Mehren, 2020). This improvement in focus would increase the likelihood that students achieve their goals, promoting success and allowing children to achieve better results in their academic lives and careers. Supporting students' learning early would boost confidence and fuel innovation in generations to come.

Survey results from the Centers for Disease Control and Prevention found that the percentage of high schoolers who experience persistent hopelessness and sadness has increased from 26% in 2009 to 37% in 2019, and suggests these numbers will continue to increase with time (Rodriguez, 2021). Cycling is associated with happiness, and implementing safe bicycle infrastructure is the perfect way to provide opportunities to get kids moving outside, away from their phones, which can increase their quality of life (Dutch Cycling Vision, 2018). In our current digital world, connection and in-person social interaction

Cycling offers freedom to children

Dutch children are the happiest in the world. Cycling allows them to reach destinations safely and gives them the feeling of freedom.¹¹



Exhibit 9.8: Youth cycling
Source: Dutch Cycling Vision

are lacking among youth, and the pandemic exacerbated this. Cycling is a social activity where kids can chat and connect with their friends. Such an activity provides opportunities to foster a sense of community, which is extremely important for mitigating depression in young people.

SUPPORT THE PHYSICAL AND MENTAL WELLBEING OF YOUTH PT. 2

AUTHOR: Lucy Partridge

Why should politicians support more bicycle and traffic safety education in the United States? For starters, U.S. children do not rank well when it comes to mental and physical well-being on an international scale. Children in the U.S. (out of 38 international countries) rank 32nd for mental well-being. They also rank last for physical health (UNICEF, 2020). Meanwhile, both the Netherlands and Denmark rank within the top five internationally for mental well-being and the top ten for physical health. These two countries also have the highest rates of cycling in the world. If the U.S. could replicate their bicycle education model, more children in the U.S. would receive physical and mental health benefits.

The Netherlands also teaches traffic safety in public schools starting at age six. Much of the traffic education in the U.S. is done outside of school, usually at an extra cost for parents through driver’s education or programs like “Safety Town.” If parents do not pay for these extra programs, they often have to teach their kids themselves about cycling and pedestrian safety. Due to this fact, traffic safety education that kids in the U.S. receive is not as established as programs in the Netherlands and Denmark.

Why is traffic safety an issue? In 2020, there were 35,766 fatal motor deaths in the United States. In the Netherlands, the number was less than 600. While these two countries have largely different populations, the Netherlands is similar in size to the state of Florida. The Netherlands has around 17 million residents while Florida has around 20 million. In Florida alone, there were 3,000 fatal crashes in 2020 (IIHS, 2022). This number is similar to the record number of traffic deaths the Netherlands

experienced in the early 1970s. Due to the high amount of fatalities from crashes, politicians should support more bicycle infrastructure bills and traffic safety education grants. With new safety programs taught at elementary schools and better bicycle infrastructure, we can lower the number of deaths and accidents in the U.S. The Netherlands and Denmark have already done this, as both countries were once very car dependent. We can change our car culture just like they did.

Figure 9: A league table of child well-being outcomes: mental well-being, physical health, and academic and social skills

Overall ranking	Country	Mental well-being	Physical health	Skills
1	Netherlands	1	9	3
2	Denmark	5	4	7
3	Norway	11	8	1
4	Slovenia	15	3	17
5	Ireland	12	6	2
6	Spain	3	29	8
7	France	7	16	5
8	Belgium	17	7	6
9	Slovenia	23	11	2
10	Sweden	32	5	13
11	Croatia	10	25	10
12	Ireland	26	17	6
13	Luxembourg	15	7	29
14	Germany	16	10	21
15	Hungary	16	21	13
16	Austria	21	12	17
17	Portugal	6	26	20
18	Cyprus	7	29	24
19	Italy	8	31	15
20	Japan	37	1	27
21	Republic of Korea	34	13	11
22	Czech Republic	24	14	22
23	Finland	31	15	16
24	Iceland	20	16	24
25	Romania	3	34	25
26	Slovakia	14	27	26
27	United Kingdom	24	19	26
28	Latvia	25	24	23
29	Greece	8	35	31
30	Denmark	31	20	18
31	Ireland	23	22	28
32	Australia	16	28	19
33	Lithuania	35	28	25
34	Malta	32	32	25
35	New Zealand	35	33	25
36	United States	32	38	35
37	Russia	19	37	27
38	Estonia	27	38	28

Exhibit 9.9: Child well-being outcomes: mental well-being, physical health, and academic and social skills | Source: UNICEF

THE COST OF SUPPORTING CAR-CENTRIC TRAVEL

AUTHOR: Brendan Irsfeld

One of the persistent challenges facing governments at all levels in the United States is maintaining and operating the transportation system. Automobile travel dominates our travel habits and our use of land in cities to support vehicle use is both expensive and wasteful. As local budgets come under increasing pressure from rising expenditures combined with less availability from state and federal sources, it becomes increasingly difficult for local government to maintain its

transportation system. Those entities holding large debt balances and find their sources of revenue limited by current conditions feel the strain even more so. Roadways and bridges are expensive to build and maintain. Parking lots, especially those offering free parking, add even more to the exorbitant spending done on supporting the use of a car. Traffic and congestion continue to get worse in cities across the country as the output for all this spending.

The issue is about over-investing in just one type of transportation mode; the car. Sadly, we have bet on one of the most expensive types available. In the 1970s, the countries of Denmark and the Netherlands also found their cities overwhelmed by cars. When the oil shocks of the 1970s hit, places such as Copenhagen and Amsterdam responded by substituting the bike as a means of transport to reduce car usage and thus fuel consumption. Over time, people preferred the experience enough to push local officials to support more bike friendly policies and infrastructure. Over the last 40 years,

these efforts continue with some failed attempts existing alongside an extensive history of successful projects implementing a bike-friendly network within the transportation system. What cities discovered in the process is that bike infrastructure is much less expensive to build compared to car-supportive infrastructure.

If transportation costs need to be reduced, the cost to build and maintain it must come down. Parking spaces for vehicles can range from \$30,000 to \$100,000 compared to \$3,000 to \$10,000 per space for bike parking. Building cycle tracks compared to bridges and roadways can produce miles and miles of pathways that accommodate more people in less space rather than wide roadways that take up far more space for moving far fewer people. Copenhagen spent approximately the equivalent of \$2.24 million to build 300 kilometers (186 miles) of cycle tracks within the capital region compared to its spending on Nordhavnsvej, a 3 kilometer (just under 2 miles) bypass road in the Northern Harbor District, which cost an equivalent of \$352

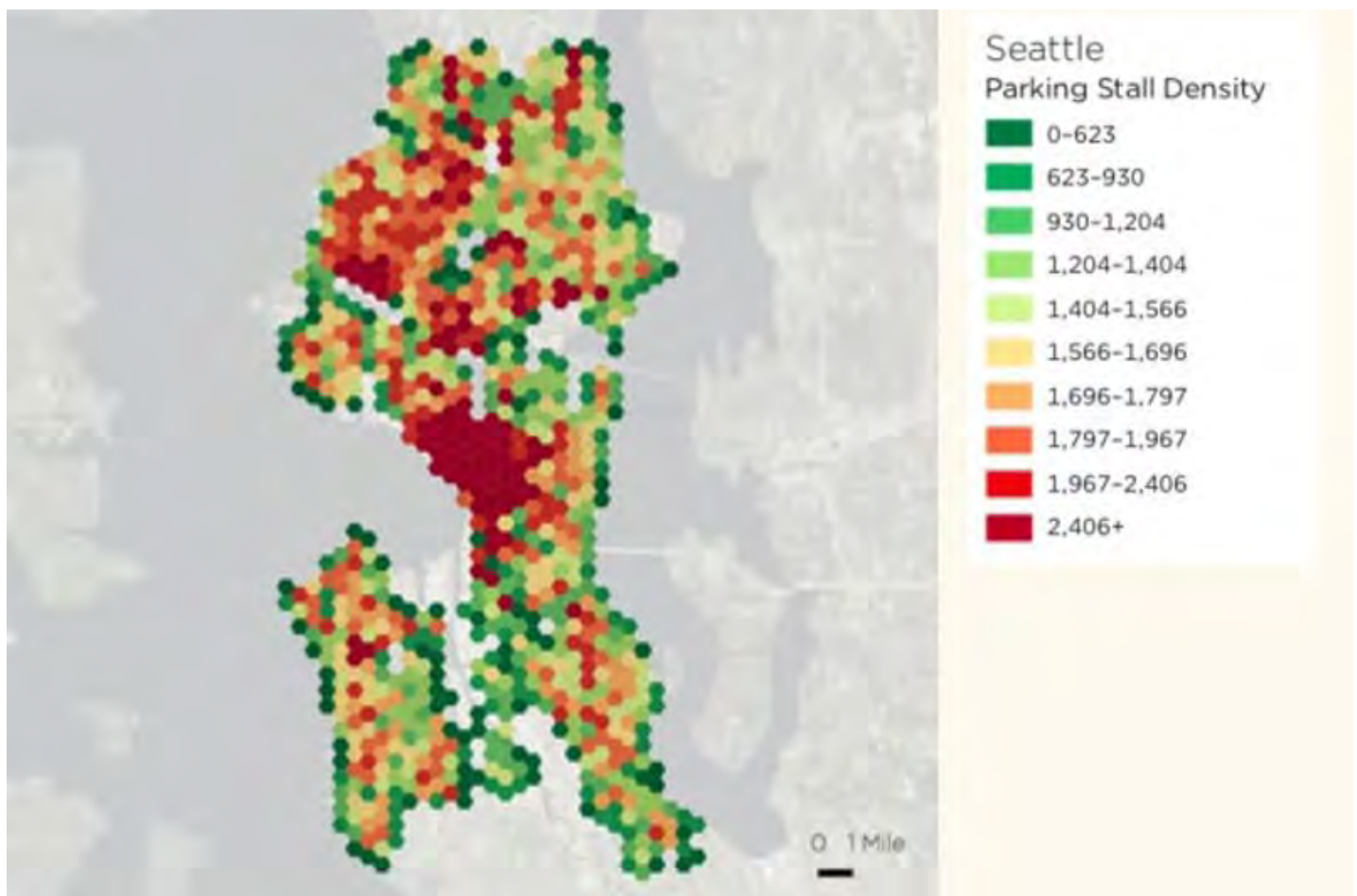


Exhibit 9.10: Seattle parking density map | Source: Research Institute for Housing America

million. The fact that bicycle parking also takes up less space compared to car parking frees land for productive uses, including new businesses, housing units, nonprofit spaces, public parks and green space, and civic spaces (See Exhibit 9.10).

When examining transportation systems in the United States, recognizing the expensive price tag of the car-centric system forces us to think about how to bring down the cost of maintaining it. We must reevaluate how the system functions, what it costs for that operation to exist, and then rethink an effective, less expensive alternative. Cycling in the United States is becoming increasingly popular due to a number of reasons, including purported health benefits, the reducing of carbon emissions, or the cost compared to car ownership. Bike share companies are expanding their operations but their users, along with people wishing to ride their personal bike, require a properly designed system and to build it is more affordable than people may think. The effects can lead to other economic opportunities as well.

A visible feature of transportation in the Netherlands is how biking is integrated along with public transit services, namely the rail system. Underground bike parking garages provide a convenient and secure space for personal bikes while docking bikeshare stations allow for the return or renting of a bike. A bike ride to the train station completed by a bike ride after the train describes many commutes in Dutch cities. In this example, cycling contributes ridership to the rail operator. What is important is that amenities supporting biking, such as parking, are located close to public transit stations and services. Bike parking also uses less physical space and is much less costly to build, further lowering the cost of transportation spending compared to building more car parking space and facilities (often providing spaces for free).

As our current transportation system becomes more expensive to maintain, taking the streets we already built and redesigning them mile by mile to include a safe and efficient network of biking routes could be remedy for local governments across the country in addressing the rising cost of road maintenance and ever increasing demand for widening roadways and creating more parking spaces. The demand exists because the

transportation system is designed mostly for cars. If a suitable, complete biking network existed as well, it is very possible that a number of users will adopt biking and reduce demand on the roadways for driving. When Copenhagen and Amsterdam faced financial pressures in the 1970s, turning to a more bike inclusive system was in part driven because the cost of driving increased. One option considered was to “reduce driving” and give it a try. It ended up working. The price of driving has increased again in the 2020s for users and governments alike. Here too, can elected officials push our cities toward better fiscal and functional health by recognizing the value, and low investment compared to maintaining the current model, of creating safe, connected, and useful biking networks.

CAR ENTHUSIASTS

COMMUNICATING WITH COMMUTERS

AUTHOR: Vivian Sheperd

I want to address people who have long commutes to work. The commute may be from the suburbs to the city center or between towns. I'll start by discussing how using an integrated travel system that contains several types of travel options offers a solution to lengthy commutes. Making commuter trips by motor vehicles may seem most efficient, but in reality, bike-to-transit can take much less time. Using a combination of cycling and transit saves time for a number of reasons. People who use both methods of transportation don't have to wait in heavy traffic on highways during rush hours, when there is construction, or if there's been an accident. They also don't have to spend time finding parking in dense areas that only offer minimal spaces.

Using the integrated travel system is also much less expensive than owning a car. Transit commonly offers monthly and yearly passes, and a day pass is still typically less costly than parking in cities. You also don't have to pay for gas or other vehicle-related payments. Gas becomes extremely expensive during long commutes, especially if done daily. Using the integrated travel system also allows people to customize their trips to their needs and preferences. This includes both physical ability and time availability. People can take transit if the terrain becomes too rough for part of the ride, bike paths

aren't offered, they're in a time crunch, the ride would be too long by cycling alone, etc. Using the integrated travel system rather than commuting by cars offers people a variety of solutions and choices. Overall, it will improve their lifestyle and provide an alternative to the long and frustrating motor vehicle commute.

A GOOD BIKE AND PEDESTRIAN NETWORK IS A GOOD DRIVING NETWORK

AUTHOR: Rachel Hess

Allocating more of the public right-of-way to other modes beyond just automobiles will ultimately benefit car drivers as much as other travelers. With more options, and safe routes, most people will opt to travel by walking, biking, or public transit. There will be fewer cars on the streets making car travel faster and easier for those who wish to drive. Copenhagen has found this to be the case. Congestion is non-existent on main arteries as many people who were driving only because it was

the most convenient option today bike and walk because it is the more convenient option for them.

There's a theory called "induced demand" that describes the effect of if you build something, people will use it (See Exhibit 9.11). This theory is useful for explaining congestion on roads. When a road is widened and more lanes are added in an effort to reduce congestion, the effect is often the opposite. More people who would generally take other routes or modes of transportation will instead start using the new road because new capacity now exists. Over time, more cars use the roadway and thus, the congestion gets even worse than it was before the widening.

A better solution for resolving congestion is to add other transportation options like trains, buses, biking, and walking routes. With more options to travel, the people that take advantage will take cars off the roads, freeing up more space for people who do want to drive.



Exhibit 9.11: Induced demand in California | Source: Vox

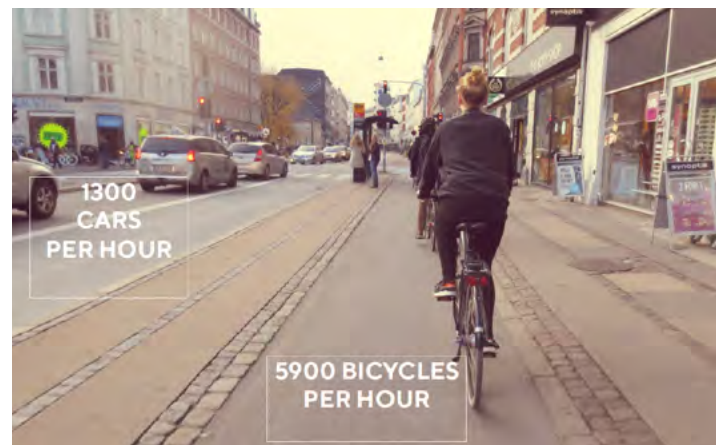


Exhibit 9.12: Transit movement per hour | Source: Copenhagenize

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