

# Denver Traffic & the Failure of Vision Zero

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In October 2017, the city of Denver adopted a Vision Zero plan whose goal is to reduce traffic fatalities to zero by 2030.<sup>1</sup> While this is a laudable goal, it is worth questioning whether the tools the city is using to reach that goal are the right ones.

In the five years before it adopted its plan, Denver suffered an average of 53 traffic fatalities per year. In the five years since it adopted this plan, average traffic fatalities grew to 70, an increase of 33 percent.<sup>2</sup> While other circumstances have contributed to this increase, including changes in driving behavior since the beginning of the pandemic, this increase suggests that Vision Zero is the wrong solution and that other policies could do more to improve traffic safety.

The heart of Vision Zero is expressed by a banner shown at the top of Denver's 2021 Vision Zero annual report: "Slow Down."<sup>3</sup> Most of the actions taken under Vision Zero are aimed at slowing traffic by reducing speed limits, creating "slow zones," adding barriers to roads, and converting general purpose lanes to exclusive bike lanes.<sup>4</sup> This is based on the proposition that someone hit by a car going 50 miles per hour is less likely to survive than someone hit by a car going 20 miles per hour.

If speed isn't the real problem, however, then Vision Zero's strategies are misguided. It is also likely that Vision Zero has a hidden agenda: to discourage auto driving and instead encourage transit ridership, cycling, and walking. While some people may think this is a laudable goal, it has two problems. First, it has never worked in any city that has used it. Second, it ignores the real benefits that automobiles provide that cannot be achieved by transit, bicycles, or pedestrianism.

## *The Smoke-and-Mirrors Plan*

Denver's *Vision Zero Action Plan* is a 48-page document that is divided into four chapters: "Our Call to Action," "Let's Take Action," "Positive Changes," and "How We Developed the Plan." The first chapter recites grim statistics about how many people are killed in Denver traffic accidents each year. It also includes maps of streets that make up Denver's "high-injury network," that is, the 5 percent of Denver streets that see 50 percent of the city's traffic fatalities.

The second chapter is full of bureaucratese such as "Institutionalize Vision Zero as the City's approach to its transportation system," "Implement a multimodal safety education program for all," and "Equity is an important Vision Zero guiding principle." The chapter promises to do such things as modify two to four locations per year that see a lot of traffic accidents, change traffic signal timings at 10 intersections per year, build 14 to 20 miles of pedestrian trails a year, and reconfigure streets to add 20 to 25 miles of bike lanes a year. The chapter also calls for reducing speed limits on the city's high-injury network, creating even slower zones in some areas, and installing 1 to 2 new automated speed enforcement (speed cameras) a year.

The third chapter describes what has been done (going back to the late 1800s) and what will be done to improve safety. This chapter is just three pages long, only two of which are in the "What We're Doing" category, so it is rather light on actual steps that are being taken to eliminate traffic fatalities. However, those two pages list three examples: 1. The city added flashing lights to alert motorists of a pedestrian crossing; 2. The city reduced speed limits on a street that had seen

several accidents; and 3. The city changed a traffic signal to include a protected left turn to minimize conflicts between pedestrians and automobiles. Finally, the last chapter lists the people who contributed to the plan.

What the plan doesn't contain is any real evidence that it will work. Will the policies and practices it promises actually reduce fatalities to zero by 2030, or is that just a slogan? Is the city going to monitor all of the changes it makes to see if they really improve safety and use the information from that monitoring to modify the plan? The plan doesn't say.

About 4 percent of Denver traffic fatalities are bicycle riders; for them, the plan proposes 120 miles of new bike lanes. Is there any evidence that bike lanes will significantly reduce those fatalities? As will be shown below, they probably won't.

Nearly a third of Denver traffic fatalities are pedestrians; for them, the plan mainly proposes better crosswalks and other intersection improvements. Is there any evidence that this will address most pedestrian fatalities? As will be shown below, it probably won't.

More than 20 percent of Denver traffic fatalities are motorcyclists, yet the plan offers little to protect them other than to slow traffic in general. Is this the solution they need? These questions aren't answered either in the plan or in the technical supplement that was published with the plan.<sup>5</sup>

To provide better answers to these questions, this paper will look at the big picture of historic traffic safety trends and then scrutinize recent traffic issues in the city of Denver. The paper will also consider the benefits of automobiles to explain why they are the mode of choice for the vast majority of Denver residents. Based on traffic safety data, the paper will then ask whether a strategy of making transportation safer without being biased against one particular mode could be more successful than a strategy that is primarily anti-automobile.

## *The Big Picture*

Fifty years ago, critics of automobiles and highways had valid arguments. American cars were gas guzzlers, getting an average of only 13.5 miles per gallon.<sup>6</sup> They were also serious polluters that darkened urban skies with particulates and photochemical smog.<sup>7</sup> Finally, automobiles killed more than 55,000 people per year in 1972 and 1973, which was a fatality rate of well over 40 deaths per billion vehicle-miles.<sup>8</sup>

Many cities responded to critics' concerns by stopping construction of new freeways, spending money instead on urban transit. The 1970s saw Atlanta, Portland, the San Francisco Bay Area, and other major urban areas begin a concerted effort to "get people out of their cars," efforts that have continued to this day. Some people have called this the "war on the automobile."

The changes since then have been remarkable. The average car on the road today gets nearly 30 miles per gallon, and even light trucks (pickups, vans, and sports-utility vehicles) get more than 21 miles per gallon.<sup>9</sup> Total highway-related air pollution has declined by nearly 90 percent.<sup>10</sup> As of 2020, total highway fatalities declined by more than 30 percent.

None of these improvements resulted from efforts to "get people out of their cars." Instead, improvements in auto efficiency, cleanliness, and safety resulted from making improvements to the automobiles themselves.

Reductions in pollution and traffic fatalities happened despite the war on the automobile. In fact, anti-auto and anti-highway programs made many of the problems worse because they increased congestion, which reduced fuel economy and increased air pollution.

Efforts to get people out of their cars were, in fact, a miserable failure, since driving nearly tripled between 1970 and 2019.<sup>11</sup> Pollution and traffic fatalities declined despite this increase in driving, which means that pollution per vehicle-mile fell by well over 95 percent and fatality rates per billion vehicle-miles declined by around 70 percent.

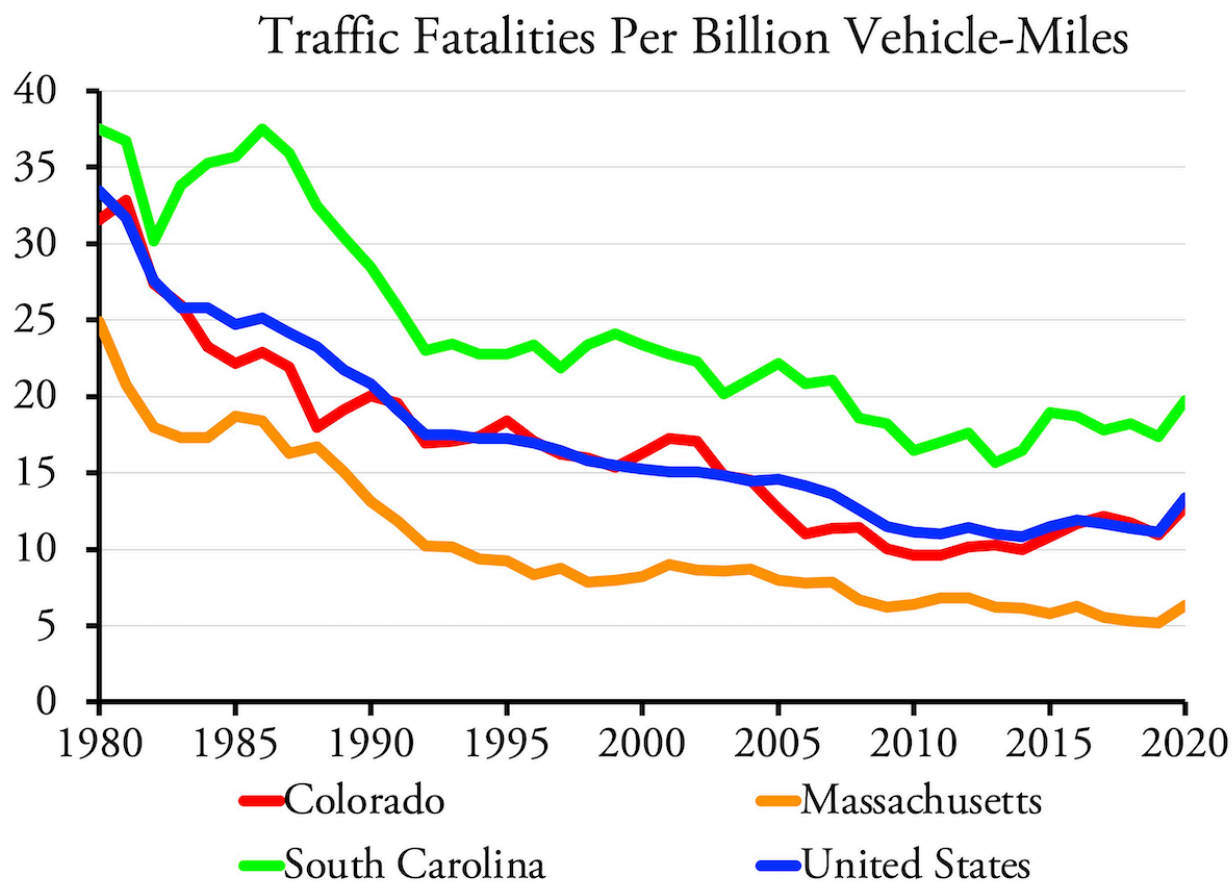


Figure 1: Highway fatality rates are higher in rural areas than in urban areas, so urban states such as Massachusetts have lower rates than more rural states such as South Carolina. Colorado is right in the middle, but all states saw a decline in fatality rates through the early 2010s, then rates increased. Source: Highway Statistics (Washington: Federal Highway Administration) tables FI-20 (fatalities) and VM-2 (vehicle-miles) for the indicated years.

As of 2020, Massachusetts had the lowest fatality rates in the nation and South Carolina the highest, while Colorado's was about equal to the national average. This doesn't mean that Massachusetts drivers are extraordinarily safe or that South Carolina drivers are reckless. Instead, rural highways tend to have significantly higher fatality rates than urban roads, and more than 90 percent of driving in Massachusetts is urban while nearly half of driving in South Carolina is rural. About 69 percent of Colorado driving is urban, which is nearly identical to the national average.

Fatality rates declined in both urban and rural areas, and in every state, from 1980 (the earliest year for which state data are available) to the early 2010s. Since then, however, the national and state fatality rates have increased. A particularly sharp increase took place after the beginning of the pandemic.

Many speculations on the causes of the recent rise in fatality rates are questionable. One report claims it was due to people traveling more as the economy recovered after the 2008 recession. Since rates declined as driving increased for many years before 2010, it doesn't seem credible that increases in driving since 2010 would increase fatality rates. The article also blamed states for failing to tighten up traffic safety laws.<sup>12</sup> Yet if states failed to tighten traffic laws, that should result in a flattening of rates, not an increase. The article pointed to increases in maximum freeway speed limits in some states as a problem, but fatality rates are lowest on freeways.

A more significant factor that probably increased fatality rates after 2010 was the widespread adoption of smart phones. The first smart phones appeared in 2007. According to surveys by Pew Research, 35 percent of adult Americans had smart phones in 2011, increasing to 56 percent by 2013, 72 percent by 2016, and 85 percent by 2021.<sup>13</sup>

People aren't always going to admit that they allowed themselves to become distracted before an accident. But surveys by Traveler's Insurance found that texting or emailing, checking social media, and other on-line distractions while driving were much higher in 2021 than 2019.<sup>14</sup> All of these increased still further in 2022.<sup>15</sup> This period also saw an increase in fatalities despite a decline in driving, thus significantly increasing fatality rates.

Drivers aren't the only ones distracted by smart devices. At least one report on the rise of pedestrian fatalities has put part of the blame on "pedtextrians," pedestrians distracted by their smart phones.<sup>16</sup>

## *Focus on Denver*

### Denver Travel

While personal travel statistics are not available for the city of Denver, according to the Federal Highway Administration, in 2019 the average resident of the Denver urban area traveled more than 15,000 miles by motor vehicle.<sup>17</sup> According to the Federal Transit Administration, the average resident of the region traveled about 215 miles by urban transit in 2019.<sup>18</sup>

Denver data aren't available for motorcycles, pedestrians, and bicycle riders, but nationally American traveled 14,900 miles by car or light truck (pickups, vans, SUVs), and 70 miles by motorcycle in 2019. The latest estimates for walking and cycling are from 2017 and estimate the average American walked 104 miles and bicycled 27 miles.<sup>19</sup> However, these walking and cycling numbers include only trips with destinations such as work, school, or shops; walking for recreation or exercise was not included. It is likely that total urban walking and cycling numbers are at least double if not triple the 2017 estimates, yet even so it is only a small share of total travel.

According to the Census Bureau's 2019 American Community Survey, 81.9 percent of commuters in the city of Denver went to work by automobile, 8.4 percent by mass transit, 6.0 percent on foot, 2.6 percent on a bicycle, and 0.4 percent on a motorcycle.<sup>20</sup> In general, transit's share of other kinds of travel is much smaller than its share of commuting while walking's share of other kinds of

travel (including walking for exercise and recreation) is larger than its share of commuting.<sup>21</sup> Bicycling is likely more like walking in this regard.

The pandemic had a major effect on transportation habits, although this effect was largely an acceleration of trends that were already taking place. The most visible effect was the increased number of people working at home. According to American Community Survey data, the number of Denver residents who worked at home increased by 250 percent from 2019 to 2021. This had unequal effects on different modes of commuting: the number taking automobiles to work declined by 23 percent, while the number taking transit declined by 61 percent, walking by 50 percent, cycling by 38 percent, and motorcycles by 75 percent.<sup>22</sup>

Despite the 23 percent decline in auto commuting, driving quickly recovered after the depths of the pandemic. According to the Federal Highway Administration, at the end of 2021 urban driving in Colorado was 13 percent less than in 2019.<sup>23</sup> Meanwhile, 2021 transit ridership in the Denver urban area was just 46 percent of 2019, and by November 2022, the latest month for which data are available, it was still only 58 percent of 2019.<sup>24</sup>

Transit was hit harder than most other modes by increased numbers of people working at home because the largest share of transit commuters were downtown office workers, and these are among the most likely people to switch to telecommuting. Driving, meanwhile has come closer than transit to a full recovery because, studies show, people who work at home actually drive more miles than when they commuted to work.<sup>25</sup>

## Denver Traffic Fatalities

While Denver has published some data on traffic fatalities from 2013 through 2022, a more comprehensive dataset is available from the National Highway Traffic Safety Administration (NHTSA). While NHTSA's data only goes through 2020, it goes back to 2006 and can distinguish between drivers, vehicle passengers, cyclists, and pedestrians. It is broken down by time of day, the type of road where fatalities take place, and where they take place (such as intersections or not at intersections) as well as such factors as the ages of people killed and whether drivers or others were intoxicated.<sup>26</sup>

Classes of roads in NHTSA data include interstate freeways (such as I-25 and I-70), other freeways (such as U.S. 6), other arterials (such as west Colfax), collectors (such as west 20<sup>th</sup>), and local streets. While data aren't available for the city of Denver in particular, within the Denver-Aurora urban area, local streets make up 77 percent of the road but provide only about 10 percent of vehicle travel. Freeways make up 3 percent of road miles but provide 45 percent of travel. Other arterials include 12 percent of road miles and provide 38 percent of travel. Finally, collectors include 8 percent of road miles and 7 percent of travel.

Though Denver is the nation's 21<sup>st</sup> largest city, it is small enough that year-to-year variations in traffic fatalities can be partly due to luck, especially if fatalities are broken down into categories such as auto, bicycle, and pedestrian. For example, NHTSA says Denver had zero bicycle fatalities in 2020, but that's not necessarily attributable to Vision Zero as there were also zero bicycle fatalities in 2006, 2009, and 2013.

These variations can be smoothed out by comparing five-year averages. By this measure, Denver had the lowest number of total traffic fatalities in the five years between 2009 and 2013. This period also saw the lowest number of pedestrian and bicycle fatalities, though fatalities among vehicle occupants were slightly lower in the 2010-2014 period.

The five years ending in 2020 saw a 49 percent increase in overall fatalities from the 2009-2013 period, including a 47 percent increase in fatalities among motor vehicle occupants, a 34 percent increase in pedestrian fatalities, and a 180 percent increase in bicycle fatalities. These increases were not caused by Vision Zero, but they suggest that Vision Zero is addressing the wrong issues.

## Pedestrians

Fatality data for pedestrians are particularly alarming because of sheer numbers. The average Denver resident probably travels at least 50 times as many miles a year by automobile as by walking (outside of homes and workplaces). Yet pedestrian fatalities make up almost a third of all traffic deaths in Denver, making walking far more dangerous than driving or riding in a car.

Between 2006 and 2020, 70 percent of all pedestrian fatalities took place on non-freeway arterials. About 16 percent took place on freeways, 6 percent on collectors, and 8 percent on local streets. These percentages did not appreciably change over time. Whether measured by fatalities or fatalities per billion vehicle miles, non-freeway arterials are by far the most dangerous roads to pedestrians while freeways are the safest.

NHTSA data indicate that more than two-thirds of all pedestrian fatalities take place at night. This increased from about 65 percent in the five years ending in 2010 to 71 percent in the five years ending in 2020. The nighttime share is over 70 percent on all roads except local streets. There are no systematic data on when and where people are most likely to walk, but it is reasonable to assume that most walking takes place during the day, so nights must be particularly dangerous when measured per mile of walking.

The data also indicate that about three-fifths of pedestrian fatalities take place away from intersections where there are likely to be crosswalks. More than half of those were on arterials. This declined from 62 percent in the five years ending in 2010 to 55 percent in the five years ending in 2020.

About 11 percent of pedestrian fatalities involve children 20 years and under. The age class suffering the most fatalities are 45-54 year olds, at 21 percent of the total. Next is 55 to 64 year olds at 17 percent.

As might be expected, alcohol was much more likely to be a factor at night. In 28 percent of nighttime pedestrian fatalities, the driver had a blood alcohol content (BAC) of 0.08 grams/deciliter or more, compared with just 5 percent of daytime fatalities. However, the pedestrians themselves were even more likely to be inebriated, with 52 percent of pedestrians at night and 19 percent during the day having a BAC of 0.08. By far the most likely pedestrians to be inebriated were in the 35- to 54-year age classes.

NHTSA data don't have a category for homelessness, but anecdotal information from other cities suggests that a high share of pedestrians killed in traffic accidents are homeless. According to the city of Portland, 70 percent of 2021 pedestrian fatalities in that city were homeless.<sup>27</sup> San Jose reports that 20 percent of all 2021 traffic fatalities, which probably means more than half of pedestrian fatalities, were homeless.<sup>28</sup> Homeless people often camp near arterial streets that are the most dangerous to pedestrians.

If the average Denver resident walks outdoors 300 miles a year (the national average times three to account for recreational walking), then fatality rates were about 50 per billion pedestrian-miles. (Note this is per billion passenger-miles, while the rates listed above were per billion vehicle-

miles.) This number is only approximate, but as will be shown below it is much higher than the rate for car and truck drivers and passengers.

## Bicycle Riders

Between 2006 and 2020, only 29 bicycle riders were killed in traffic accidents, which is about 4 percent of all traffic fatalities in Denver. This is high relative to the amount of cycling people do, but not as bad as pedestrian fatalities. While pedestrian fatalities have hovered around 31 percent of the total, bicycle's share of fatalities have grown from 3.6 percent in the five years ending in 2010 to 5.1 percent in the 2016-2020 period.

As with pedestrians, about two-thirds of bicycle deaths happen on non-freeway arterials. Nearly half of all fatalities—14 out of 29—were in the 45-64 year age classes; only 1 was under the age of 16.

In sharp contrast to pedestrians, almost two-thirds of cycling fatalities happen during the day and most happen at intersections. Although the information was not available for 10 of the 29 fatalities, of the remaining 19, three resulted from a motor vehicle overtaking the cyclist; two from someone on the wrong side of the street, probably because many cyclists erroneously believe it is safer to ride on the wrong side of the street; and one for a motorist failing to yield mid-block, meaning the motorist probably turned into or out of a drive way and hit the bicyclist. The remaining 13, or almost two-thirds, were related to intersections.

Since most fatal bicycle accidents happen during the day, alcohol was less of a factor: of the 29 fatal bicycle accidents, 14 percent of the drivers and 39 percent of bicycle riders had BAC levels of 0.08 or more. Naturally, these were mostly at night: 35 percent of nighttime bicycle fatalities involved drivers and 80 percent involved bicycle riders with BAC levels over 0.08.

If Denver residents bicycle an average of 80 miles a year, which is the national average times three to account for recreational bike riding, then fatality rates were about 25 per billion bicycle-miles. That's surprisingly lower than pedestrian rates, but much higher than the rates for automobile occupants.

## Motorcyclists

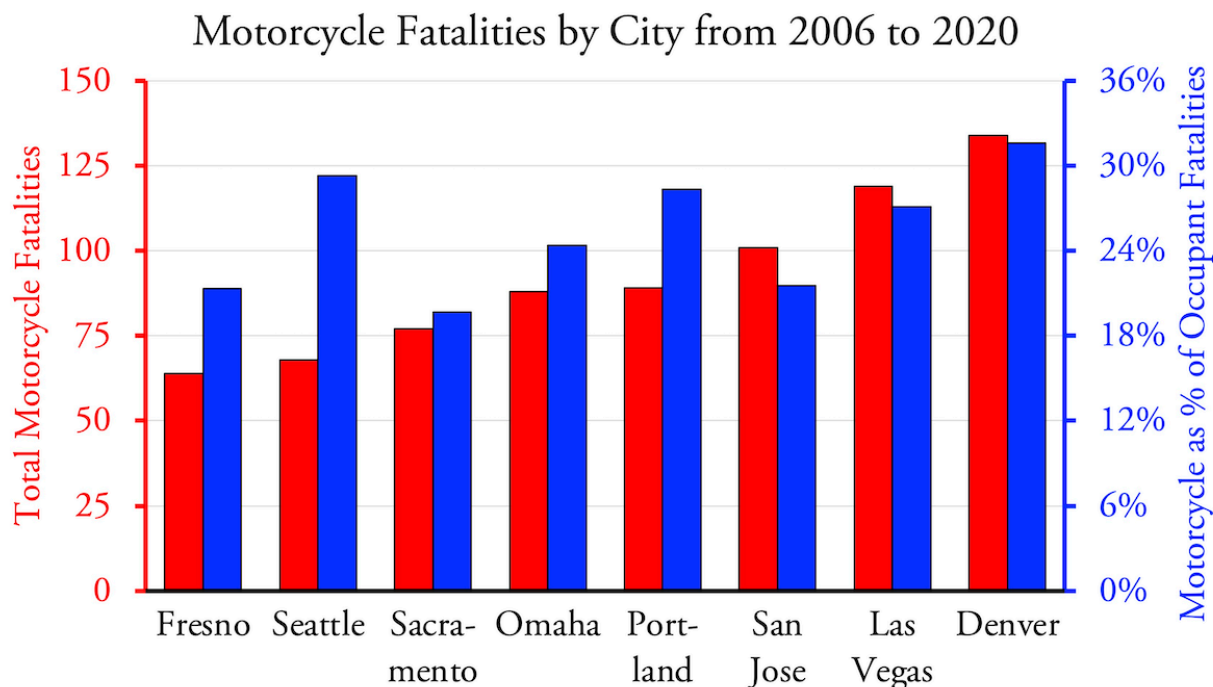
Motorcycles are motor vehicles and motorcyclists are vehicle occupants. Unfortunately, NHTSA data do not list motorcyclist deaths as a separate category, but the data do say how many people were killed in accidents involving motorcycles. Presumably, nearly all of those people were motorcyclists.

The numbers say that, from 2006 through 2020, 136 people died in Denver accidents involving motorcycles, which is 32 percent of all occupant fatalities. Nationwide, 99.5 percent of light vehicle travel is in cars and light trucks while less than 0.5 percent is by motorcycle, so 32 percent of occupant fatalities should be as alarming as the rate of pedestrian fatalities.

The average number of motorcycle deaths shrank from an average of 8.0 per year in the five years ending in 2010 to just 5.2 in 2009-2013 but then grew to 12 in 2016-2020. The share of occupant deaths that were in accidents involving motorcycles grew slightly from 31.5 percent in 2006-2010 to 34.7 percent in 2016-2020.

As with vehicle occupants in general, a majority—55 percent—of deaths in accidents involving motorcycles took place at night. Freeways saw 27 percent of such accidents, other arterials 61 percent, collectors 2 percent, and local streets 9 percent. The age class with the highest number of fatalities was 25-34, but 35-44 and 45-54 were high as well. Fatality numbers in the 25-34 age class were particularly high between 2015 and 2019; for whatever reason, they were much lower before 2015.

One factor that must be considered regarding motorcycle fatalities is helmets. Denver's Vision Zero plan notes that 64 percent of motorcycle fatalities in the city were not wearing a helmet.<sup>29</sup> NHTSA estimates that helmets can reduce the risk of fatal injury to motorcyclists by more than 40 percent.<sup>30</sup> Colorado requires motorcycle riders under the age of 18 to wear helmets but for older riders they are optional. In contrast, California, Nebraska, Nevada, Oregon, Washington and several other states require all riders to wear helmets.<sup>31</sup> Comparing Denver's fatalities with those of Fresno, Las Vegas, Omaha, Portland, Sacramento, San Jose, and Seattle—all of which are roughly comparable in size to Denver—reveals that all of them have both fewer fatalities in motorcycle accidents and a smaller percentage of occupant fatalities in motorcycle accidents.



*Figure 2: Denver's peer cities in western states with universal motorcycle helmet laws have both fewer motorcycle fatalities and fewer motorcycle fatalities as a share of all vehicle occupant fatalities. Note that the data only say that the indicated numbers of fatalities took place in accidents "involving motorcycles," so it is possible that a few of the fatalities were of people who weren't riding motorcycles.*

Motorcyclists claim that helmet laws infringe on their freedom and that they are the only ones put at risk when not wearing a helmet and so they should get to choose to take that risk. Of course, if high motorcycle fatality rates lead to political efforts to restrict motor vehicle usage in Denver, then the motorcyclists are not the only ones at risk. Denver motorcycle fatalities are both high in number and as a percentage of total occupant fatalities, and any effort to reduce fatalities should include a reexamination of Colorado's helmet law.



Street design, which is Vision Zero's focus, is also a factor in motorcycle fatalities. According to NHTSA, "unforgiving roadway barriers" can be particularly dangerous to motorcycle riders. Much of what Vision Zero is doing is adding barriers to roads, including chicanes, bump outs, and median barriers. These may actually increase risks to motorcycles. Motorcycle riding makes up an extraordinarily small portion of Denver travel yet an extraordinarily large portion of Denver traffic fatalities, so the emphasis should be on reducing barriers, not increasing them.

The Federal Highway Administration estimates that the average motorcycle carries 1.2 people.<sup>32</sup> If Denver residents ride motorcycles at the national average of about 70 miles per year, then motorcycle fatality rates were about 130 per billion passenger-miles, making motorcycles 100 times more dangerous than automobiles.

## Vehicle Occupants

Between 2006 and 2020, 424 motor vehicle occupants died in traffic accidents in Denver, an average of 28.2 per year. The five-year averages shrank from 25.4 in 2006-2010 to 23.4 in 2010-2014 but then grew to 34.6 in 2016-2020. About 25 percent of occupant fatalities took place on freeways, 59 percent on other arterials, 8 percent on collectors, and 9 percent on local streets. The freeway and other arterial shares have not significantly changed over time but the five-year average collector share shrank from 8 to 6 percent and local share grew from 7 to 10 percent. About 60 percent of fatalities take place at night.

If all 136 fatalities in accidents involving motorcycles were motorcycle riders, then 288 occupants of cars and trucks died in Denver in 2006 through 2020, or an average of 19.2 per year. If the average resident of Denver traveled 15,000 miles a year by automobile, this is a rate of 1.3 fatalities per billion passenger-miles. Motorcycle riders are roughly 100 times more likely to die in traffic accidents than auto users, while pedestrians are roughly 40 times and bicycle riders 20 times more likely to die in such accidents.

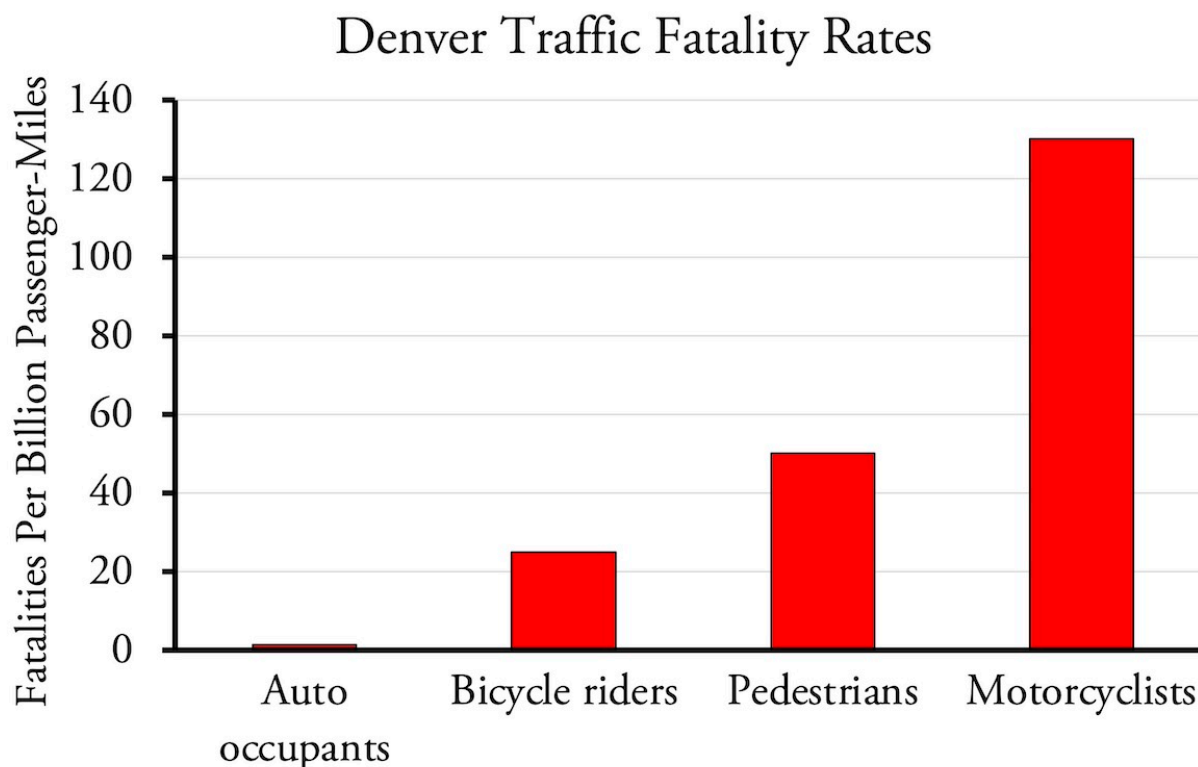


Figure 3: Motorcycles appear to be riskiest form of travel in Denver. These estimates are approximate; see text for how they were calculated.

### Transit Fatalities

Denver's Vision Zero plan does not address transit as a separate issue, but it is an important factor in traffic fatalities. Between 2014 and 2021, 18 people were killed by RTD buses and 17 by RTD light-rail trains.<sup>33</sup> These are not large numbers compared with total traffic fatalities, but transit carries so few passenger-miles that this represents 7.6 fatalities for every billion passenger-miles carried by buses and 13.4 for every billion carried by light rail. Both of these are much higher than the rates even for non-freeway arterials, the most dangerous streets in Denver.

Bus fatalities, which averaged about 2 per year from 2014 to 2021, jumped to 6 in 2022, which may be a sign of poor driver training considering RTD's documented driver shortages.<sup>34</sup> Light-rail fatalities remained at about 2 per year. Yet buses and light rail carried far fewer passenger miles in 2022 than they did before the pandemic, so fatality rates greatly increased for both.

A number of rail-pedestrian accidents have happened in downtown Denver where, in an incredibly stupid move, RTD built light rail going the wrong direction on one-way streets. Pedestrians, conditioned to think they only need to look one way for cars on those streets, step in front of light-rail trains. RTD blames the victims, but it wasn't the victims who decided to put 300,000-pound light-rail trains in the same streets as 150-pound people.

One way for RTD to reduce accidents is to have collision avoidance technology installed on all new transit vehicles.<sup>35</sup> Until that happens, it may need to better train drivers to minimize such

accidents. The city and RTD should work together to reverse either light rail or other traffic on downtown one-way streets where trains currently move in the opposite direction from other vehicles.

## *The Value of Automobility*

Much of the discussion on street safety focuses on automobiles as the primary threat to pedestrians, cyclists, and others. While that is appropriate, much of the rhetoric goes too far in demonizing automobiles as dangerous to society as a whole due to pollution and energy consumption as well as traffic safety. “Streets should be for people, not cars,” is one favorite mantra, as if every automobile on the road didn’t have people in it.

Transit advocates like to show photographs of a bus and all the cars needed to carry all of the people who could fit on the bus at the rate of one person per car.<sup>36</sup> This is biased because it compares a full bus (including standees) with single-occupant cars when a more reasonable comparison would be buses and cars that are either full or at their average occupancy. Instead of 60 cars, about 10 cars are all that would be needed to hold the passengers of a full bus. Considering average occupancies, RTD buses carried an average of 8.5 people (calculated by dividing passenger-miles by vehicle-revenue miles) in 2019 and 5.6 in 2021.<sup>37</sup> Cars and light trucks carry an average of 1.67 people, so it would take only three to five cars to carry as many people as a bus.<sup>38</sup>

The bus/car comparison also ignores speeds: automobiles tend to travel two to three times the average speeds of buses, so they occupy any given street space for a proportionately smaller amount of time. Thus, it is quite likely that RTD buses add more to congestion than any cars they take off the road. This is only compounded if general purpose lanes are dedicated to buses that are both infrequent and relatively empty.

Automobiles have their costs, including dollar costs, energy costs, environmental costs, and traffic safety costs. Yet these costs must be weighed against their benefits. If they have costs and no benefits, then efforts to reduce auto driving by converting general purpose lanes to dedicated bicycle or bus lanes make sense. But automobiles have significant benefits, then it is worth asking whether traffic safety can be better improved using practices that aren’t hostile to auto drivers.

Automobiles in fact have huge benefits. More than almost any other invention of the last 200 years, mass-produced automobiles have transformed society, increasing wealth, reducing wealth inequality, and improving the quality of life for almost every American.

Wealth and incomes have increased because automobiles give potential employees access to more jobs and employers access to a more highly skilled work force. Researchers at the University of Minnesota calculate that a typical resident of the Denver urban area can reach almost twice as many jobs in a 20-minute auto drive as in a 60-minute transit trip. Transit is so slow that bicyclists in reasonably good condition can reach more jobs in a given amount of time than transit riders, but neither can compete with automobiles.<sup>39</sup> Other researchers have shown that giving employers access to 15 percent more potential workers increases worker productivity by 3 percent, so the huge advantages in job access provided by the automobile translate to proportional advantages in income.<sup>40</sup>

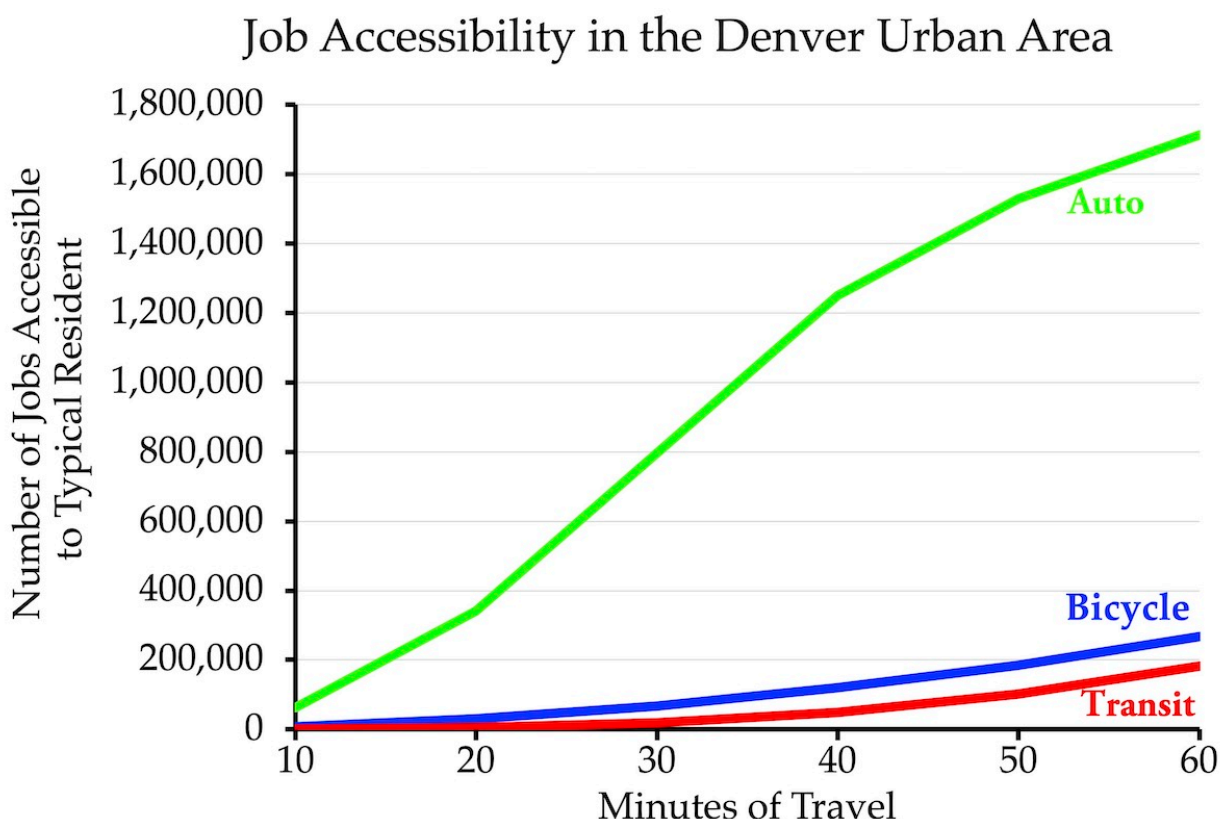


Figure 4: Given the same amount of time to travel, a typical resident of the Denver urban area can reach 8 to 12 times as many jobs by auto as by transit in trips of 50 minutes or less and more than 6 times as many in 60 minutes of travel. Source: University of Minnesota Accessibility Observatory.

This has led to both higher incomes and reduced income inequality. In 1910, average incomes in the United States were about \$15,000 per year in today's dollars.<sup>41</sup> Today, the average worker earns at least four times that amount. The increase in working-class incomes has been much larger than the increase in middle-class incomes, thereby reducing income inequality.

Autos also reduced wealth inequality. A little over a century ago, when the main ways of getting around cities were by foot or streetcar, most working-class employees couldn't afford to regularly ride streetcars, so they had to walk to work. This limited the number of jobs they could reach and forced them to live in crowded, high-density rental housing. However, Henry Ford's Model T was so affordable that it democratized mobility, allowing working-class employees to buy suburban homes, often in the same neighborhoods as middle-class workers. Increases in auto ownership and urban homeownership went hand in hand, increasing the wealth of the homeowners so that, by the 1960s, the United States had the lowest wealth inequality in its history.

Better housing meant better quality of life for urban residents. Automobiles also gave people access to a wider variety of low-cost consumer goods. In 1912, the average grocery store in the United States carried just 300 different products.<sup>42</sup> By 2000, the average supermarket had 25,000 different products, and some had more than 100,000.<sup>43</sup>

Automobiles have been blamed for suburban sprawl (as if better housing and higher homeownership rates are undesirable), but in fact autos and their relatives, tractors and trucks, have had huge environmental benefits. Before motor transport, farmers had to devote large portions of their farms to growing feed for the horses and other animals that were used to power the farms and move products to markets. Between 1920 and 1970, about 40 million acres of pasture lands were converted to crop lands, and another 80 million were turned to forests.<sup>44</sup> This is far more than the number of acres of low-density suburbs; the 2020 census found that all urban areas in the country occupy only about 67.5 million acres.<sup>45</sup>

Autos and street networks are essential for emergency services. A researcher in Boulder estimates that, for every pedestrian whose life is saved by slowing of auto traffic, 85 people would die due to delays in emergency service vehicles.<sup>46</sup>

Highways and streets are also vital for freight. Rail costs are lower than truck costs, but trucks are essential for moving goods within cities. Moreover, the combined cost of shipping by rail and truck is lower than the cost of rail alone. Due to the growth of shipping over highways, the real costs of shipping manufactured goods have declined by 90 percent since 1929.<sup>47</sup>

Automobiles have produced many other benefits. Both the civil rights movement and women's rights movement were partly enabled by increasing auto ownership. Automobiles give people access to numerous social and recreational opportunities that were once available only to the wealthy. In 1914, when Yellowstone Park was closed to automobiles, barely 20,000 people visited the park. When it was opened to autos in 1915, attendance increased by 150 percent. Today, more than 4 million people a year visit the park, nearly all of them by auto.<sup>48</sup>

Not all of these benefits will be affected by policies of slowing traffic in Denver and other cities, but many of them will. In particular, policies that slow traffic will impose the greatest costs on people whose jobs have fixed hours and cannot be done at home. Such policies are likely to reduce their incomes, thus contributing to income inequality. These policies will also increase consumer costs and reduce the responsiveness of emergency service vehicles to fire and health issues.

For these reasons, programs aimed at improving traffic safety should aim to do so without reducing the capacity of streets to move autos and other vehicles. Not only should reducing street capacity be a last resort, but it is also possible that programs that improve safety without reducing capacities will actually be more successful.

## *Improving Roadway Safety*

The above estimates of Denver traffic fatality rates per billion passenger-miles are rough approximations, but they show that motorcyclists, bicyclists, and pedestrians face far more hazardous conditions than automobile occupants. Auto safety devices such as seat belts, air bags, anti-lock brakes, vehicle stability control, and most recently collision avoidance have greatly improved safety for occupants of automobiles. Except for anti-lock brakes, none of these improvements are available to motorcycles. While collision avoidance is likely to improve safety for non-auto occupants in the long run, it will take several years before most of the automobile fleet is using it.

This means that Vision Zero is correct in that improved roadway designs are an important part of protecting non-automobile occupants. However, Denver's Vision Zero plan appears to be more about discouraging people from driving and nudging them to take transit, walk, or bicycle

instead. If this actually worked, this could actually lead to more fatalities as pedestrians and cyclists suffer far more fatalities, per passenger-mile, than auto users.

There is little evidence, however, that emphasizing transit, bike lanes, and pedestrian ways does anything to promote these modes. Cities such as Seattle, Portland, and San Francisco have been taking actions like these for years and have had no significant effect on driving or transit. Instead, these policies seem more oriented to making streets hostile to automobiles than friendly to other modes.

Phillip Washington, who until recently was CEO of Los Angeles Metro (and is now CEO of Denver International Airport), made this clear when he tried to address rapidly declining bus ridership on Los Angeles. "It's too easy to drive in this city," Washington said of the city that is often ranked the worst congested in the United States. His solution was to convert general purpose lanes to exclusive bus lanes, thus increasing congestion for automobiles and encouraging some people to ride the buses to avoid the congestion.<sup>49</sup> It is worth noting that, shortly after Denver adopted its Vision Zero plan, it also adopted a transit plan that calls for dedicated bus lanes throughout the city.<sup>50</sup>

Instead of focusing on one factor—vehicle speeds—as Vision Zero largely does, transportation planners need to learn a lesson from the airline industry. After several fatal airline crashes in the 1990s, airlines, pilots' unions, and airplane manufacturers developed a data-driven incident reporting system that was aimed at fixing problems, not on finding people to blame for the problems. The result is that there have been no fatal commercial airline crashes in the United States since 2009.<sup>51</sup> The National Highway Traffic Safety Administration already has a database, known as the Fatality and Injury Reporting System Tool (FIRST), that is largely ignored by many local transportation planners.<sup>52</sup> Denver transportation agencies should use and enhance this system to identify and solve real safety problems.

Here are a few specific flaws in Denver's Vision Zero plan.

1. To protect pedestrians, Vision Zero relies on slowing traffic and improving crosswalks. Yet the data show that most pedestrian fatalities happen at night, away from crosswalks, and the pedestrians are often intoxicated, all things that Vision Zero does not address.
2. Given the high numbers of intoxicated pedestrians who are killed at night, it appears likely that homelessness is strongly associated with increasing fatality rates. Vision Zero does nothing to address this issue.
3. Motorcyclists appear to suffer the highest fatality rates of any roadway users, yet Vision Zero does nothing to specifically address their safety. Instead, many of the things it proposes, including adding chicanes to narrow lanes, bump outs at crosswalks, and median barriers, may make streets more dangerous for motorcycles.
4. Bike lanes installed under Vision Zero focus on protecting bicycle riders from being overtaken by automobiles. The data, however, show that such accidents are rare, while the most dangerous places for cyclists are at intersections, about which Vision Zero does little. Bike lanes may actually increase bicycle accidents as they give riders an illusion of safety that doesn't exist at intersections.

While I can't predict what exactly would emerge from a data-driven system, here are some examples of programs that will do more than Vision Zero to improve traffic safety without impeding traffic.

1. *Separating users*: When measured by fatalities per billion vehicle-miles, Denver freeways are the safest roads in the city because they largely separate motor vehicles from non-motorized traffic. Meanwhile, non-freeway arterials are the most dangerous roads as they invite all users. Denver should consider redesigning major non-freeway arterials to give them some freeway characteristics, such as fewer cross streets and safer intersections of major streets, while at the same time providing alternative routes for pedestrians and bicycles.
2. *Bicycle boulevards*: For bicycles, those alternative routes would be in the form of bicycle boulevards. Such boulevards would consist mainly of local streets that parallel arterials and collectors. The local streets would be redesigned to allow bicycles to use them with as few stops as possible, but with a few barriers to discourage auto drivers from using them for through traffic. They would still be left open to local auto traffic. This would do more to increase bicycle safety than bike lanes on the arterials and collectors themselves while not impeding or slowing traffic.
3. *Pedestrian barriers*: Denver should consider installing barriers between sidewalks and non-freeway arterials to discourage pedestrians from crossing streets away from crosswalks.
4. *Solve the homeless problem*: Solving homelessness is beyond the scope of this report, but if the homeless are a major reason for increased pedestrian fatalities, then Vision Zero is doing nothing to fix this. Ideally, solving homelessness would mean ending drug addiction, curing mental illnesses, and finding shelters for all homeless people. For the purposes of this report, it means moving homeless people away from the arterial streets where too many end up as fatality statistics because they attempt to cross those streets at night.
5. *Motorcycle helmet law*: The data show that there are fewer motorcycle deaths and motorcycle deaths make up a smaller share of total vehicle occupant fatalities in Denver's peer cities in the West in states that have universal helmet laws. The data appear to indicate that motorcycle fatality rates per passenger-mile are far higher than for pedestrians and bicycle riders, so anyone who wants to reduce fatality rates should support a helmet law.
6. *Traffic flow improvements*: Traditional traffic measures, such as conversions of two-way streets to one-way couplets and coordination of traffic signals, have been proven to reduce congestion even as they make the roads safer for everyone. Signal improvements are included in Vision Zero, but only at 10 intersections per year, which seems inadequate compared with the number of major intersections in the city.

## Conclusions

When we worry about traffic accidents, we often think of a child running after a toy into a street and being struck by a car in broad daylight. It turns out that fatal pedestrian accidents are much more likely to involve a middle-aged person who is possibly homeless crossing a busy street at night away from crosswalks, while a disproportionate share of vehicle occupant fatalities are motorcyclists.

Information like this would be useful to know when designing a traffic safety program for Denver. Instead, Vision Zero ignores this kind of information and instead focuses heavily on slowing traffic, with a likely hidden agenda of trying to discourage driving.

Denver should replace Vision Zero with a data-driven program that identifies the real causes of traffic accidents and takes the appropriate steps to fix those problems. This can be done without reducing the ability of Denver streets to handle vehicle traffic if the remedies include such

practices as separating users on major non-freeway arterials, protecting the homeless from busy traffic, and improving motorcycle safety laws.

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