

**NATIONAL TRANSPORTATION SAFETY BOARD**  
**Public Meeting of November 5, 2019**  
**(Information subject to editing)**

**Bicyclist Safety on US Roadways: Crash Risks and Countermeasures**  
**DCA18SS002**

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

## **Executive Summary**

### **Safety Research Topic**

It has been 47 years since the National Transportation Safety Board (NTSB) analyzed bicyclist safety in the United States (NTSB 1972). Recently, several safety issues involving bicyclists and other vulnerable road users have emerged in NTSB reports (NTSB 2013a, 2017a, 2017b, 2018a, 2018b). In 2017 alone, 806 bicyclists died in crashes with motor vehicles on US roadways, which was comparable to the deaths resulting from railroad or marine accidents and more than twice the number of deaths resulting from aviation accidents in the same year (NCSA 2019; NTSB 2017c).<sup>1</sup> The increasing availability of bicycles, their growing use as a means of transportation, and the resulting trends and safety issues require attention. This NTSB safety research report updates our understanding of bicyclist safety in the United States by examining the prevalence and risk factors of bicycle crashes involving motor vehicles on US roadways and assessing the most applicable countermeasures.<sup>2</sup>

Bicyclists, like pedestrians and motorcyclists, are considered vulnerable road users because they are unprotected by an enclosed vehicle compartment, leaving them more vulnerable to injury or death in the event of a crash. In 2018, the NTSB issued reports addressing pedestrian and motorcyclist safety, and with this safety research report on bicyclist safety, the NTSB again expands its effort to increase awareness of and address safety issues affecting vulnerable road users (NTSB 2018a, 2018b). To conduct this research, the NTSB used the following combination of quantitative and qualitative methods: reviewing countermeasures and research literature; analyzing crash and injury data; and interviewing national, state, and local traffic safety stakeholders. The research goals were to (1) describe fatal and nonfatal injury trends associated with bicycle crashes involving motor vehicles, (2) examine the scope and nature of bicyclist crash and injury risk factors and assess data limitations, (3) identify proven countermeasures that may

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<sup>1</sup> In 2017, 761 people died as a result of railroad accidents, 694 people died as a result of marine accidents, and 350 people died as a result of aviation accidents.

<sup>2</sup> Additional information about this safety research can be found in the NTSB [Docket Management System](#), using the NTSB ID DCA18SS002. For more information about NTSB safety recommendations, see the [Safety Recommendation Database](#) at [www.nts.gov](http://www.nts.gov).

be underused, (4) assess obstacles that may interfere with the full use of the identified countermeasures, and (5) explore emerging issues that are relevant to bicycling safety.

Bicyclists involved in crashes with motor vehicles are more likely to sustain severe injuries than bicyclists involved in any other crash type. As a result, this research focuses on bicycle crashes involving motor vehicles and specifically examines existing and emerging countermeasures designed to improve bicyclist safety on public roads, such as roadway and infrastructure designs to separate bicycles from motor vehicle traffic; rider and bicycle conspicuity enhancements; vehicle technologies designed to reduce collisions between motorists and bicyclists when they are sharing the road; and protective equipment for reducing the severity of injuries to bicyclists involved in crashes with motor vehicles. Single-bicycle crashes and bicycle collisions with pedestrians are not addressed; however, many of the safety countermeasures examined have the potential to prevent other bicycle crash types or reduce injury severity.

## Safety Issues

The safety issues identified in this report include the following:

- **Improving roadway infrastructure for bicyclists.** Although more bicycle crashes involving motor vehicles occur at intersections, crash severity is higher when a crash occurs at a midblock location. The travel speeds of motor vehicles at midblock locations tend to be higher compared to intersections where there may be traffic lights, stop signs, or turning vehicles. Improving public roadway infrastructure with separated bike lanes, intersection treatments, and road diets can reduce crashes at midblock and intersection locations by separating bicycle and motor vehicle traffic, and by lowering motor vehicle travel speeds in areas where traffic speed and volume are high.<sup>3</sup>
- **Enhancing conspicuity.** There are different reasons why motorists and bicyclists may not detect each other in time to prevent a collision. In about one third of cases in which bicyclists died in crashes involving a motor vehicle overtaking a bicycle, the motorist reported not detecting the bicyclist before the crash. Improving the ability to see other road users can reduce the likelihood of collisions when motorists and bicyclists are sharing public roadways. Bicyclists wearing bright or reflective clothing, bicycles with lights or reflective materials, enhanced motor vehicle headlights, and in-vehicle crash warning and prevention systems are all countermeasures that could potentially alert motorists to bicycle traffic and help them avoid collisions with bicyclists.

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<sup>3</sup> According to the FHWA, a *road diet* repositions pavement markings to better meet the needs of all road users. Examples of road diets include reducing the number of through lanes, a wider shoulder, a two-way left turn lane, and providing a dedicated space for bicycle facilities (FHWA 2014).

- **Mitigating head injury.** Head injury is the leading cause of bicycle-related deaths, and head injuries are prevalent in bicycle crashes with motor vehicles. A bicycle helmet is an effective way to mitigate head injury when a bicycle crash occurs. However, the underutilization of helmets continues to contribute to the incidence of deaths and serious injuries among crash-involved bicyclists. A comprehensive national strategy to increase helmet use among riders of all ages is needed. The strategy should focus on evidence-based approaches for state and local governments to increase helmet use among all bicyclists, such as a helmet requirement for bicyclists of all ages; helmet distribution programs; and effective educational campaigns.

## Findings

1. Current available data likely underestimate the level of bicycling activity in the United States.
2. Combining traditional and innovative data collection approaches could improve measures of bicycling activity.
3. Police crash report data likely underestimate the scope of bicyclist nonfatal injuries.
4. Bicycle crashes involving motor vehicles at midblock locations are more likely to result in fatal and serious injuries for the bicyclists.
5. Separated bike lanes could prevent bicycle crashes involving motor vehicles at midblock locations and, thereby, also reduce the number of fatalities and serious injuries associated with such crashes.
6. Combining proven countermeasures to improve bicyclist safety at intersection and midblock locations can create a network of safer roadways for bicyclists.
7. Consolidating guidance concerning separated bike lanes, intersection treatments, and the transition between them may increase the implementation of separated bike lanes by transportation planning and engineering practitioners.
8. Reducing traffic speeds can improve bicycle safety by reducing the likelihood of fatal or serious injury in the event of a crash.
9. The road diet is a proven safety countermeasure that both reduces traffic speeds and provides space on the roadway for the implementation of bicycle facilities, such as separated bike lanes.
10. Including separated bike lanes and intersection safety treatments in the Federal Highway Administration's Proven Safety Countermeasures initiative and Every Day Counts program could help accelerate their adoption and improve bicyclist safety.
11. Improving bicycle conspicuity may reduce the likelihood of collisions between bicycles and motor vehicles.

12. The existing requirements for bicycle conspicuity, established in 1980, are outdated and do not adequately reflect modern advances in bicycle conspicuity materials and technologies.
13. Revising Federal Motor Vehicle Safety Standard 108 to allow adaptive headlight systems and to require evaluating headlights in real-world settings rather than in a laboratory would likely result in headlights that improve drivers' ability to detect other road users, including bicyclists.
14. Collision avoidance system technologies could be modified to detect bicycles, which would likely reduce the incidence of collisions between motor vehicles and bicycles and mitigate injuries caused by collisions when they occur.
15. The National Highway Traffic Safety Administration's delays in updating the New Car Assessment Program have likely slowed the development of important safety systems for vulnerable road users and their implementation into the vehicle fleet.
16. The US Department of Transportation's slow progress in developing standards for connected vehicle technology has delayed the implementation of potentially lifesaving technology.
17. The larger blind spots of large vehicles make it more difficult for their drivers to detect vulnerable road users.
18. There continues to be a need for performance standards to ensure blind spot detection systems are capable of detecting vulnerable road users, including bicyclists.
19. Head injury is the leading cause of bicycle-related deaths, and bicyclists involved in crashes with motor vehicles sustain a higher proportion of head injuries.
20. Bicycle helmets provide effective protection and mitigate head injuries in the event of a crash.
21. The underutilization of bicycle helmets has contributed to the incidence of deaths and serious injuries among crash-involved bicyclists.
22. Requiring helmet use is the most effective means for increasing helmet use and reducing bicyclist head injuries.
23. A comprehensive strategy that includes both helmet legislation and complementary nonlegislative interventions is most likely to increase overall helmet use among bicyclists of all ages.

## Recommendations

### New Recommendations

#### **To the Intelligent Transportation Systems Joint Program Office**

1. In collaboration with the National Highway Traffic Safety Administration and the Federal Highway Administration, expand vehicle-to-pedestrian research efforts to ensure that bicyclists and other vulnerable road users will be incorporated into the safe deployment of connected vehicle systems.

#### **To the National Highway Traffic Safety Administration**

2. Incorporate into the New Car Assessment Program tests to evaluate a car's ability to avoid crashes with bicycles.
3. In collaboration with the Intelligent Transportation Systems Joint Program Office and the Federal Highway Administration, expand vehicle-to-pedestrian research efforts to ensure that bicyclists and other vulnerable road users will be incorporated into the safe deployment of connected vehicle systems.
4. (1) Convene a bicycle safety coalition of stakeholders to develop a comprehensive national strategy to increase bicycle helmet use among bicyclists of all ages that would include, at a minimum, a model all-ages bicycle helmet law; (2) disseminate the strategy to all states and make it available on your website.
5. After Safety Recommendation 4 is completed, include the model all-ages bicycle helmet law in *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices*.

#### **To the Federal Highway Administration**

6. (1) Develop methods to combine traditional and innovative bicycle-counting approaches that capture bicycling activity data generated by bicyclists and bikeshare operations; (2) disseminate the methods to state transportation departments.
7. Include separated bike lanes and intersection safety treatments on the list of Proven Safety Countermeasures.
8. Include separated bike lanes and intersection safety treatments in the Every Day Counts program.

9. In collaboration with the Intelligent Transportation Systems Joint Program Office and the National Highway Traffic Safety Administration, expand vehicle-to-pedestrian research efforts to ensure that bicyclists and other vulnerable road users will be incorporated into the safe deployment of connected vehicle systems.

**To the US Consumer Product Safety Commission**

10. Conduct an evaluation to determine whether bicycle conspicuity could be improved by modifying the requirements described in Title 16 *Code of Federal Regulations* 1512.16; if so, revise the regulation accordingly.

**To the 50 states, the District of Columbia, and the Commonwealth of Puerto Rico:**

11. Require that all persons shall wear an age appropriate bicycle helmet while riding a bicycle.

**To the American Association of State Highway and Transportation Officials**

12. Include geometric design guidance materials on separated bike lanes, intersection treatments, and the transition between them in the next revision of the *Guide for the Development of Bicycle Facilities*.

**Previously Issued Recommendations Reiterated in This Report**

**To the National Highway Traffic Safety Administration**

H-13-11

Develop performance standards for visibility enhancement systems to compensate for blind spots in order to improve the ability of drivers of single-unit trucks with gross vehicle weight ratings over 10,000 pounds to detect vulnerable road users, including pedestrians and cyclists, in their travel paths.

H-13-12

Once the performance standards requested in H-13-11 have been developed, require newly manufactured single-unit trucks with gross vehicle weight ratings over 10,000 pounds to be equipped with visibility enhancement systems meeting the performance standards.

H-13-30

Develop minimum performance standards for connected vehicle technology for all highway vehicles.

#### H-13-31

Once minimum performance standards for connected vehicle technology are developed, require this technology to be installed on all newly manufactured highway vehicles.

#### H-14-1

Require that newly manufactured truck-tractors with gross vehicle weight ratings over 26,000 pounds be equipped with visibility enhancement systems to improve the ability of drivers of tractor-trailers to detect passenger vehicles and vulnerable road users, including pedestrians, cyclists, and motorcyclists.

#### H-15-6

Expand the New Car Assessment Program 5-star rating system to include a scale that rates the performance of forward collision avoidance systems.

#### H-15-7

Once the rating scale, described in Safety Recommendation H-15-6, is established, include the ratings of forward collision avoidance systems on the vehicle Monroney labels.

#### H-18-39

Revise Federal Motor Vehicle Safety Standard 108 to include performance-based standards for vehicle headlight systems correctly aimed on the road and tested on-vehicle to account for headlight height and lighting performance.

#### H-18-40

Revise Federal Motor Vehicle Safety Standard 108 to allow adaptive headlight systems.

#### H-18-43

Incorporate pedestrian safety systems, including pedestrian collision avoidance systems and other more-passive safety systems, into the New Car Assessment Program.

## References

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