



San Francisco Severe Traffic Injury Trends: 2011-2018

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Executive Summary

Vision Zero is San Francisco’s initiative to eliminate traffic fatalities and reduce severe traffic-related injury on San Francisco’s streets. The Department of Public Health’s Vision Zero team monitors severe injuries utilizing trauma registry data from Zuckerberg San Francisco General Hospital – our City’s Level I Trauma Center where the most severely injured patients are seen and treated, and where injury severity is clinically assessed by medical professionals. We track both **severe injuries** as well as **critical injuries** - a subset of patients that are the most severely injured. This is our best and most reliable data source for detecting severe injuries in our transportation system. We supplement this data with SF police data collected from police traffic collision reports (see Appendix A), which has been historically the primary data source for severe injury in San Francisco. The eight years of data presented in this report inform City and community understanding of those most severely injured on streets in San Francisco – and how that picture is shifting over time, including since the adoption of Vision Zero in 2014. Vision Zero SF monitors and reports fatality data, which is more readily available, separately and on a monthly basis.¹ This severe injury data helps us to further assess Vision Zero progress, and guide injury prevention initiatives.

Next steps include updating the existing 2013-2015 Transportation-related Injury Surveillance System linkage of police and hospital data to include data through 2018. This six-year dataset will enable more in depth analyses of location, crash characteristics, socio-demographic information and travel mode.

MONITORING SEVERE INJURIES IN OUR TRANSPORTATION SYSTEM USING ZUCKERBERG SF GENERAL HOSPITAL AND TRAUMA CENTER (ZSFG) DATA

WHO IS TREATED FOR SEVERE INJURY AT ZSFG?

- People walking comprise approximately one-third of severe and 30-40% of critical injuries in recent years (2015-2018, tables 1-2).
- Motor vehicle injury makes up 27% of severe injuries and 18% of critical injuries in 2018. The proportion of injuries to people in motor vehicles treated at ZSFG fell in 2018 after rising in 2017, returning to a proportion consistent with previous years. (See fig. 4, tables 1-2).
- People biking have comprised approximately 20% of severe and critical injuries in recent years (2015-2018). (See fig. 3, tables 1-2).
- People on motorcycles represent an increased proportion of both severe and critical injuries in 2018: 22% in both categories. (See fig. 5, tables 1-2).
- People biking and motorcycling have a notably higher burden of injury relative to the proportion of trips they represent on SF streets.

¹ Available at: <https://sfgov.maps.arcgis.com/apps/MapTools/index.html?appid=38d13e08cd74492ea674cdf27343370a>



WHAT ARE TRENDS IN ZSFG SEVERE AND CRITICAL INJURY BY TRAVEL MODE?

OVERALL (See Fig. 1, Page 5)

- **Severe injuries:** Overall **severe injuries** increased in hospital data in 2015 and thereon have been relatively stable. Notably, implementation of Emergency Medical Services Agency triage guidelines led to more patients with severe injury being sent to ZSFG and contributed to the increase in 2015 that has since remained steady.
- **Critical injuries:** ZSFG counts of critically (the most severely) injured patients during 2015-2018 were relatively stable.

PEOPLE WALKING (See Fig. 2, Page 6)

- **Severe injuries** have remained relatively steady since 2015.
- **Critical injuries** rose to pre-2014 levels in 2018, halting a four-year trend of reduced or stable numbers.
 - Within the pedestrian category, injuries associated with **e-scooters** were tracked for the first time in 2018. Seven severe injuries were associated with the devices, of which two injuries were critical.

PEOPLE ON BIKES (See Fig. 3, Page 7)

- Both **severe and critical injuries** to SF cyclists have been relatively steady 2014-2018.

PEOPLE IN MOTOR VEHICLES (See Fig. 4, Page 8)

- **Severe injuries** to people in motor vehicles declined 15% in 2018, partially countering a 2017 increase.
- **Critical injuries** to people in motor vehicles decreased 30% between 2017 and 2018, but remain higher than recent lows. Notably, hospital data includes people injured on freeways.

PEOPLE ON MOTORCYCLES (See Fig. 5, Page 8)

- **Severe injuries** to people riding motorcycles increased 31% from 2017 to 2018.
- **Critical injuries** to people riding motorcycles increased relative to 2017, though remain within the range of 18-28 annual critical injuries seen since 2013.

Detailed Findings: 2011-2018 Severe Traffic Injury Trends

Methodology

We rely on data from Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG)'s trauma registry to monitor severe injury trends for Vision Zero. Strengths of this data system include clinical assessment of injury severity, and that ZSFG is the City's only Level I Trauma Center, where the most severe injuries in the city are treated. SFPD data was historically the only data source used to track severe injury, and is summarized in Appendix A for comparison.

We categorize injury severity in hospital data using a clinical injury severity scale (ISS) ranging from 1-75, as well as whether someone required hospital admission for treatment. This analysis presents

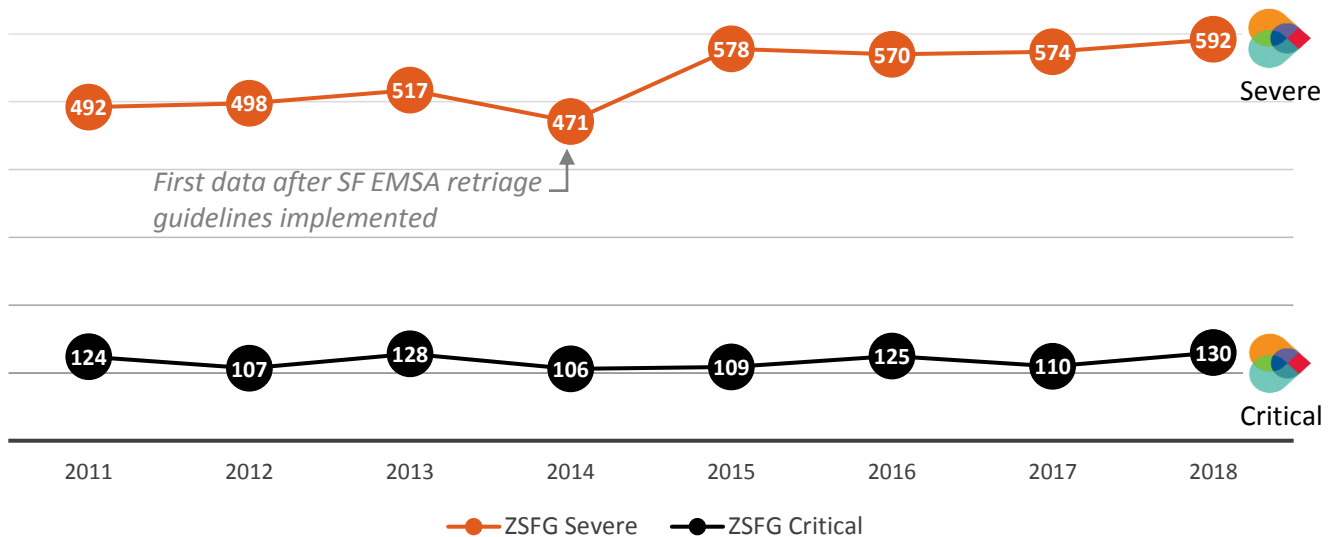


severe injuries from hospital data coded as *critical* (ISS greater than 15) and/or *severe* (all traffic injuries resulting in hospital admission).² For hospital data, critical injury is included in severe injury counts and statistics.

Interpretation Notes

At the end of 2013, the **San Francisco Emergency Medical Services Agency (SF EMSA)** issued **retriage guidelines** to ensure the most severely injured people were treated at ZSFG, even if they initially reported to another hospital. People with severe injury receive the highest level of medical care when treated in a trauma center. Recognizing this, the protocol change in the SF EMSA retriage guidelines facilitates the rapid transfer of severely injured trauma patients from non-trauma hospitals to the trauma center with unconditional acceptance. This change helps increase our inclusion of the most severely injured in the ZSFG hospital data – and also likely contributed to the increased but stable number of severe injuries observed from 2015 forward, relative to earlier years (fig. 1). Additionally, a shift to the new International Classification of Diseases medical coding system (ICD-10) beginning with 2017 data affects the categorization of traffic modes, but is not anticipated to have substantially changed number of patients attributed to each mode. Please note – hospital data includes people injured on SF freeways, making it distinct from VZSF fatality data which exclude people killed in freeway crashes (in addition to other factors, summarized in footnote 2).

Figure 1: Total Traffic Injury Counts by Year



Overall injury trends reflect relatively stable counts of both severely and critically injured patients in recent years. However, this consistency is not true of each individual travel mode, as explored in figures 2-5.

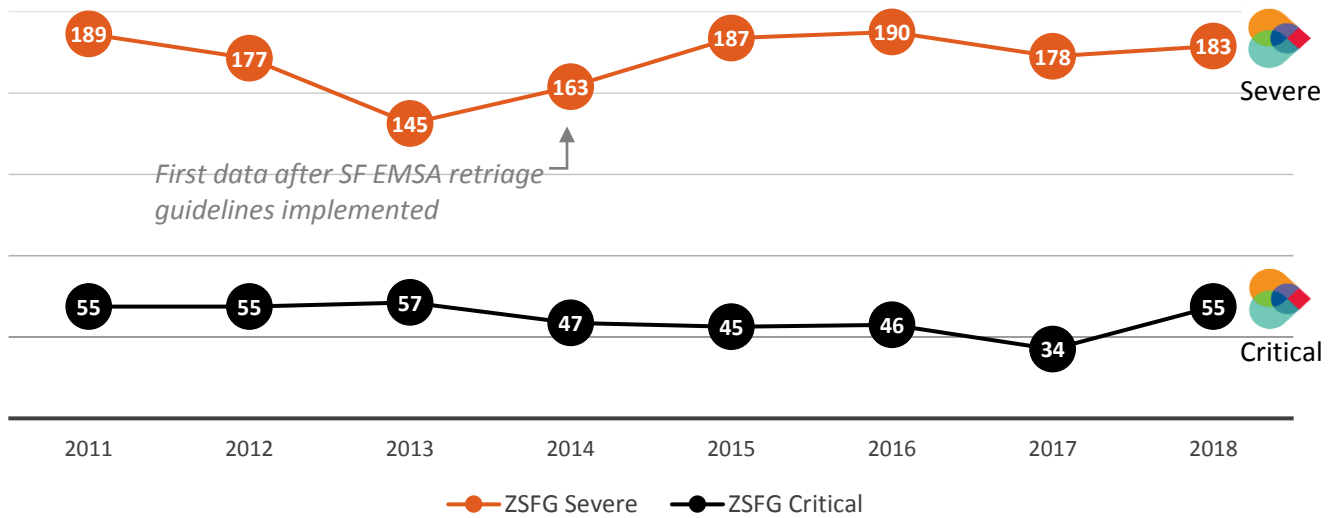
² Note: Severe injury reporting excludes deaths that occur within 30 days of injury which are tracked separately for Vision Zero fatality monitoring. Distinct from fatality monitoring for Vision Zero SF, severe hospital injuries in this analysis *include* those sustained on freeways, not-at-grade MUNI, BART and Caltrain infrastructure and in the Presidio. Fatality data do not. Protocol available at: https://www.sfdph.org/dph/files/EHSdocs/PHES/VisionZero/Vision_Zero_Traffic_Fatality_Protocol.pdf



Note: ZSFG severe injury numbers *include* ZSFG critical injury counts.

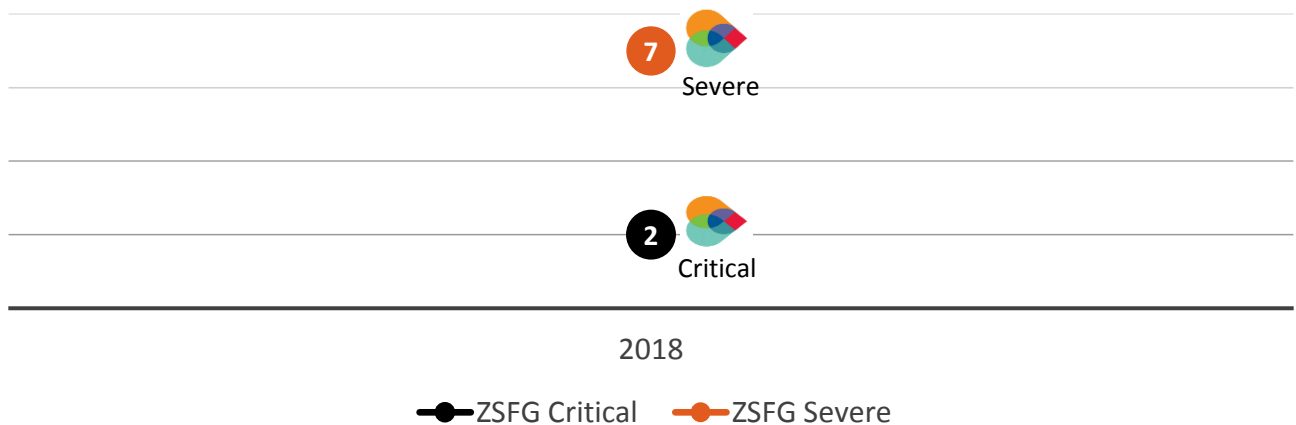
Severe Injury by Mode of Travel

Figure 2: Pedestrian Traffic Injury Counts by Year



Pedestrian injury is the most common severe traffic injury reported by ZSFG. Notably, the annual count of critical pedestrian injuries rose to pre-2014 levels in 2018, halting a trend of reduced or stable numbers.

Figure 2A: e-Scooter Traffic Injury



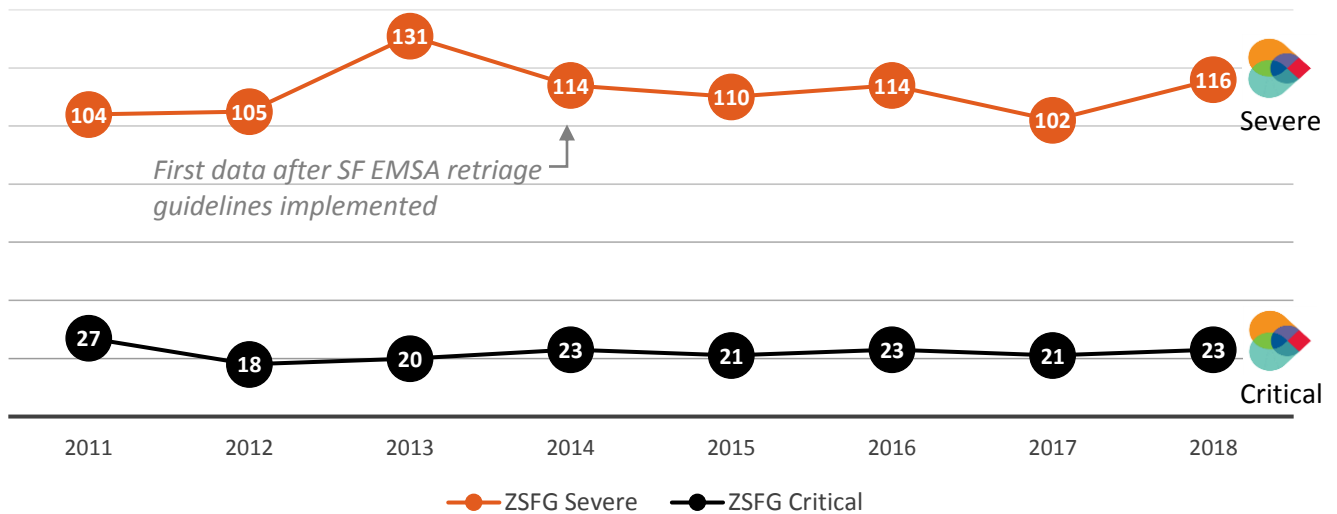
2018 is the first year in which ZSFG tracked injuries associated with use of standing electric scooters, following a proliferation of such devices available for rent on San Francisco streets and generally increased popularity of the devices beginning in April 2018.



Finalized 2018 hospital data show 7 severe (requiring hospital admission) e-scooter related injuries, and of these two were critical injuries. E-scooter injuries are presently included within the pedestrian category of injury surveillance, whether the injured party was a person on foot or an e-scooter rider.

A detailed analysis of preliminary data from e-scooter companies, police reports and ZSFG tracking is available.³ Analysis of other micromobility modes, mopeds and e-bicycles in ZSFG and SFPD data is forthcoming, informed by a recently-implemented methodology.⁴

Figure 3: Bicycle Traffic Injury Counts by Year



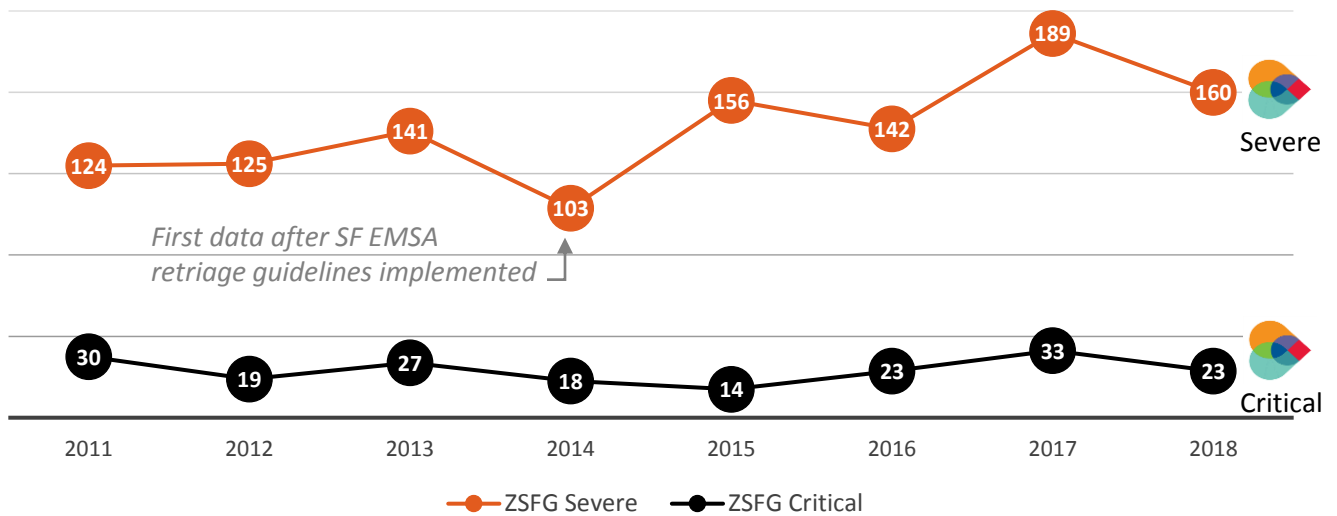
Severe and critical cyclist injury counts have held stable since 2014. However, people riding bicycles remain vulnerable road users who are over-represented in severe injury data relative to their proportion of trips on San Francisco streets.

³ Vision Zero SF Injury Prevention Research Collaborative. (2019, April). *E-Scooter Collision and Injury Analysis*. San Francisco, CA. Available at: <https://www.sfdph.org/dph/files/EHSdocs/PHES/VisionZero/E-Scooter Collision Injury 2019.pdf>

⁴ Vision Zero SF Injury Prevention Research Collaborative. 2019. *A Methodology for Emerging Mobility Injury Monitoring in San Francisco, California Utilizing Hospital Trauma Records: Version 2.0*. San Francisco, CA. Available at: <https://www.sfdph.org/dph/EH/PHES/PHES/TransportationandHealth.asp>

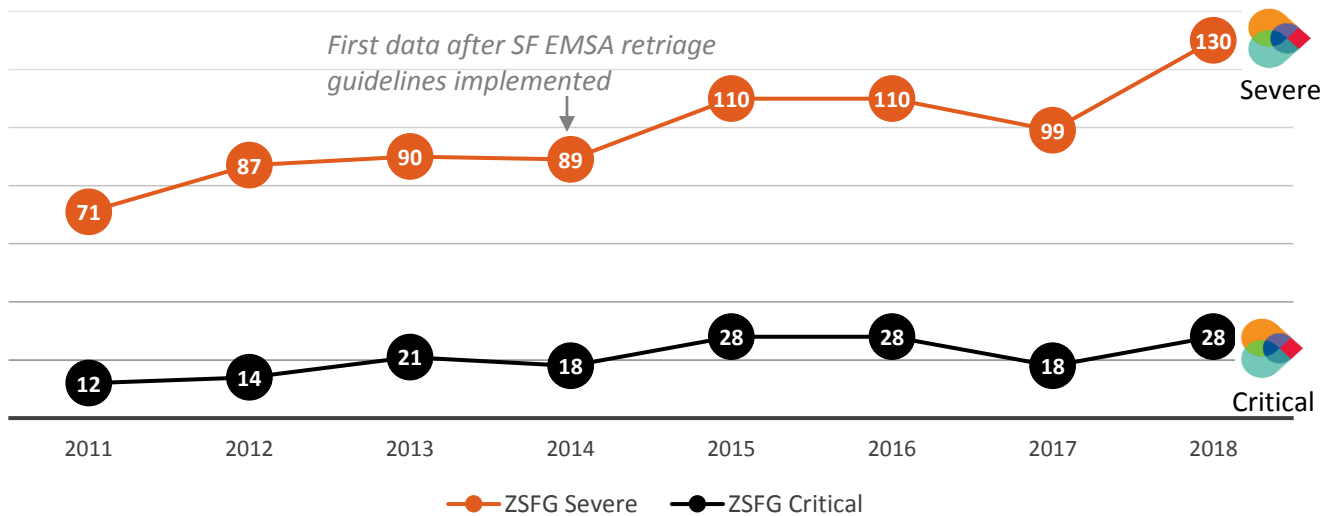


Figure 4: Motor Vehicle Traffic Injury Counts by Year



Counts of severe motor vehicle injury have fluctuated over time. Critical and severe motor vehicle injury declined in 2018 after increasing in 2017. However, both remain higher than recent lows. Notably, this data includes freeway injuries.

Figure 5: Motorcycle Traffic Injury Counts by Year



Counts of severe injuries to people riding motorcycles increased 30% from 2017 to 2018. Critical motorcycle injuries increased relative to 2017, to 2015 and 2016 levels.



Table 1: Count of Severe Injuries and Proportion by Travel Mode - from Hospital Data

| Year | Pedestrian | Cyclist | Motorcyclist | Motor vehicle occupant | Other/Unknown | Total |
|------|------------|-----------|--------------|------------------------|---------------|------------|
| 2011 | 189 (38%) | 104 (21%) | 71 (14%) | 124 (25%) | 4 (1%) | 492 (100%) |
| 2012 | 177 (36%) | 105 (21%) | 87 (17%) | 125 (25%) | 4 (1%) | 498 (100%) |
| 2013 | 145 (28%) | 131 (25%) | 90 (17%) | 141 (27%) | 10 (2%) | 517 (100%) |
| 2014 | 163 (35%) | 114 (24%) | 89 (19%) | 103 (22%) | 2 (0%) | 471 (100%) |
| 2015 | 187 (32%) | 110 (19%) | 110 (19%) | 156 (27%) | 15 (3%) | 578 (100%) |
| 2016 | 190 (33%) | 114 (20%) | 110 (19%) | 142 (25%) | 14 (2%) | 570 (100%) |
| 2017 | 178 (31%) | 102 (18%) | 99 (17%) | 189 (33%) | 6 (1%) | 574 (100%) |
| 2018 | 183 (31%) | 116 (20%) | 130 (22%) | 160 (27%) | 3 (1%) | 592 (100%) |

Among severe injuries from hospital data, pedestrian injury frequently ranks as the most prevalent mode of injury, ranging from 28-38% of severe injuries. In 2018 the proportion of severe injuries attributable to motorcycle crashes rose to 22%; severe injuries to cyclists comprised 20%. Motor vehicle occupant was the only mode for which proportion of severe injury fell in 2018, following an unusual increase in that mode the prior year.

Table 2: Count of Critical Injuries and Proportion by Travel Mode - from Hospital Data

| Year | Pedestrian | Cyclist | Motorcyclist | Motor vehicle occupant | Other/Unknown | Total |
|------|------------|----------|--------------|------------------------|---------------|------------|
| 2011 | 55 (44%) | 27 (22%) | 12 (10%) | 30 (24%) | 0 (0%) | 124 (100%) |
| 2012 | 55 (51%) | 18 (17%) | 14 (13%) | 19 (18%) | 1 (1%) | 107 (100%) |
| 2013 | 57 (45%) | 20 (16%) | 21 (16%) | 27 (21%) | 3 (2%) | 128 (100%) |
| 2014 | 47 (44%) | 23 (22%) | 18 (17%) | 18 (17%) | 0 (0%) | 106 (100%) |
| 2015 | 45 (41%) | 21 (19%) | 28 (26%) | 14 (13%) | 1 (1%) | 109 (100%) |
| 2016 | 46 (37%) | 23 (18%) | 28 (22%) | 23 (18%) | 5 (4%) | 125 (100%) |
| 2017 | 34 (31%) | 21 (19%) | 18 (16%) | 33 (30%) | 4 (4%) | 110 (100%) |
| 2018 | 55 (42%) | 23 (18%) | 28 (22%) | 23 (18%) | 1 (1%) | 130 (100%) |

Among critical injuries, the proportion attributable to injured pedestrians rose in 2018, reversing a decline observed in 2017. Regardless of year, pedestrian injury stands out as the leading mode of critical injury. The proportion of critical injury occurring among people riding bicycles has been relatively level over the past few years (~20%), while injury to motor vehicle occupants declined from a high of 30% in 2017 to 18% in 2018, a proportion consistent with previous years.



Next Steps

SFPD and ZSFG injury assessments represent overlapping populations and do not compare severity between data sources. We know that some of the injured people in police data are also captured in hospital injury data, while some injured people are included in police or hospital data only. To address this issue SFDPH completed a pilot linkage of SFPD and ZSFG data for 2013-2015, creating San Francisco's Transportation-related Injury Surveillance System which found that ~60% of records classified as severe appeared both in police and hospital data, with notably differences in proportion captured in hospital-only data based on travel mode. In 2020 SFDPH will complete another linkage of 2016-2018 data. The linked data from 2013-2018 will then become our primary data source to analyze severe injury trends as we will have six years of data, with data from records in both police and hospital sources.

Data linkage will facilitate analyses at the intersection level and offer more comprehensive data on crash and socio-demographic factors. In particular, we seek to investigate factors contributing to 2018's increase in severe motorcycle injuries, as well as those contributing to 2018's increase in critical pedestrian injuries following recent decline.

Discussion

San Francisco continues to invest significant resources to eliminate traffic deaths and reduce severe injuries on San Francisco streets. This work is described in the **2019 Vision Zero Action Strategy** – which includes: data-driven, strategic actions city agencies are advancing; evidence-based, high-impact transformative policies to address vehicle speeds and miles travelled that require local legislative authority; complementary city goals to increase walking, biking, and improved transit while reducing driving and vehicle miles travelled; and the critical importance of equity and ensuring a safe transportation system for even the most vulnerable communities to realize Vision Zero.

Vehicle speed is a fundamental predictor of crash survival and injury severity – and is thus a focus of Vision Zero efforts to slow speeds, save lives and prevent severe injury. Seniors are more vulnerable at any given speed.

San Francisco has a dynamic transportation environment that includes a number of additional factors that can impact the number and type of severe injuries sustained on the transportation system. These factors include:

- **Increases in population and vehicle miles travelled:** The City will see nearly 150,000 new residents with 170,000 new jobs between 2010 and 2020, and has already experienced an increase in daily vehicle miles travelled (VMT) of over 630,000 miles between 2010-2016.⁵ Transportation network companies (TNCs) such as Uber and Lyft account for 47% of this increase, according to SFCTA estimates. A 2019 study by Fehr & Peers on behalf of Uber and Lyft indicate reports that TNCs account for 12.8% of the total VMT on San Francisco roadways.

⁵ San Francisco County Transportation Authority. 2018. TNCs & Congestion: October 2018. San Francisco, CA.



- **Aging population:** One in five residents are seniors according to the Department of Aging and Adult Services – a population particularly vulnerable to severe injury when injured in a crash. The Bay Area’s senior population is forecasted to grow by 137% by 2040 according to Plan Bay Area 2040.
- **Increasing homelessness:** 2019’s biannual Point-in-Time Count showed a 17% increase in people living on the streets compared to 2017. This means that more people are living where exposure to traffic and potential traffic injury is highest, while facing the increased physical and mental health issues experienced by people without housing.

This context highlights the continued importance of targeted and coordinated Vision Zero SF initiatives to save lives and prevent severe injuries on our transportation system.



Appendix A: SAN FRANCISCO POLICE DEPARTMENT (SFPD) DATA

VZSF relies on ZSFG hospital data for severe injury monitoring due to the aforementioned strengths, including clinical assessment of injury severity and more complete assessment of severe injuries based on data from the City’s only Level I Trauma Center.

This Appendix summarizes SFPD-reported severe injury data, which was historically the primary source of severe injury data reported to the public and used by City staff. Excluding fatal injuries, police data offer three categories of injury severity, assessed at the injury scene: Severe Injury, Other Visible Injury, and Complaint of Pain.

Notably, a memo released to SFPD officers in Dec. 2014 advised head injuries be classified as severe to avoid under-reporting of traumatic brain injury. This guidance likely partially accounts for the increase in severe injuries recorded in police data from 2015 onward.

WHO IS SEVERELY INJURED?

Among severely injured people in police data, proportions of people injured while engaged in various travel modes are generally comparable to hospital data. Consistent with ZSFG data, pedestrians are the group of road users most affected by severe injury.

SEVERE INJURY TRENDS

Overall severe injury trends in police data are comparable to that in hospital data, as are trends for people walking, cycling and motorcycling. Notably injuries to motor vehicle occupants rose 30% in police data from 2017 to 2018. By contrast, numbers declined for both severe and critical injuries in ZSFG data for the same time period and mode.

Table A: Count of Severe Injuries and Proportion by Travel Mode - from Police Data

| Year | Pedestrian | Cyclist | Motorcyclist | Motor vehicle occupant | Other/Unknown | Total |
|------|------------|----------|--------------|------------------------|---------------|------------|
| 2011 | 76 (38%) | 36 (18%) | 31 (16%) | 44 (22%) | 11 (6%) | 198 (100%) |
| 2012 | 83 (41%) | 31 (15%) | 43 (21%) | 41 (20%) | 6 (3%) | 204 (100%) |
| 2013 | 80 (40%) | 47 (23%) | 36 (18%) | 38 (19%) | 0 (0%) | 201 (100%) |
| 2014 | 79 (39%) | 49 (24%) | 32 (16%) | 44 (21%) | 1 (0%) | 205 (100%) |
| 2015 | 87 (38%) | 51 (22%) | 45 (20%) | 47 (20%) | 0 (0%) | 230 (100%) |
| 2016 | 118 (42%) | 40 (14%) | 56 (20%) | 64 (23%) | 0 (0%) | 278 (100%) |
| 2017 | 112 (43%) | 46 (18%) | 48 (18%) | 53 (20%) | 2 (1%) | 261 (100%) |
| 2018 | 110 (39%) | 55 (19%) | 45 (16%) | 69 (24%) | 4 (1%) | 283 (100%) |

Among police-designated severe injuries, pedestrian injury perennially ranks as the most prevalent mode of injury – comprising 39% in 2018. The disproportionate burden of injury to motorcyclists and bicyclists compared to motor vehicles observed in hospital data is also seen in police data, as these



road users make up 16% and 19%, respectively, of severe injury reports in 2018 yet represent relatively smaller proportions of trips in San Francisco.

Numbers of severely injured pedestrians were relatively consistent 2016-2018.

Numbers of severely injured cyclists rose in 2018 in SFPD data.

Motorcycle injuries captured in police collision reports remained stable in 2018.

SFPD data show increased motor vehicle injury collisions in 2018, while hospital data show declines in motor vehicle severe and critical injuries. Contributing factors to these differing trends will be investigated in more detail when the Transportation-related Injury Surveillance System linkage of police and hospital data is completed in 2020.

PUBLIC DATA

While granular hospital data are not distributable to the public, police crash report data are annually released and can be explored via www.transbase.sfgov.org.