

# New Haven Bike Vision

2021



Health  
Safety  
Equity  
Climate

# Transform New Haven Now

We face a climate emergency that can only be addressed by immediately and drastically reducing greenhouse gas emissions. The climate emergency, affirmed by the Board of Alders 2019 Resolution, compels us to significantly reduce car use in New Haven as soon as possible. Fewer cars in our city means reduced carbon emissions and safer streets that support the use of other less polluting modes of transportation like public buses, walking, and bicycles.

Communities in New Haven are not equally impacted by the effects of climate change. For example, the negative effects of air pollution are felt more acutely in low-income neighborhoods, where there are higher rates of asthma. As with so many aspects of our world, racism has compounded the harm of climate change and pollution felt by communities of color in New Haven. Encouraged by the Board of Alders recognizing racism as a public health crisis in 2020, we must address the climate emergency with an understanding of structural racism and the goal of creating a more equitable, sustainable, and safe city. Changing transportation infrastructure will play a critical role in both efforts to address the climate emergency and racism. Currently, the roads we all pay for favor those with the means to afford a car, and disproportionately harm those who cannot. The present car-dominated transportation system creates vast public health costs, perpetuates inequities and poverty, and negatively impacts families, local businesses and the City. Road re-design favoring pedestrians, cyclists, and buses instead would create a more equitable use of public space and ensure people thrive without having to be dependent on a car to reach work, food, essential services, and family and friends.

The Mayor and Board of Alders must act rapidly over the next three years (2021-2024) to create an interconnected, protected bike network in New Haven. As this report shows, there are successful models of street reconfiguration for limited costs, and converting just 6% of City street space to protected bike infrastructure would create an effective bike network. Created in consultation with community members, this bike network would be an important part of a comprehensive redesign of multimodal transit in New Haven that would give residents and visitors safe, healthy, sustainable options to move around New Haven.

**It's time to humanize the streets of New Haven.**



## Purpose

The purpose of this report is to re-imagine a transportation system that supports all modalities of travel and list the many benefits it would have on the New Haven community. This is a call to action - let's mobilize our community and demand that the Mayor and Board of Alders move to address climate emergency through an improved bike network.

## Vision

Safe, reliable, equitable, and sustainable transportation infrastructure that serves all residents of New Haven, regardless, age or ability, or modality.

## Partners

Safe Streets Coalition, New Haven Climate Movement, Junta for Progressive Action, Bradley Street Bicycle Co-op, Citywide Youth Coalition

## Time for Action

Today's car-centric transportation system has proven to be unsustainable, energy inefficient, and negatively impacting the health of communities; these consequences disproportionately effect groups least likely to own or drive a car.<sup>1</sup> The need to re-imagine our transportation system is about more than getting from point A to B, it's about the health, safety, equality, and vitality of our communities, and ensuring the needs of the most vulnerable members are met. We need to focus on moving people within New Haven, not just through it.<sup>2</sup> The benefits of a system that promotes active transportation can help address many of the consequences created by our car-centric society.

**We are asking that between 2021 and 2024, the Board of Alders and the Mayor to commit \$150,000 per year in operating funds for resources to manage this project, and \$500,000 per year in capital costs for initial infrastructure. While we are cognizant of the budget challenges in New Haven, the climate crisis is unrelenting and the benefits of this infrastructure will be substantial and far-reaching. We also believe this City investment will attract additional State and Federal funding.**

# New Haven Bike Vision

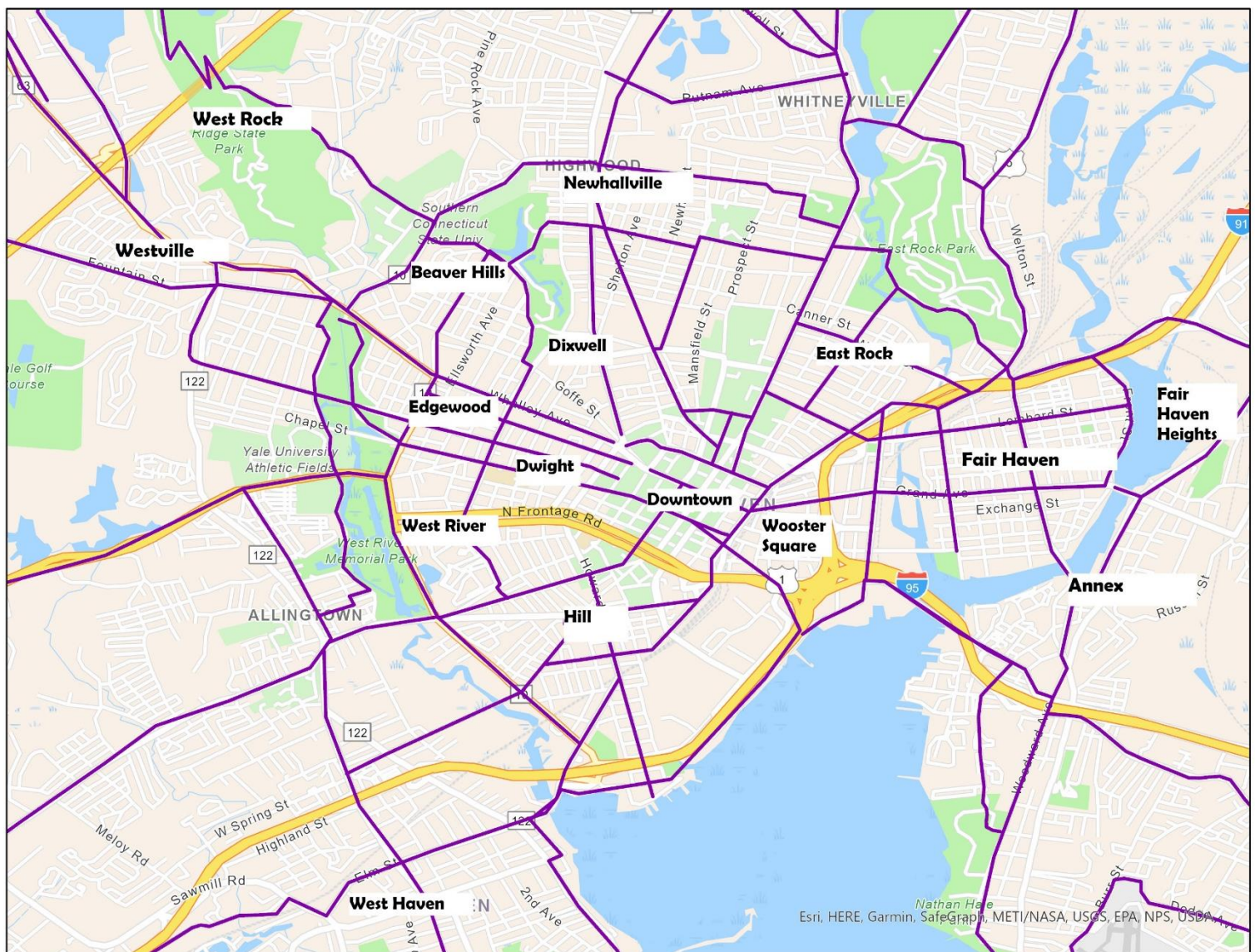
2021



# New Haven Cycle Track Vision Map

The map below is the result of a community envisioning project where bike enthusiasts came together to craft a vision for a cycle track network in the greater New Haven area. Through a series of workshops, community members identified points of interest (education, employment, retail, culture, health, recreation, etc.) and discussed routes that connect and cover those points of interest while serving folks citywide. Once drafted, it was presented to the public at different local events, via social media, and by surveying folks on the Green, New Haven Hospital, and more. About 60 people, ages 15 - 75+, who bike for different reasons (i.e., physical activity, leisure, or as transportation) responded (in English and Spanish), and their feedback was incorporated into a final version. The majority of respondents lived in New Haven, East Rock, or Wooster Square, and spent most of their time biking in Downtown New Haven.

This map is not a plan but a vision, reflecting New Haveners' desire for greener, safer, healthier, cheaper transportation infrastructure. Our vision for a comprehensive bike network will supplement other necessary improvements to public transit and pedestrian infrastructure.



0 0.3 0.61 1.22 Miles

Scale: 1:50,000

# New Haven Bike Vision

## Historical Perspective

Americans had access to various transportation options until the 1920s, when the country's affluence spurred by mass production and rich oil reserves in conjunction with a growing network of paved roads helped cultivate the car-centric culture we know so well.<sup>1</sup> The popularity of cars grew as they became more affordable and purchasable on credit.<sup>1</sup> In 1956 Congress passed the Federal-Aid Highway Act, giving life to 41,000 miles of interstate network designed for motorists, and intended to reach every city with a population of more than 100,000 people.<sup>1</sup> The passage of this act allowed for the construction of the Oak Street Connector in New Haven, an urban renewal project that displaced about 3,000 people.<sup>2</sup> People of color, and individuals who did not identify as heterosexual felt the burden of displacement the most.<sup>2</sup> The Oak Street Connector demolished a connected community of neighbors, churches, and local businesses.<sup>2</sup>

In the 1960's and 70's, people began to question the benefits of a car-centric society.<sup>1</sup> Environmentalists realized that the increased popularity of the automobile came with serious environmental consequences.<sup>1</sup> A movement began, promoting the creation of a more sustainable transportation system that could support active transportation, and public transit.<sup>1</sup>

**Active Transportation** is defined by the CDC as "any self-propelled, human-powered mode of transportation, such as walking or bicycling."<sup>3</sup>

In 1992, the Intermodal Surface Transportation Act was signed into effect, authorizing funding from the Highway Trust Fund to develop a national intermodal transportation system that was "economically efficient, environmentally sound, provide[d] the foundation for the nation to compete in the global economy, and [moved] people and goods in an energy efficient manner."<sup>4</sup> Over a decade later, in 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law, authorizing \$305 billion into transportation through the year 2020.<sup>5</sup>

With the FAST Act approaching expiration, the Complete Streets Act was introduced in 2019, which "would require states to set aside money for Complete Streets projects, create a statewide program to award the money, and adopt design standards that support safer, complete streets."<sup>6</sup> In 2010, New Haven put in place a Complete Streets policy; however in the decade since its passage, not enough progress has been made on improving street safety for pedestrians and cyclists, and the Complete Streets policy has not been followed.<sup>7</sup>

**Complete Streets** "are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities."<sup>8</sup> Adopting a Complete Streets policy means that with each transportation project, the street network is made better and safer for all.<sup>8</sup>

## New Haven Trolley System



In 1860, New Haven's first horse-drawn street trolley went into operation, with tracks from Grand Avenue to Whalley Avenue.<sup>9</sup> Trolley lines continued to be expanded and eventually extended to Hamden and West Haven.<sup>9</sup> In 1893, the horse-drawn trolley lines began to be converted to electric railways, and by 1900 New Haven was home to the largest street railway system in Connecticut!<sup>9</sup> Trolley routes followed most of the main arterial roads, provided transportation to less urban sites like Lighthouse Point, and carried tens of thousands of people to the Yale Bowl.<sup>9</sup> After 88 years of triumph, New Haven's trolley lines were converted to bus lines.<sup>9</sup>

# Benefits of a Bike Network

## Climate Change

At 38%, transportation is Connecticut’s largest contributor to greenhouse gas emissions.<sup>10</sup> Greenhouse gas emissions are causing the Earth’s temperature to rise.<sup>11</sup> The change in climate is causing more frequent and intense weather events, raising sea levels, and altering ecosystems.<sup>11</sup> These changes threaten the survival of our species and the world as we know it.<sup>11</sup> In 2019, the United Nations announced that we have 11 years to stop irreversible damage from climate change.<sup>12</sup> To stop climate change, we must reduce the number of cars on the road significantly and urgently. Someone who bikes a 4-mile commute to work and back generates 2,000 less pounds of carbon each year compared to someone who drives; that adds up to a 5% reduction in the average American’s carbon footprint.<sup>13</sup> People of color and low-income individuals are more likely to live in close proximity to major arterial roads and highways with higher traffic volumes, and higher levels of emissions.<sup>14</sup> Although people of color and low-income individuals contribute the least to climate change, they have been, and will be impacted the most.

*...we have 10 years to stop irreversible damage from climate change.<sup>12</sup>*

## Equity

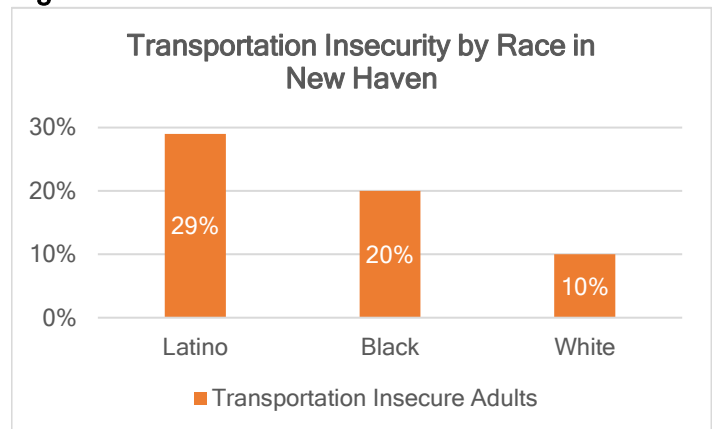
We will not be able to face the climate emergency without addressing racism and poverty. Equity asks us to give people what they need in order to make things fair and this principle underlies all of the benefits listed in this report, from public health to safety to economic vitality.

The rate of low-income people and people of color who walk or bike as a means of transportation is growing more rapidly than the rest of the population.<sup>14</sup>

Similarly, children of color and those from low-income households are more likely to bike or walk to school.<sup>14</sup> Our car-centric culture creates significant barriers to economic stability, upward mobility, health, safety and well-being for those without regular access to a car.<sup>14</sup>

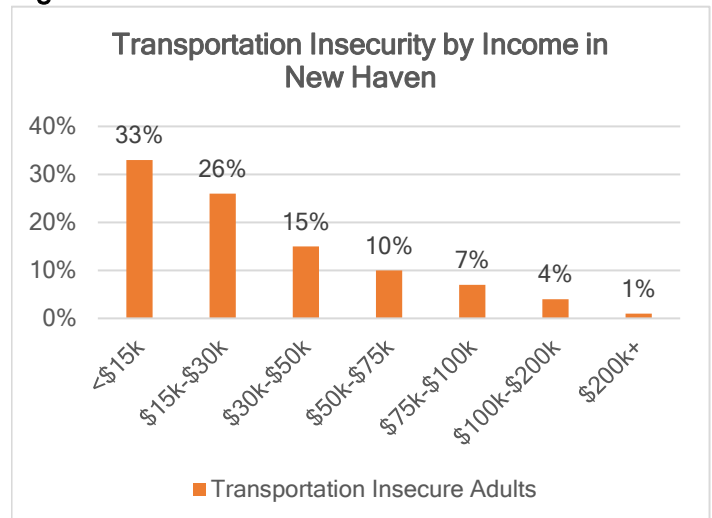
About 21% of the population of New Haven are transportation insecure, meaning they lack the material, financial, or social resources to regularly and reliably get from point A to B in a safe and timely manner.<sup>16, 23</sup> Latino and Black residents have significantly higher rates of transportation insecurity when compared to White residents (see Figure 2).<sup>16</sup> Low-income people also face higher rates of transportation insecurity (see Figure 3).<sup>16</sup> Being able to thrive without owning a car is essential for many people in New Haven and across America. Biking and walking are healthy and affordable modes of transportation that can provide those without access to a car an opportunity to get to jobs, education, stores, healthcare facilities, and public transit.<sup>13</sup> The current bike/pedestrian infrastructure in New Haven is inadequate, which can prevent people from using active transportation, and create a dangerous situation for those who rely on these modes. Benefits to the environment, public health and safety will also benefit equity.

Figure 2



Data from DataHaven<sup>16</sup>

Figure 3



Data from DataHaven<sup>16</sup>

# Public Health

Motor vehicle crashes are a leading cause of death in America.<sup>15</sup> Thousands of pedestrians die each year in traffic crashes, with people of color dying at a higher rate. Creating a transportation network that supports safe active transportation could help to reduce the pedestrian fatalities.

Many leading causes of preventable death, including heart disease, stroke, Type 2 diabetes, and certain types of cancer have been linked to obesity.<sup>14</sup> These health conditions disproportionately impact people of color and low-income communities.<sup>14</sup> Moderate physical exercise can reduce a person's chance of many of the leading causes of death listed above, as well as dementia, depression, colon cancer, anxiety, and high blood pressure.<sup>13</sup> Active transportation is an affordable way to build physical activity into one's daily routine.<sup>14</sup> Those who commute by foot or bicycle report significantly higher overall psychological well-being than those who commute by car or transit.<sup>14</sup>

Transportation insecurity describes the inability to move reliably from place to place and it is a significant barrier to health resulting in 3.2 million American children per year either missing a scheduled health care appointment or not scheduling one at all.<sup>14</sup> Similarly, in New Haven, about half of adults who are transportation insecure report having missed a doctor's appointment because they lacked access to transportation.<sup>16</sup>

Traffic-related nitrogen oxide emissions are associated with the onset of childhood asthma, chronic bronchitis and heart disease among those over 65, and mental health disorders.<sup>14, 17, 18</sup> New Haven residents have the highest rates of asthma hospitalization and emergency room visits compared to those living in surrounding suburbs.<sup>19</sup> Children who live in neighborhoods that are walkable and bikeable are less likely to develop asthma, and if they do, it is less likely to persist as they age.<sup>19</sup>

Tiny particle pollution, which comes mainly from burning fuels, and brake and tire dust, increase the risk of anxiety and depression by 39%.<sup>17</sup> People of color and low-income individuals are more likely to live in close proximity to major arterial roads and highways, where the air quality is especially poor, contributing to a disproportionate rate of hospitalization, death, and disease.<sup>14</sup> Poor air quality is associated with many respiratory illnesses that increase one's risk of dying from COVID-19.

High traffic volumes create noise pollution. In addition to being unpleasant, environmental noise can lead to noise-induced hearing loss, cardiovascular disease.<sup>20</sup> Some research suggests that noise pollution may be associated with increased injuries, diabetes, poor mental health, and reduced reading comprehension, memory, and executive function.<sup>20</sup> Figure 1 illustrates noise pollution in New Haven.<sup>21</sup>

Figure 1. Noise Pollution in New Haven



Image from Department of Transportation<sup>21</sup>

# Safety

In 2019, more than 6,500 pedestrians were killed in traffic crashes in the US, the highest number in over 30 years.<sup>22</sup> In the past 10 years, the number of pedestrian deaths has increased by more than 50%.<sup>22</sup> The pedestrian fatality rate is about two times higher for people of color than whites.<sup>14</sup>

*In the past 10 years, the number of pedestrian deaths has increased by more than 50%.<sup>22</sup>*

Safe street infrastructure is more commonly found in high-income areas. Disparities in safe street infrastructure discourage people in low-income areas from walking and biking, and put them in danger when they do.<sup>14</sup> Streets with sidewalks on both sides of the street, with sufficient lighting, and with various traffic calming measures are found significantly more often in high-income communities.<sup>14</sup> There is a higher concentration of major arterial roads and highways in low-income areas, creating more barriers to active transportation, and an even more dangerous situation for those who rely on these modes.<sup>14</sup> Children are four to six times more likely to be involved in crashes when crossing high-speed roads or when on streets with high traffic volumes, respectively.<sup>14</sup>

Bike/pedestrian infrastructure calms traffic and reduces the frequency of crashes. On NYC streets where protected bike lanes were installed, injuries for motorists, pedestrians, and bicyclists decreased by 20%.<sup>13</sup> Bike/pedestrian infrastructure creates organization by defining street space for various users and helps motorists understand where bicyclists or pedestrians are traveling.<sup>13</sup>

The rate of low-income people and people of color who walk or bike as a means of transportation is growing more rapidly than the rest of the population.<sup>14</sup> Similarly, children of color and those from low-income households are more likely to bike or walk to school.<sup>14</sup> Our car-centric culture creates significant barriers to economic stability, upward mobility, health, safety and well-being for those without regular access to a car.<sup>14</sup>

## Economic Vitality

Bike/pedestrian infrastructure is beneficial to the community's economic success. For example, in Indianapolis, the construction of a bike/pedestrian network helped revive struggling businesses.<sup>13</sup> An Australian study showed that per square foot, bike parking produced more than triple the amount of revenue for businesses than car parking in a given hour.<sup>26</sup> Bike/pedestrian infrastructure improves access to storefronts, and research shows that bike lanes can boost retail sales. In New York City, streets with protected bike lanes saw an increase of up to 24% in retail sales.<sup>27</sup> This year has been tough on local businesses, and introducing bike/pedestrian infrastructure could help them recover from the economic devastation caused by COVID-19.

Bike infrastructure has a significant, positive impact on home values. An 8-mile network of bike-pedestrian infrastructure in Indianapolis sparked a \$1 billion increase in property values.<sup>13</sup>

Companies are looking to locate in communities that are bike and pedestrian-friendly, because it attracts young workers, and contributes to a healthier, happier, and more productive workforce.<sup>13</sup> Workplace programs that incentivize physical activity can reduce short-term sick leave and healthcare costs, and increase productivity.<sup>26</sup>

The construction of bike lanes also creates more jobs than road-only projects. Research shows that for every million dollars spent on bike infrastructure, projects created 11.4 local jobs, compared to 7.8 jobs for road-only projects.<sup>27</sup>

## Community

*“When streets are places where people can interact with one another, they become valuable public spaces that contribute to community cohesion.”<sup>14</sup>*

Cities that are walkable and bikeable are more attractive; the quality of air is better, there is less noise, and there is less crime.<sup>13</sup>

Creating a network of bike/pedestrian infrastructure is crucial for creating social cohesion throughout the community. When people are out walking and biking, interaction between neighbors increases, as well as engagement in community issues.<sup>14</sup> When there are more people out walking and biking, the streets are safer to use, because if somebody is in danger, there are others ready to assist and protect.<sup>24</sup> If communities are safer, the nature of policing can change.

“In a ‘15-minute city’, everyone is able to meet most, if not all, of their needs within a short walk or bike ride from their home.”<sup>31</sup> The principles of a 15-minute city include<sup>25</sup>:

- All residents have access to goods and services, especially fresh, healthy food, and healthcare
- Every neighborhood has a variety of housing sizes and levels of affordability to accommodate various types of households and allow people to live closer to where they work
- All residents have clean air and green spaces



# Traffic & Congestion

Including a network of bike infrastructure would decrease congestion on busy streets, reducing the need to build larger multi-lane roadways. In Arlington, VA, the addition of bike/pedestrian infrastructure decreased their traffic volume by 15-20%, despite an overall increase in population size.<sup>13</sup> In cities, bike lanes can accommodate 7-12 times as many people per meter than a car lane.<sup>26</sup>

**Induced Demand: The Fundamental Law of Traffic Congestion** Widening roads can actually make traffic congestion worse! “Added capacity encourages more people to drive, and in dense urban environments, there’s plenty of ‘latent demand’ that almost immediately fills added lanes as soon as they’re built.”<sup>28</sup>

According to the Texas Transportation Institute, “gridlock costs the average peak period traveler almost 40 hours a year in travel delay, and costs the U.S. more than \$78 billion each year.”<sup>26</sup> The same report indicates that congestion wastes 2.9 billion gallons of gas every year.<sup>26</sup>

Decreasing traffic congestion would benefit motorists too. Traffic congestion has also been found to cause stress, fatigue, irritability, and rage.<sup>29</sup> These feelings of stress and rage can lead to high blood pressure, or heightened activity of the part of the brain responsible for controlling functions like breathing, heartbeat, and digestion.<sup>29</sup> Traffic congestion can also lead to work absences and a lack of motivation to engage in activities outside of work.<sup>29</sup>

## Cost Savings

### *For Society*

Bike-pedestrian infrastructure is considerably less costly to build and maintain when compared to road projects, and is a more efficient use of city funds.<sup>13</sup> Annually, roadways cost an average of about \$550 per capita, with about half of this being funded through general taxes.<sup>26</sup> Ultimately, this means that the cost of building and maintaining roads is shared by everyone; however, our current car-centric system does not support all users. Compared to motorists, pedestrians and cyclists cause significantly less wear and tear on roadways, reducing the amount of maintenance required.

Connecticut spends about \$31 million per year in medical and work lost costs associated with bicyclist and pedestrian deaths.<sup>35</sup>

Spending less on transportation maintenance and the costly consequences of a car-dominated society, allows city funds to be invested in other public assets to better the community.

### *For Organizations*

Employees who bike or walk to work tend to be healthier than those who drive. Companies that offer incentives for employees who chose active transportation can save tremendously on healthcare costs. One US company reported that an incentive program offered to employees who biked or walked to work saved them 4.4% in the first two years, equaling \$200,000 per year in savings.<sup>13</sup> During this same time period, other companies saw an average increase of 25% in healthcare costs.<sup>13</sup>

### *For Individuals*

In Connecticut, the average cost of owning and operating a car is \$12,978 per year, which is about one-third of the average New Haven resident’s annual income.<sup>30, 36</sup> The average operating cost for a bicycle is \$308, or less than 1% of the average New Haven resident’s annual income.<sup>14, 36</sup> Spending less on transportation allows individuals to spend more on other needs like housing, food, and healthcare.

## In Closing

New Haven’s car-centric transportation system is exacerbating public health, safety, inequality, and environmental crises.

*The time for change  
is now.*

We envision a New Haven where you do not need a car to get around, and where you do not need to be afraid to walk or bike within the city. The benefits of a system that promotes active transportation can help address many of the consequences created by our car-centric society.

**We are asking the Board of Alders and Mayor Elicker to invest the resources in staff and materials to create an effective bike network by 2024. The benefits are clear, and the damage to climate and public health demand action now.**

# New Haven Re-Imagined



## Dixwell Avenue

Dixwell Avenue is a four-lane road connecting the area with various commercial amenities. Currently, there are no bike lanes on either side of the road. An improved bicycle infrastructure would allow for access to shops and restaurants located along Dixwell Avenue and would result in a reduction of space that is currently occupied by car parking.

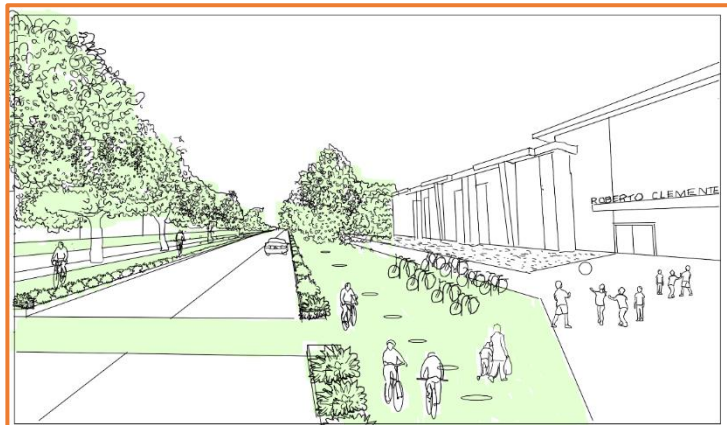
The sketch is showing an affordable bike lane variant using pavement markings only.



## Orange Street

Orange Street is a lively neighborhood street surrounded by single and multi-family homes. Orange Street already has a basic bike lane infrastructure that is frequently used by students and families, and acts as a connector to the popular East Rock Park. The high demand calls for an upgrade of the current bike infrastructure in capacity and safety.

The sketch on the left is showing a variant using a precast curb as a physical demarcation.



## Howard Ave

Howard Avenue, predominantly a three-lane road, does not have any bike lanes currently. It provides access to important public facilities, such as the Yale New Haven Hospital Emergency Room and Roberto Clemente Elementary School. Providing a secure bike network along Howard Avenue offers an opportunity to create transport alternatives and to invest in sustainable education from an early age.

The sketch on the left is showing a variant using planters with an increased protection level.



## Diamond Street

Diamond Street is a residential street with relatively low traffic volumes. Being near to various parks, such as Edgewood park and West Rock, it provides an excellent opportunity for the creation of "green pockets" as a way of slowing down car traffic and creating space for alternative uses.

# Types of Infrastructure

## Neighborhood Greenways

Neighborhood greenways, or bike boulevards, are streets where people of all ages and abilities have the opportunity to bicycle, walk and play. As such, neighborhood greenways need to maintain low auto volumes and speeds, provide protected crossings at major intersections, and create an environment that encourages people of all ages to travel actively.<sup>31</sup>



## Bike Lanes

*Bike lanes* are a portion of the roadway that designate exclusive space for bicyclists using striping, signage, and pavement markings.<sup>32</sup> Protected bike lanes have a physical barrier restricting encroachment of motorized traffic.<sup>32</sup> Bike lanes typically run next to motor vehicle lanes, in the same direction as traffic.<sup>32</sup> They are typically located on the right-hand side of the street between the adjacent travel lane and a curb, road edge, or parking lane.<sup>32</sup>



*Cycle tracks* are a portion of the roadway that designate exclusive space for bicyclists that is separated and protected from motor traffic and distinct from the sidewalk.<sup>32</sup> Cycle tracks can be one- or two-way.<sup>32</sup> In contrast to bike lanes, cycle tracks are typically located on the curb-side of a parking lane.<sup>32</sup>



**Tactical Urbanism** “refers to a city, organizational, and/or citizen led approach to neighborhood building using short-term, low-cost, and scalable interventions to catalyze long-term change.”<sup>33</sup> This approach allows cities to start small, and set the expectation that the first attempt will likely need to be refined based on community feedback.<sup>33</sup> This approach can result in quick wins that lead to broader change.

# Types of Infrastructure

Cities across the globe are humanizing streets and investing in infrastructure that supports active transportation. There are cost-effective ways to construct a bike network in New Haven illustrated by some options presented below.

The following is adapted from [PeopleforBikes](#)<sup>34</sup>, and showcases various options for protecting bike lanes. For a more comprehensive listing, please visit the PeopleforBikes article.



## Parked Cars

11 ft. for parking + buffer; \$8-\$16k per lane-mile

Protection Level	★ ★ ★ ★ ★
Installation Cost	★ ☆ ☆ ☆ ☆
Durability	★ ★ ★ ★ ★
Aesthetics	★ ★ ★ ☆ ☆



## Delineator Posts

1.5 ft. additional width; \$15-\$30k per lane-mile

Protection Level	★ ★ ★ ★ ☆
Installation Cost	★ ★ ☆ ☆ ☆
Durability	★ ☆ ☆ ☆ ☆
Aesthetics	★ ☆ ☆ ☆ ☆



## Turtle Bumps

1.5 ft. additional width; \$15-\$30k per lane-mile

Protection Level	★ ★ ★ ★ ☆
Installation Cost	★ ★ ☆ ☆ ☆
Durability	★ ★ ★ ★ ☆
Aesthetics	★ ★ ★ ☆ ☆



### Large Bumps

1.5 ft. additional width; \$15-\$30k per lane-mile

Protection Level	★★★★★
Installation Cost	★★☆☆☆
Durability	★★★★☆
Aesthetics	★★★★☆



### Oblong Low Bumps

1.5 ft. additional width; \$10-\$20k per lane-mile

Protection Level	★★★☆☆
Installation Cost	★★☆☆☆
Durability	★★★★☆
Aesthetics	★★★★☆



### Planters

3 ft. additional width; \$80-\$400k per lane-mile

Protection Level	★★★★★
Installation Cost	★★★☆☆
Durability	★★★☆☆
Aesthetics	★★★★★



### Cast in Place Curb

1 ft. additional width; \$25-\$80k per lane-mile

Protection Level	★★★★☆
Installation Cost	★★★☆☆
Durability	★★★★★
Aesthetics	★★★★☆

# Endnotes

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