MINNESOTA GO

Planning Minnesota's
Transportation Future

GENERAL TRANSPORTATION SAFETY TREND ANALYSIS

CONTENTS

SUMMARY

Transportation safety has improved over the last 50 years. Fatality rates trended down even while the country's population grew and Americans traveled more. The U.S. prioritizes transportation safety today more than in the past. Statistically, Americans are safer than ever while flying, driving, or riding. However, the large safety gains from the 1970s to the early 2000s have slowed for most types of travel. Fatalities have been rising in recent years for some types of travel. For example, 2021 witnessed the largest number of fatalities in vehicle traffic crashes on the U. S. roadways since 2005. Almost 43,000 people died on the nation's roadway system in 2021, a more than 10% increase from 2020.[1] In Minnesota, there were 488 deaths on Minnesota roads in 2021, up from 394 deaths in 2020.[2]

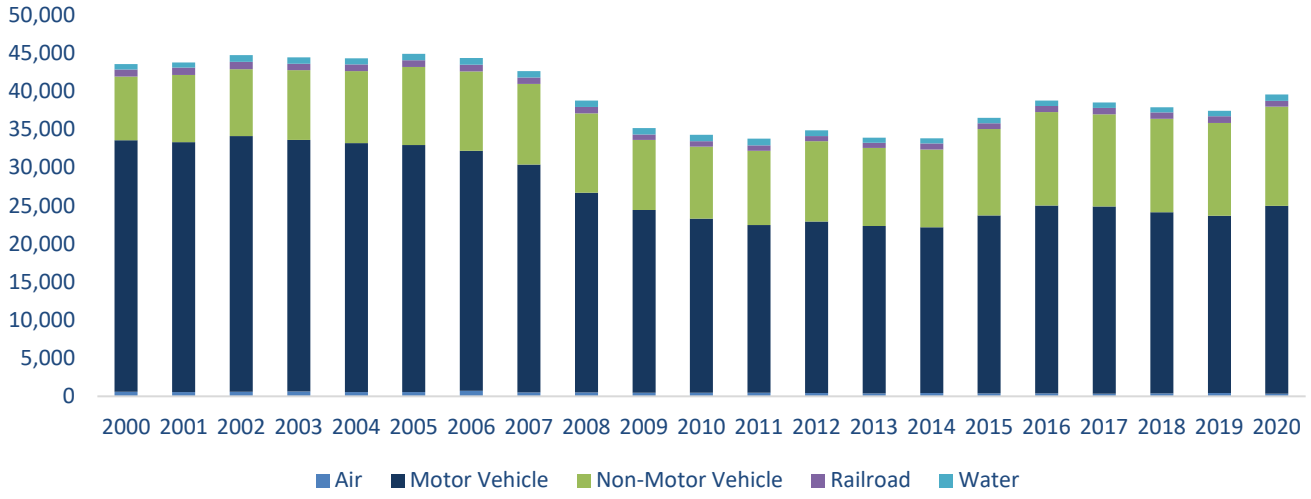
For much of the 20th century, deaths or serious injuries related to traffic crashes were seen as an unfortunate but unavoidable side effect of the automobile. A focus on safety has reduced deaths across most parts of the system from their peak in the 1970s. As seen in Figure 1, annual deaths have fallen by about 10,000 per year compared to 2000. A reduction in motor vehicle deaths was the largest contributor to this overall reduction. However, this same trend is also seen in trains, planes, and watercraft. Major railroad derailments and other accidents have declined sharply since the 1970s. During the same period, airplanes became safer, too, with major airline disasters eliminated and total accidents less than a quarter of their 1970s levels.

The decline in deaths and serious injuries resulted from many efforts, including policy changes, increased safety-based regulation, improved technology, and increased awareness of transportation safety. For example, the first federal seat belt law took effect in 1968 and required that seatbelts are installed in all cars.[3] It wasn't until 1986 that Minnesota passed a seat belt enforcement law that required the usage of seatbelts. Additionally, the Vision Zero movement, first organized in 1995, has spread across the nation to promote transportation safety and reduce deaths on U.S. roadways. Vision Zero contends that even a single roadway death is one too many. In Minnesota, Toward Zero Deaths, founded in 2003, is the state's cornerstone traffic safety program.

This paper looks at general transportation safety initiatives being implemented in Minnesota. It provides an overview of different types of transportation and safety trends. As long as there are transportation injuries and deaths, transportation safety has room for improvement.

[1] "New Release Estimates Show Traffic Fatalities Reached a 16-year High in 2021," National Highway Traffic Safety Administration, accessed June 16, 2022, https://www.nhtsa.gov/press-releases/early-estimate-2021-traffic-fatalities
[2] "Minnesota Traffic Fatalities," Minnesota Toward Zero Deaths, accessed June 16, 2022, https://www.minnesotatzd.org/
[3] James Kraus, "1968: U.S. Lawmakers Introduce Automotive Safety Standards," Auto Universum, August 24, 2020, https://autouniversum.wordpress.com/2018/01/03/1968-u-s-lawmakers-introduce-automotive-safety-standards/.

Figure 1. Total annual deaths for all modes of transportation in the United States from 2000 to 2020[4]



TRAFFIC SAFETY TRENDS

Safety has generally improved on the nation's roadways in the last 40 years, with fewer deaths and serious injuries annually. There is also evidence of slight increase of fatalities from 2015, as shown in Figure 2. However, motorcyclists, bicyclists, and pedestrians have not seen the same safety gains as motor vehicles. Nationally, more motorcyclists lost their lives on roadways in 2020 than did in 1980, and roughly the same number of bicyclists were killed in 2020 as in 1980. While pedestrian deaths have declined since 1980 by 19%,[5] this trend is also borne out in Minnesota, with motor vehicle deaths and pedestrian declining while bicycle remain relatively flat, and motorcycle slightly increasing.

Compared to the United States, transportation in Minnesota is safer. In 2019, Minnesota's fatality rate per 100,000 people was 6.45 compared to 11 for the nation, thus, representing 41.3% fewer deaths.[6] Rural roadways experienced the greatest reduction in deaths. Deaths per 100 million vehicle miles driven on rural roadways declined to 0.86 in 2019 compared to 1.17 in 2010, a 26.5% reduction.[7] Urban roadways fatality rates have stayed relatively steady over the same period at 0.42 in 2019 compared to 0.39 in 2010, an increase of 7.6%.[8] Similarly, Minnesota recorded a total of 394 deaths in 2020, which is about an 8.2% increase compared to 2019. In the same vein, deaths per 100 million vehicle miles driven in 2020 is 0.76 compared to the rate of 0.60 in 2019.[9]

[4] "Transportation Fatalities by Mode," Bureau of Transportation Statistics, April 14, 2019, https://www.bts.gov/content/transportation-fatalities-mode.
[5] "Traffic Safety Facts Annual Report Tables," National Highway Traffic Safety Administration, May 25, 2021, https://cdan.nhtsa.gov/tsftables/tsfar.htm.
[6] "Fatality Rates: Minnesota, U.S. and Best State," National Highway Traffic Safety Administration, accessed May 24, 2022, https://cdan.nhtsa.gov/SASStoredProcess/guest.
[7] "Traffic Safety Performance Measures for Minnesota," National Highway Traffic Safety Administration, accessed May 24, 2022, https://cdan.nhtsa.gov/SASStoredProcess/guest.
[8] Ibid.
[9] Overview of Motor Vehicle Crashes in 2020, accessed May 27, 2022, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813266

Unfortunately, 2021 continued the trend of increasing fatalities with a preliminary estimate of 488 people losing their lives on Minnesota roads.

Many factors contribute to the decline of motor vehicle occupants' deaths and the lack of change for other roadway users. Vehicle design is safer for vehicle occupants; laws now mandate seatbelt use for vehicle occupants and highway design considerations and improve safety outcomes. All of these ensure that crashes that could be fatal in the past now result in less severe crashes. Americans are also driving larger trucks and SUVs at a greater rate than ever before. The proliferation of large personal trucks and SUVs can pose an additional danger for those outside of the vehicles while protecting the user more than a passenger car.[10]

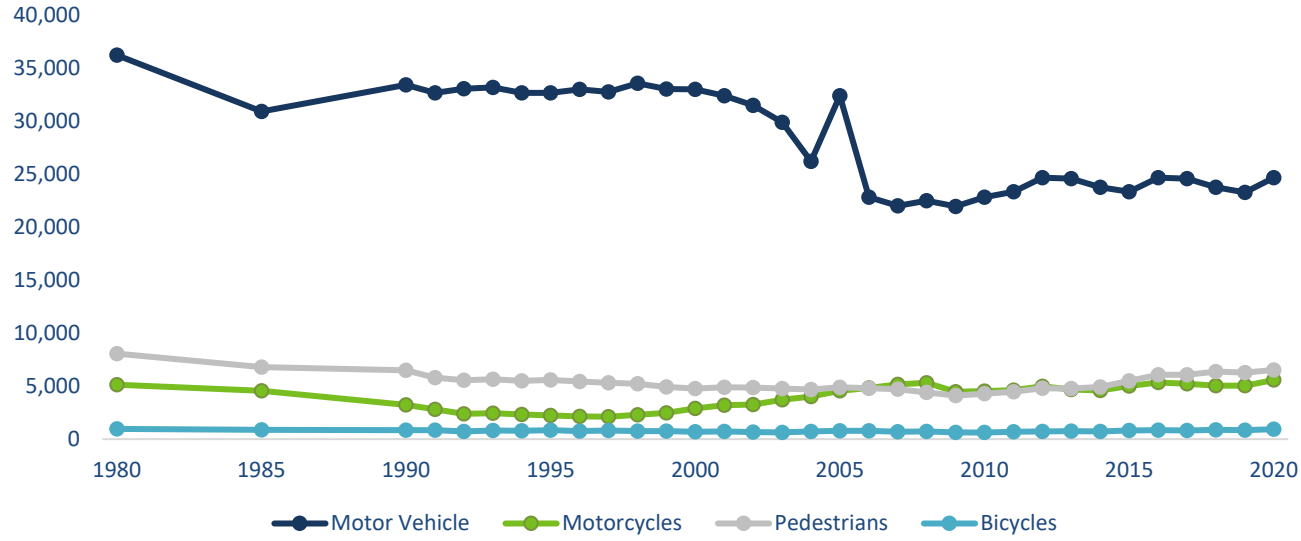
Connected and automated vehicles (CAV) also have the potential to make vehicles safer and reduce crashes in the future by automating safety features and minimizing human error. Today's new cars already have features like lane change warnings, lane departure warnings, emergency braking, and other detection technologies to augment a driver's ability.

It is important to note that many factors can be attributed to the rise in fatalities in 2020 and 2021 compared to previous years. They are noncompliance to the seat belt, alcohol, and high-speed driving.

Historically, pedestrian and bicycle safety has not received the same number of devoted resources as motorized vehicle safety. Therefore, more work needs to be done to protect the most vulnerable roadway users in this country, and more aggressive action must be taken if zero traffic death is ever to be achieved. In Minnesota, pedestrian and bicyclist deaths made up 16% of all traffic deaths in 2019 compared to just 11% of all deaths in 2015.[11] For more discussion on motorized traffic safety, see the Motorized Traffic Safety Trend Analysis, and for more discussion on non-motorized traffic safety, see the Non-Motorized Traffic Safety Trend Analysis.

[10] Samuel Monfort and Becky Mueller, "Pedestrian Injuries from Cars and SUVs," Insurance Institute for Highway Safety, May 2020, https://www.iihs.org/api/datastoredocument/bibliography/2203.
[11] "Minnesota Fatalities by Person Type," National Highway Traffic Safety Administration, accessed May 24, 2022, https://cdan.nhtsa.gov/SASStoredProcess/guest.

Figure 2. The national trend of traffic deaths separated by mode over 40 years, 1980 to 2020[12]



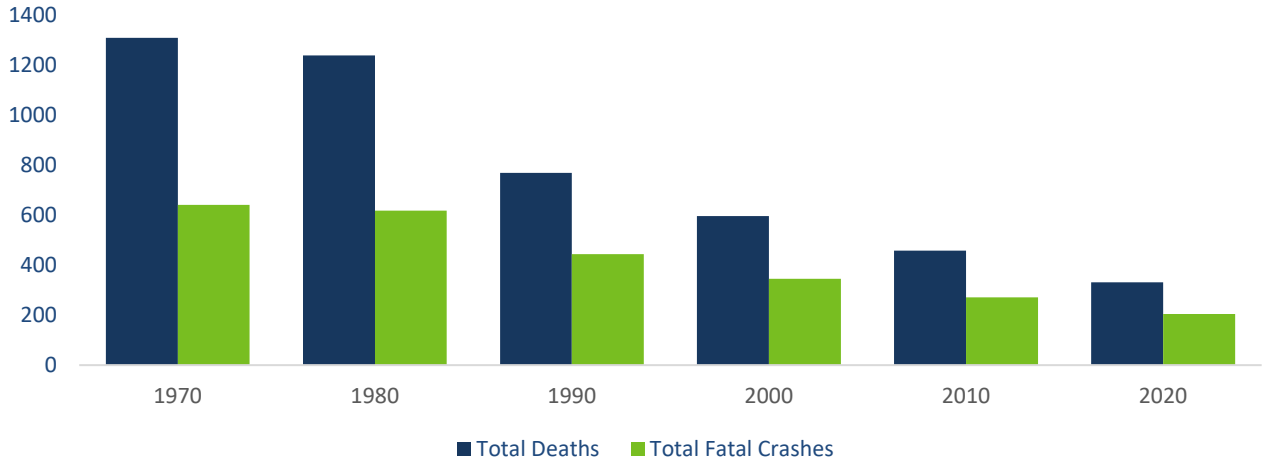
AIR SAFETY

While roadway safety remains the highest priority in transportation safety, air transportation safety is still a top consideration for policymakers and officials around the United States. Air travel is highly regulated and controlled by Federal Aviation Administration (FAA). The FAA regulates many aspects of air travel, from carry-on items passengers are allowed on planes, to airplane maintenance inspections and pilot training requirements. The barriers to access air travel are much higher and stricter than road travel. Air travel is the safest means of travel in the United States in large part due to these regulations. Figure 3 displays deaths and fatal crashes from air travel from 1970 to 2020 by decade. Deaths and fatal accidents in the air have declined significantly since 1970, while flight hours have remained consistent. Overall, deaths have fallen by 75% between 2020 and 1970. Today, flying on a commercial airline is the safest form of travel in the United States, with a fatality rate of just 0.07 per billion passenger miles.[13]

[12] "Traffic Safety Facts Annual Report Tables," National Highway Traffic Safety Administration, accessed May 24, 2022, https://cdan.nhtsa.gov/tsftables/tsfar.htm#.

[13] Ian Savage, "Comparing the Fatality Risks in United States Transportation Across Modes and Over Time," Research in Transportation Economics, vol. 43, 2013, pp. 9-22.

Figure 3. Annual fatal crashes and deaths in air travel in the United States, 1970 to 2020[14]



Due to the large-scale nature of any passenger airline crash and the events of September 11th, 2001 airline safety is highly prioritized. In 1997, the FAA created the Commercial Aviation Safety Team, which began taking a new approach to studying crash data to implement proactive mitigation strategies to prevent future incidents rather than simply reacting to them.[15] This new approach and other innovative safety strategies from the FAAs led to remarkable results. From 1998 to 2020, commercial aviation deaths have plummeted 95% when measured per 100 million passengers.[16] The vast majority of air travel deaths occur with small private planes operating out of small or private airports. Even with the recent issues with the Boeing 737MAX[17], the safety achievements of the aviation industry are a clear success. Private firms and public agencies have worked together to achieve a safety standard not seen in other industries or modes of travel.

RAIL SAFETY

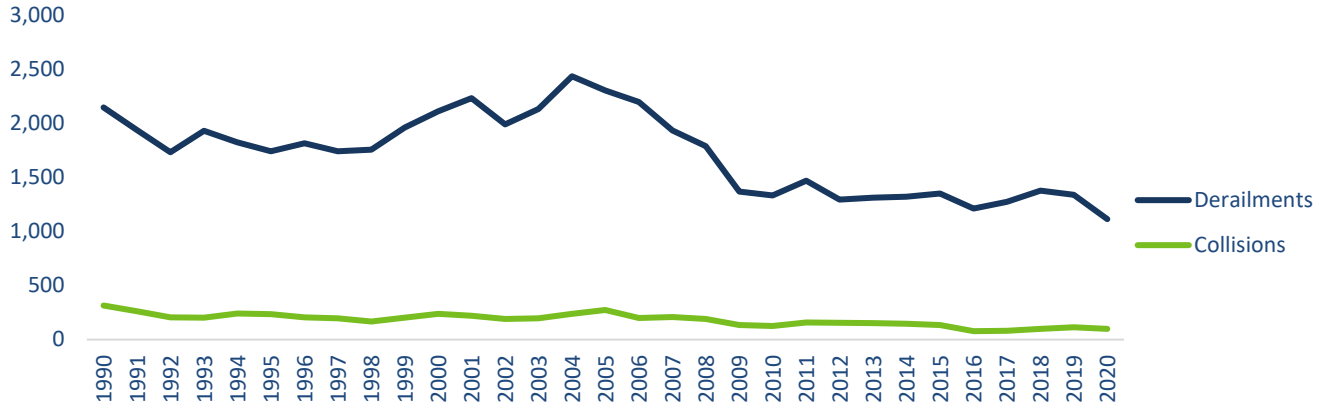
Rail safety includes trains, the materials carried on trains, and the points of conflict with other modes of travel like roadway-rail crossings. Rail safety is broadly defined because trains generally have primacy in the ground transportation network, and any collision between a train and another vehicle will cause far more damage to the other vehicle than the train. Railroad safety has improved in recent decades, like nearly every form of transportation in the United States. Like air travel, passenger travel on rail is extremely safe, with 0.43 deaths per billion passenger miles.[18] Only 391 train passengers have died since 1990, with 30% occurring in two large crashes. One is the Big Bayou Canot rail incident in 1993. The crash resulted in 47 passenger deaths when a barge

[14] "U.S. General Aviation Safety Data," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/us-general-aviationa-safety-data.
[15] "Fact Sheet – Out Front on Airline Safety: Two Decades of Continuous Evolution," Federal Aviation Administration, August 2, 2018, https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=22975.
[16] Ibid.
[17] Kent German, "2 Years after Being Grounded, the Boeing 737 Max Is Flying Again," CNET, April 12, 2021, https://www.cnet.com/news/boeing-737-max-8-all-about-the-aircraft-flight-ban-and-investigations/.
[18] Ian Savage, "Comparing the Fatality Risks in United States Transportation Across Modes and Over Time," Research in Transportation Economics, vol. 43, 2013, pp. 9-22.

struck a rail bridge over a river. The second major crash was the Chatsworth train collision in 2008, which killed 24 passengers when a Los Angeles Metrolink commuter train collided with a freight train.[19]

Since passenger deaths on trains occur infrequently, trends cannot be discerned from annual figures like roadway users. However, since train passengers are most likely to be killed or injured during a derailment, derailments can be used as a proxy for passenger safety. Derailments have declined by 48% since 1990, while train collisions have decreased by 69%, as shown in Figure 4. The general decline in derailments will likely continue as automation, and central control of both passenger and freight rail networks continues. Technology like positive train control allows for speed and stopping control of locomotives from central facilities and decreases the likelihood of derailment or collisions. As of 2020, all Class 1 rail lines, Amtrak passenger lines, and 76% of commuter rail lines have PTC governing rail operations.[20]

Figure 4. Train derailments and collisions in the United States from 1990 to 2020[21]



Most deaths and injuries on railroads occur during collisions with a motor vehicle or pedestrian, most often at roadway-rail crossings. As seen in Figure 5, types of collisions are trending down over the previous three decades, reaching their lowest point in 2012.

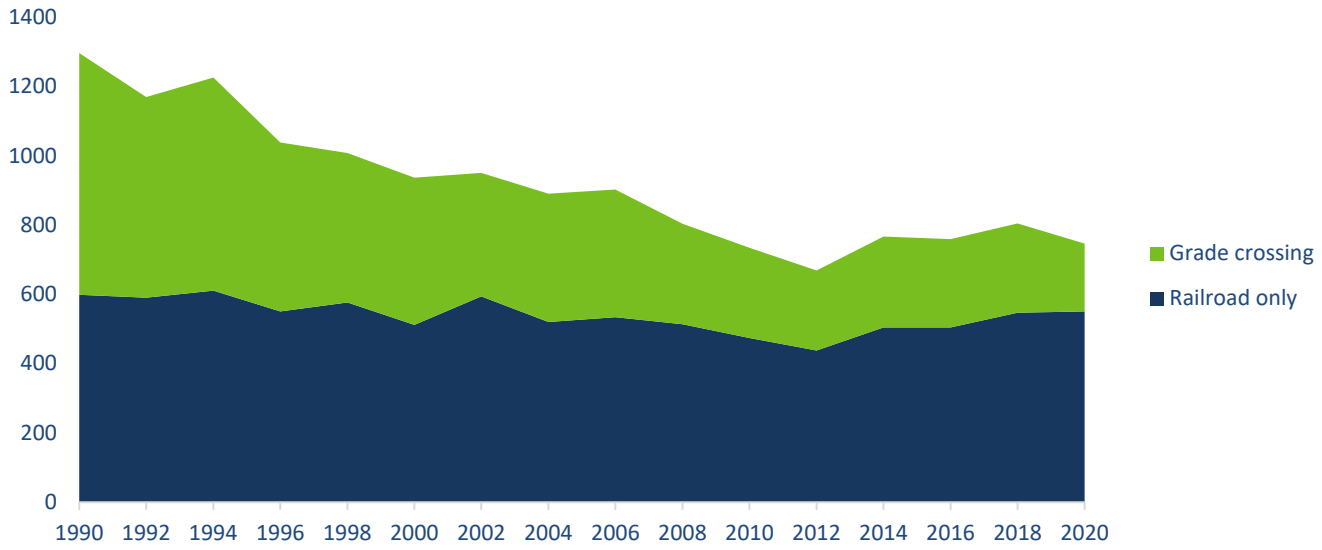
In 2020, Minnesota saw only four deaths on rail lines, all of the deaths occurring at rail crossings.[22] This is down from 27 in 1990, showing that Minnesota has been able to avoid a resurgence in deaths found in the national statistics.[23] Minnesota's continued decline is partly attributable to the decreased number of at-grade rail crossings in the state, reduced by over 50% from historical levels through roadway improvement projects.

[19] "Railroad and Grade-Crossing Fatalities by Victim Class," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/railroad-and-grade-crossing-fatalities-victim-class.
[20] "Positive Train Control," Federal Railroad Administration, accessed May 24, 2022, https://railroads.dot.gov/train-control/ptc/positive-train-control-ptc.
[21] "Train Fatalities, Injuries, and Accidents by Type of Accident," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/train-fatalities-injuries-and-accidents-type-accidenta.
[22] "Rail Transportation Safety," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/browse-statistical-products-and-data/state-transportation-statistics/transportation-safety.
[23] "Railroad and Grade-Crossing Fatalities by Victim Class," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/railroad-and-grade-crossing-fatalities-victim-class.

Another factor is increased safety features at rail crossings, including crossing gates and improved warning systems.[24]

National rail deaths may be increasing due to the growth in light rail track mileage added in the last decade. Since crossing deaths began rising in the last decade, heavy rail (commuter rail and freight rail) mileage has changed little, increasing by only 4% and 3%, respectively. However, light rail track mileage has increased by 29%, from 1497 miles to 2,096.[25] Light rail generally runs at-grade in dense urban areas and features many at-grade crossings, unlike heavy rail systems. Light rail has a fatality rate more than twice as high as heavy rail, and light rail-related deaths in 2019 have risen by 59% compared to 2010.[26] [27] [28] Minnesota features two light rail lines in the seven-county metro area that operate over 23 rail miles. As light rail systems continue to grow in Minnesota and nationally, improved safety measures are needed to reverse the increasing trend of deaths on the nation's rail lines.

Figure 5. Railroad and crossing deaths in the United States by year from 1990 to 2020[29]



WATER SAFETY

Transportation on the nation's lakes, rivers, and seas remains a popular means of recreation, commerce, and commuting where available. In 2018, 633 Americans lost their lives on the water, with 13 of those deaths in

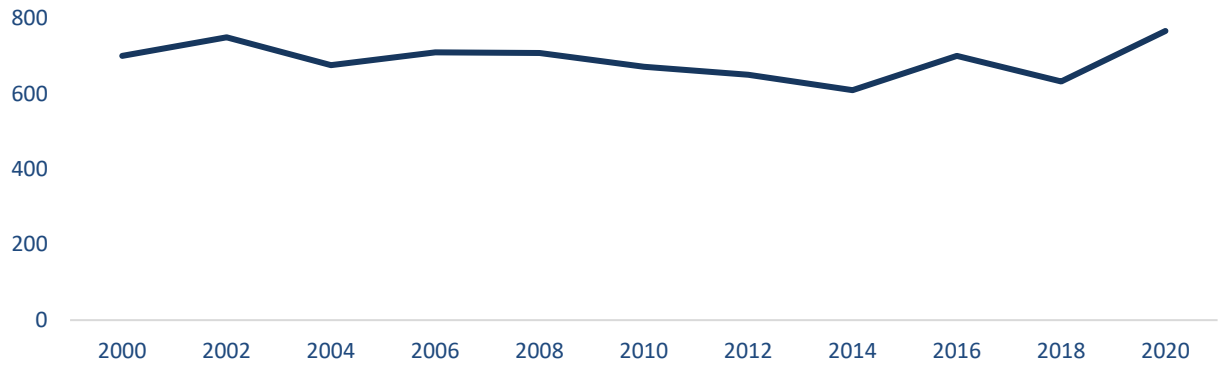
[24] "Crossing Inventory," Federal Railroad Administration, accessed May 24, 2022, https://railroads.dot.gov/crossing-and-inventory-data/grade-crossing-inventory/crossing-inventory.
[25] "System Mileage Within the United States," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/system-mileage-within-united-states.
[26] Transit and Grade-Crossing Fatalities by Rail Transit Mode, accessed May 24, 2022, Transit and Grade-Crossing Fatalities by Rail Transit Mode | Bureau of Transportation Statistics (bts.gov)
[27] "Rail Safety Statistics Report," (Federal Transit Administration, 2016).
[28] "System Mileage Within the United States," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/system-mileage-within-united-states.
[29] "Railroad and Grade-Crossing Fatalities by Victim Class," Bureau of Transportation Statistics, accessed May 24, 2022, https://www.bts.gov/content/railroad-and-grade-crossing-fatalities-victim-class.

Minnesota.[30] Annual deaths on the water have increased slightly from 701 in 2000 to 767 in 2020, an increase of 9.4%, as shown in Figure 6. Like other modes, the number of deaths is much smaller than in the 1970s, when annual deaths averaged more than 1,000.[31] Unlike other modes, most deaths from boating accidents do not occur from the collision or crash itself. The United States Coast Guard estimates that 70% of all boating-related deaths happen not from the crash itself but from drowning. Of those who drowned, 85% were not wearing a personal floatation device.[32]

The state of Minnesota only requires children under ten to actively wear a personal floatation device while on a boat. Persons over the age of ten are only required to have a floatation device located on the boat.[33] Minnesota's requirements are the same as those found in nearly all other states and territories in the United States. Only American Samoa, where all occupants are always required to wear flotation devices, and New York, where all occupants are required to wear flotation devices during winter months, have stricter policies.

These lax policies and limited enforcement in most states have led to low compliance with floatation device requirements. Recent observational studies have shown that compliance is low even for those required to wear personal flotation devices. A study from California found that compliance rates for children were only 30%.[34] Other places have made personal flotation devices compulsory for all watercraft occupants and have seen a dramatic increase in usage. In Victoria, Australia, personal flotation devices were mandated for all occupants of small, hulled crafts in 2005. In just two years, the personal flotation device compliance rate increased from 22% to 63%.[35] The most commonsense safety measures are not being instituted in the United States, and until these measures are instituted, water deaths will likely remain a persistent issue.

Figure 6. National recreational boating deaths from 2000 to 2020[36]



[30] "2018 Recreational Boating Statistics," U.S. Department of Homeland Security, accessed May 24, 2022, https://www.uscgboating.org/library/accident-statistics/Recreational-Boating-Statistics-2018.pdf.
[31] Bruce Lawrence and Ted Miller, "Recent Research on Recreational Boating Accidents and the Contribution of Boating Under the Influence," (Pacific Institute for Research & Evaluation, 2016).
[32] Ibid.
[33] "Child Life Jacket Wear Law," Minnesota Department of Natural Resources, accessed May 24, 2022, https://www.dnr.state.mn.us/safety/boatwater/pfd_childlaw.html.
[34] Garen Wintemute et al., "Compliance with an Ordinance Requiring the Use of Personal Flotation Devices by Children in Public Waterways," *Western Journal of Emergency Medicine* 14, no. 2 (January 2013): pp. 200-203, https://doi.org/10.5811/westjem.2012.1.11717.
[35] Erin Cassell and Stuart Newstead, "Did Compulsory Wear Regulations Increase Personal Flotation Device (PFD) Use by Boaters in Small Power Recreational Vessels? A before-after Observational Study Conducted in Victoria, Australia," *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention* 21, no. 1 (February 2014): pp. 15-22, https://doi.org/10.1136/injuryprev-2014-041170.
[36] US Coast Guard.

RELATED TRENDS

- Connected and Automated Vehicles
- Motorized Transportation Safety
- Non-motorized Transportation Safety
- Public Transportation
- Transportation Behavior

Minnesota's vision for transportation is known as Minnesota GO. The aim is that the multimodal transportation system maximizes people's health, the environment, and our economy. A transportation vision for generations, Minnesota GO, guides a comprehensive planning effort for all people using the transportation system and all travel modes. Learn more at MinnesotaGO.org.

REVISION HISTORY

Date	Summary of revisions
June 2022	Original paper.