Identifying Factors and Trends to Improve Motorcycle Safety in Texas

CRASH ANALYSIS

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INTRODUCTION

In 2019 there were 4,914 fatal crashes that involved a motorcycle in the United States.[1] Of those fatal crashes, 8.3 percent occurred on Texas roadways.[1] More recently in 2020, there were 473 fatal motorcycle crashes in Texas with an additional 1,753 suspected serious injury crashes.[2] In 2020, nearly 30 percent (29.8 percent) of motorcycle crashes in Texas were fatal or suspected serious injury compared to less than 3 percent (2.7 percent) of other motorists.[2] The National Highway Traffic Safety Administration (NHTSA) highlights that 23.1 percent of riders surveyed in the National Occupant Protection Use Survey in 2020, were found to not be wearing helmets while 7.9 percent were wearing a non-compliant helmet.[3] NHTSA also documented that in 2019, 29 percent of motorcycle operators were impaired by alcohol, compared to 20 percent of passenger car drivers.[4] It is clear that motorcyclists are a particularly vulnerable and overrepresented road user in Texas. Motorcyclists involved in crashes are also much more likely to sustain a fatal or suspected serious injury than other motorists. Impairment and helmet use appear to be important crash factors.

National recommendations relating to outreach and education are reflected in Texas-specific strategic plans and recommendations.[5,6] The Texas Highway Safety Plan for Fiscal Year 2021 outlines several strategies to reduce the number of motorcyclist fatalities. The first strategy listed is to "improve education and awareness of motorcycle safety among law enforcement and emergency medical service (EMS) personnel, educators, and state & local engineers."[7] This strategy aims to educate stakeholders form the 4 Es of highway safety, including engineering, enforcement, education, and emergency response.[8] The next two strategies call for improving education on the importance of wearing a helmet and not operating a motorcycle while impaired.[7]

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[1] National Highway Traffic Safety Administration. (2020). NHTSA query tool. Retrieved from: https://cdan.dot.gov/query
[2] Texas CRIS Data accessed via MicroStrategy on 12/14/2020.
[3] National Highway Traffic Safety Administration. (2021). Traffic Safety Facts: research Note: Motorcycle Helmet Use in 2020—Overall Results. Retrieved from: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813143
[4] National Highway Traffic Safety Administration. (2021). Traffic Safety Facts: research Note: Motorcycle Helmet Use in 2020—Overall Results. Retrieved from: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813112
[5] National Highway Traffic Safety Administration. (n.d.) National Agenda for Motorcycle Safety. Retrieved from: https://one.nhtsa.gov/people/injury/pedbimot/motorcycle/00-nht-212-motorcycle/summary61-66.html
[6] National Highway Traffic Safety Administration. (2020). National Highway Traffic Safety Administration Motorcycle Safety 5-Year Plan. Retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13507-motorcycle_safety_plan_050919_v8-tag.pdf
[7] The State of Texas. (2020). Texas FY 2021 Highway Safety Plan. Retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/tx_fy21_hsp.pdf
[8] Federal Highway Administration. (2011). Get Stakeholders Involved. Retrieved from: https://safety.fhwa.dot.gov/hsip/resources/fhwasa1102/flyr3_in.cfm

The 2016–2021 Texas Motorcycle Strategic Action Plan outlines "strategies and action steps" to improve the roadways for the motorcycling community in the state.[9] This document also recommends training stakeholders from the 4Es on helmet use, including law enforcement, EMS, and other professionals.[9] Another recommendation involves performing an in-depth analysis of crash data to identify significant causation factors. Finally, the strategic action plan has an entire section devoted to countermeasures to address impaired motorcycle crashes, including incorporating data into campaigns.[9]

This project responds to these recommended strategies and countermeasures through a motorcycle crash analysis. As part of responding to these recommended strategies, this project addresses one of the key limitations identified by NHTSA in their Motorcycle Safety 5-year plan, the development of accurate estimates of motorcycle-specific vehicle miles traveled (VMT).[7] VMT is needed to adequately understand crash risk and system performance to fully understand exposure to traffic risk; however, accurate motorcycle VMT methods have been a challenge.[7]

In a FY 2016 project, the project team developed a method for calculating motorcycle VMT to overcome this limitation.[10] The developed methodology estimates motorcycle VMT by using odometer readings from travel survey data to produce an annual mileage, which was used to compute a statewide motorcycle VMT.[10] This phase of the project updates motorcycle VMT estimates using the previously developed method and performs the requisite crash analyses to identify and address crash factors such as impaired riding and helmet use, through improved "education and awareness of motorcycle safety among law enforcement and EMS personnel, educators and state and local traffic engineers."[11]

METHODS

This section provides a description of the data sources and statistical methods used for this project.

DATA SOURCES

This section provides a description of the individual data sets used, and a brief description of any data processing steps taken.

[9] 2016–2021 Texas Strategic Action Plan for Motorcycles. Retrieved from: https://www.looklearnlive.org/wp-content/uploads/2020/04/TTI-2016-11_Texas-Motorcycle-Safety-Plan-2016-through-2021.pdf
[10] Shipp, E.M., Trueblood, A., Perez, M., Ko, M., Wu, L., Stewart, C., Pant, A., and Chigoy, B. (2018). Analysis of Motorcycle Crashes in Texas, 2010–2017. Retrieved from: https://www.looklearnlive.org/wp-content/uploads/2020/04/MotorcycleAnalysisReportFinal_Final.pdf
[11] Texas Department of Transportation. (2020). Traffic Safety Program Request for Proposals FY2022 General Grants. Retrieved from: https://www.txdot.gov/apps/eGrants/eGrantsHelp/rfp.html

Motorcycle Crash Data

Texas Department of Transportation (TxDOT) CRIS

Crash data from 2015 to 2020 were obtained from the TxDOT's Crash Records Information System (CRIS) for motorcycle and passenger car crashes. These data were extracted on March 30, 2021. Motorcycle crashes were defined as those involving a motorcycle, whereas passenger car crashes were defined as those involving a two- or four-door passenger car.

NHTSA Fatality Analysis Reporting System (FARS)

Crash data from NHTSA's FARS were obtained and used to analyze fatal crashes. FARS is a national census of fatal motor vehicle crashes. Data for both Texas and the United States, from 2015 to 2019, were used to compare motorcycle crashes and passenger car crashes, and Texas versus the nation. Motorcycle crashes include two-wheel motorcycle, moped or motorized bicycle, three-wheel motorcycle, off-road motorcycle, motor scooter, unenclosed three-wheel motorcycle/unenclosed autocycle, enclosed three-wheel motorcycle/enclosed autocycle, unknown three-wheel motorcycle, other motored cycle type, and unknown motored cycle type, whereas passenger car crashes include convertible, two-door sedan/hardtop/coupe, two-door/two-door hatchback, four-door sedan/hardtop, five-door/four-door hatchback, station wagon, hatchback (number of doors unknown), other or unknown automobile type, auto-based pickup, auto-based panel, and three-door coupe.

Motorcycle Vehicle Registration Data

Motorcycle vehicle registration data by county were obtained for 2015 to 2020 by an open records request with the Texas Department of Motor Vehicles. State-level motorcycle registration data for states other than Texas were obtained from the Federal Highway Administration at: https://www.fhwa.dot.gov/policyinformation/statistics/2019/mv1.cfm.

Population Data

Population estimates were obtained from two data sources, the U.S. Census Bureau and the Texas Demographic Center Estimates. The team used both 2019 American Community Survey 5-year estimates, which would cover 2015 to 2019 and 2019 Texas Population Estimate Program data.[12],[13]Population data were used to calculate population rates, as well as to estimate motorcycle VMT for the project.

Roadway Inventory/Vehicle Miles Traveled

Data tables for 2018 to 2019 were obtained from TxDOT and contain estimates of VMT for both on and off-system roadways. [14]This information is publicly available at:

[12] Texas Demographic Center. (n.d.). Texas Demographic Center. Retrieved from Texas Population Estimates Program: https://demographics.texas.gov/Data/TPEPP/Estimates/
[13] TxDOT. (n.d.). Roadway Inventory. Retrieved from https://www.txdot.gov/inside-txdot/division/transportation-planning/roadway-inventory.html
[14] U.S. Census Bureau. (2019). 2019 American Community Survey 5-Year Estimates Table: S0101.

https://www.txdot.gov/inside-txdot/division/transportation-planning/roadway-inventory.html. This data source was used in the estimation of motorcycle VMT for the project.

Household Surveys

Both the National Household Travel Survey (NHTS) and the TxDOT Travel Survey Program (TSP) capture inter-urban travel data and were used for the VMT estimation. Travel surveys describe household demographic and travel characteristics for Monday through Friday during the school year.

DATA ANALYSIS

The overall analysis was largely descriptive (e.g., frequencies, percentages). Geospatial analyses were also used to produce descriptive maps for counts and rates, to examine spatial patterns. The following sections describe pilot analyses and more advanced methodologies used in the report.

Rear-End Pilot Narrative Analysis

Crash narratives for 2019 motorcycle crashes involving a rear-end crash were examined. First, the team ran a bigrams extraction routine, which produced lists of the most common two words used together in the narratives. Then the team produced word clouds that highlighted commonly used words. Bigrams and word clouds allow for a better understanding of potential crash factors discussed in crash narratives. The following stop words (words found to not be meaningful and were removed) were used for the bigrams and word clouds: ([“wit,” “eastbound,” “wb,” “officer,” “offic,” “road,” “caus,” “sh,” “vehicl,” “motorcycl,” “vehicular,” “westbound,” “scene,” “one,” “two,” “number,” “ih,” “cause,” “block,” “two,” “tow,” “rd,” “observe,” “bound,” “vehicle,” “driver,” “motorcycle,” “motorcyclist,” “motorists,” “state,” “lane,” “continu,” “due,” “roadway,” “bd,” “sb,” “n,” “travel,” “unit,” “with,” “stated,” “witness,” “came,” “officer,” “south,” “north,” “east,” “west,” “northbound,” “southbound”]).

The narratives were flagged if they contained keywords. The following topic areas and keywords were examined:

- Distraction:
  - Inattention,
  - Distracted,
  - Phone, or
  - Multitasking.
- Speed:
  - Speed,
  - Too fast,
  - Speeding,
  - Speed-related.,
  - Unsafe speed,
  - Unsafe for condition,
  - Unsafe for conditions, or

    - Speed limit.
- Intersection-Related:
    - Intersection,
    - Crossing, or
    - Intersection-related.
- Failure to Yield Right-of-Way (FTYROW):
    - FTYROW,
    - Right-of-way,,
    - Failed to yield,
    - Failed-to-yield, or
    - ROW.
- Fault:
    - Cited,
    - Citation,
    - Ticket,
    - Fine,
    - Penalty,
    - At-fault,
    - Illegal, or
    - Fault.
- Visibility:
    - Sun in eyes,
    - Blinded by the sun,
    - Visibility,
    - Didn't see,
    - Did not see,
    - Line of sight,
    - Visible,
    - Couldn't see, or
    - Could not see.
- Impairment:
    - Alcohol,
    - Drugs,
    - Impaired,
    - Pending toxicology,
    - BAC, or
    - Blood alcohol concentration.

Pilot Charge Analysis

The violations with which drivers involved in crashes are charged are an open-text field entered by officers. The team manually classified charges reported for motorcycle-involved crashes into the following categories:

- Other/unclassified,
- ATV/OHV on roadway,
- Driving in improper location,
- Fail to drive in single lane,
- Drive on improved shoulder,
- Drove wrong way/wrong side,
- Possession of drugs or paraphernalia,
- Open container,
- Impairment,
- Hit and run,
- Improper/unsafe start,
- U-turn,
- Fixed object,
- Unsafe movement/reckless driving/fail to maintain control,
- Load issue,
- No helmet,
- Vehicle defect,
- No headlights/lights,
- Ran/disregard red light/stop sign/traffic control device/officer,
- Followed too closely/failed to maintain clear distance,
- No license,
- License restriction,
- No motorcycle license,
- FTYROW,
- Back when unsafe,
- Passed unsafe/disregard no passing zone,
- Unsafe lane change,
- Speed,
- Turn,
- No insurance/failure to maintain financial responsibility, or
- Unregistered/uninspected vehicle.

License categories may overlap, but the team tried to divide these into no license, license restriction violation, and no motorcycle endorsement. However, this information is an open-text field, and in many cases, it was not clear which license category should be applied. Therefore, in these instances, the violation was categorized as “no license.”

VMT Estimates

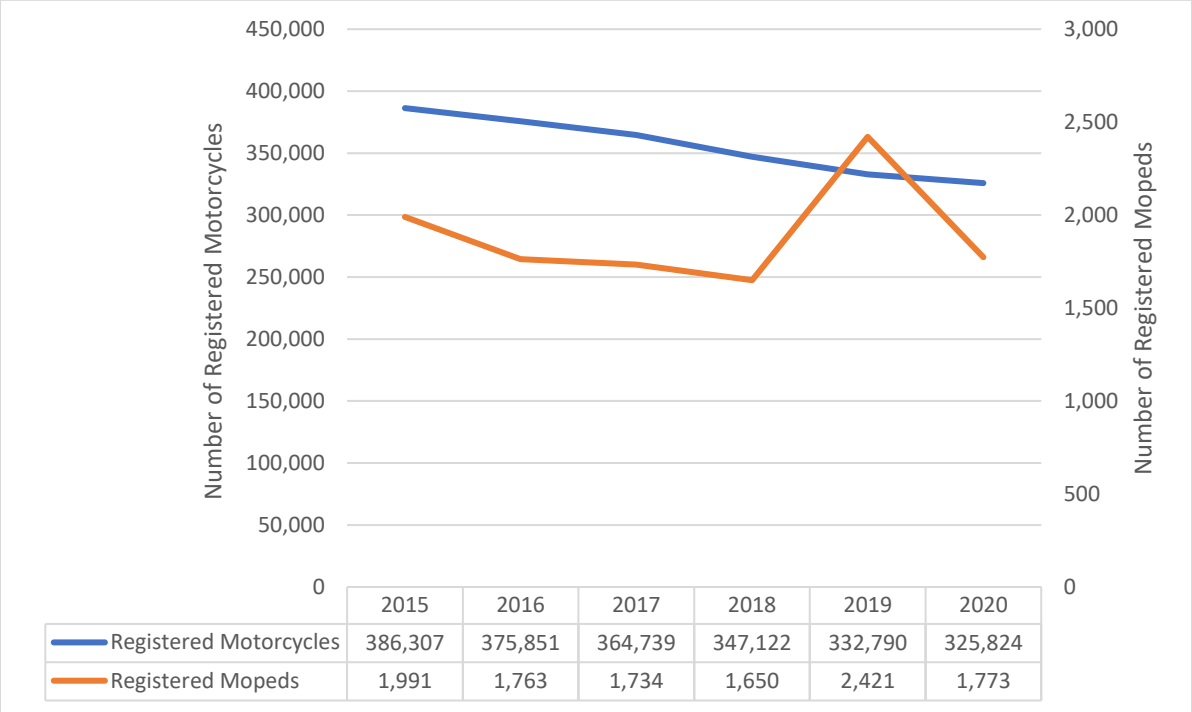
Motorcycle VMT was estimated using the reported odometer readings from travel surveys. The odometer reading methodology is an analysis of annual mileage for each reported motorcycle in the TxDOT and NHTS surveys. Both surveys report the total estimated annual mileage of motorcycles. In the TxDOT surveys, only the total mileage is reported, so the analysis incorporated an annual calculation based on the survey year and the vehicle model year. The NHTS reports an annual mileage. The average of the annual mileages calculated as a function of the proportion of total VMT attributable to motorcycles was used to compute a statewide motorcycle VMT. Average annual mileages were calculated by multiplying the reported average number of miles per motorcycle as described above, by the number of registered motorcycles in Texas.[15]

[15] Shipp, E.M., Wunderlich, R., Perez, M., Ko, M., Pant, A., Martin, M., Chigoy, B., and Trueblood, A. 2016. Comprehensive analysis of motorcycle crashes in Texas: A multi-year snapshot. TxDOT Report Number: 2016-TTI-G-1YG-0029 (Revision 1a). Available at: https://www.looklearnlive.org/wp-content/uploads/2020/04/MOTO_ReportRev1a.pdf

RESULTS

MOTORCYCLE REGISTRATIONS

Figure 1 displays the number of motorcycle registrations by vehicle classification (motorcycle and moped) by year from 2015 to 2020. There was an average of 355,439 registered motorcycles and 1,889 registered mopeds annually. Overall, there was a steady decline in the number of registered motorcycles over the time period. In 2019, the number of registered mopeds increased to 2,421, which immediately decreased in 2020 to 1,773. However, this trend should be monitored in the future as COVID-19 may have impacted the purchase of new vehicles in 2020. Overall mopeds accounted for a small proportion, 0.53 percent, of all registered motorcycles.



	2015	2016	2017	2018	2019	2020
Registered Motorcycles	386,307	375,851	364,739	347,122	332,790	325,824
Registered Mopeds	1,991	1,763	1,734	1,650	2,421	1,773

Figure 1. Number of Motorcycle Registrations by Year in Texas, 2015–2020.

Figure 2 displays the annual average number of motorcycle registrations (i.e., motorcycle and moped) by county in Texas. As expected, the counties with the highest number of motorcycle registrations correspond to metropolitan areas (e.g., Houston, Austin, Dallas, El Paso). Figure 3 displays the annual average number of total moped registrations by county in Texas. Registered mopeds also appear to concentrate in largely metropolitan areas.

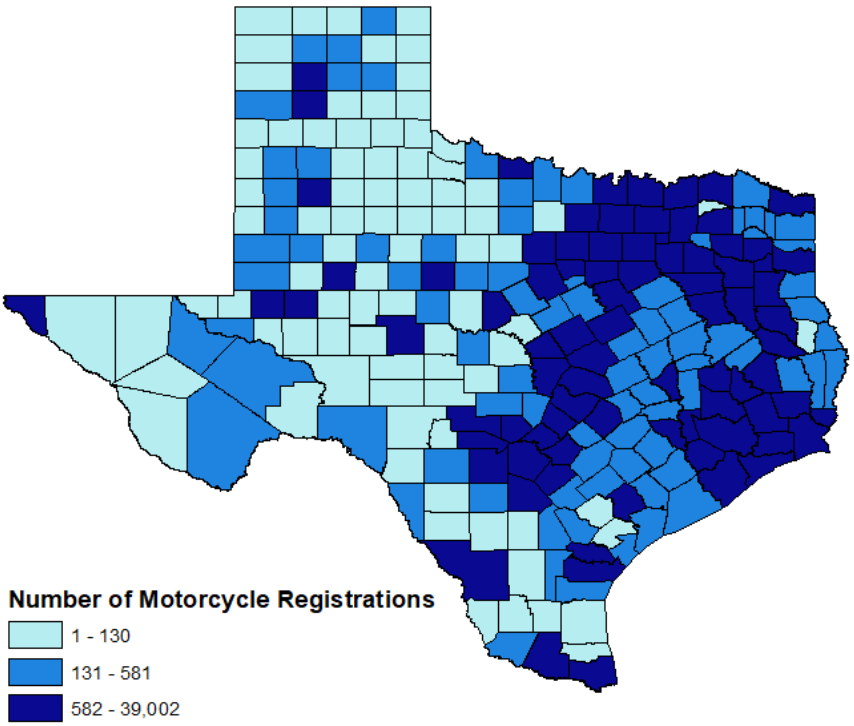


Figure 2. Average Annual Number of Motorcycle Registrations by County, 2015–2020.

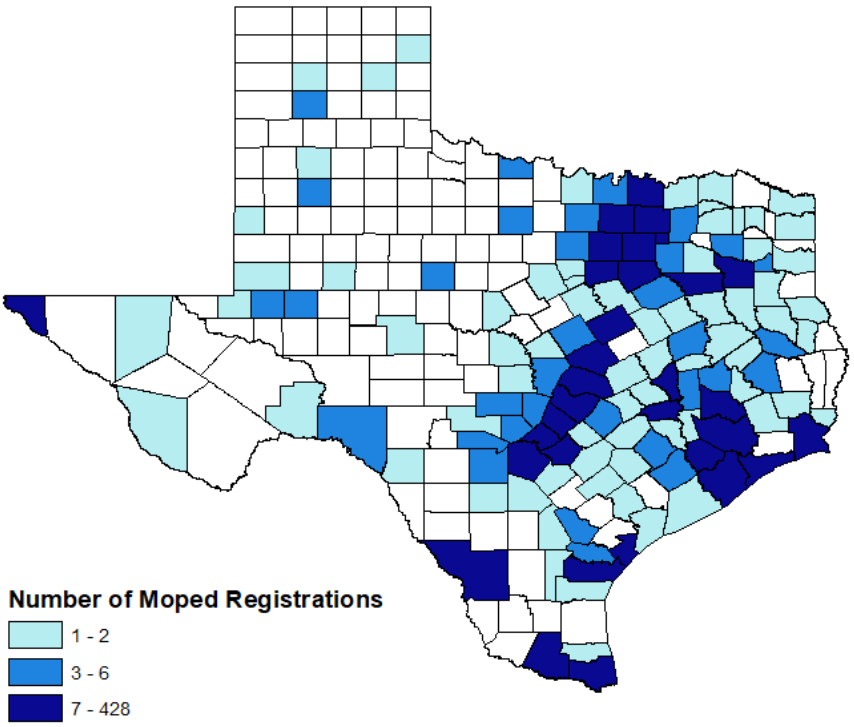


Figure 3. Average Annual Number of Moped Registrations by County, 2015–2020.

The rate of motorcycle registrations (combined motorcycle and moped) per 100,000 population over 16 years old (driving population) was examined. In Texas, on average there were 1,644 motorcycles registered per 100,000 driving population. Figure 4 shows the motorcycle registration rates per driving population by county. Interestingly, many rural areas have higher registration rates per driving population.

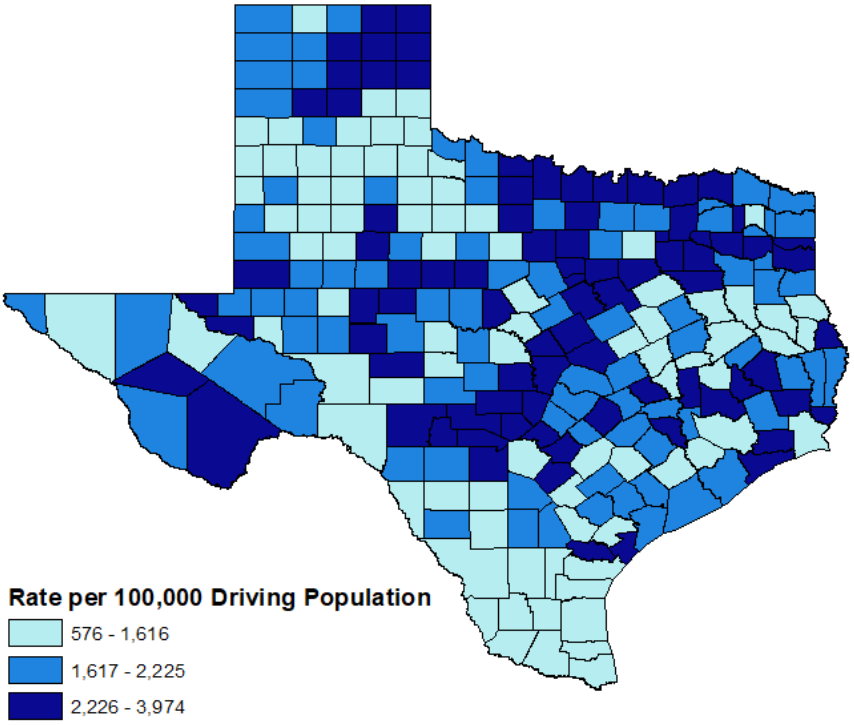


Figure 4. Motorcycle Registration Rate Per 100,000 Driving Population.

Table 1 shows the top 10 counties for motorcycle registration rates per 100,000 driving population. As indicated by the small population size, the top 10 counties for motorcycles registered by populations are largely rural counties.

Table 1. Top 10 Motorcycle Registration Rates Per 100,000 Driving Population.

County	Population 16 Years and Over	Average Number of Motorcycles Registered	Motorcycle Registration Rate Per 100,000 Driving Population
Brewster	7,641	304	3,974.8
Bandera	18,895	745	3,943.7
Lampasas	16,914	609	3,601.6
Comal	113,369	4,072	3,591.4
Blanco	9,647	334	3,463.9
Loving	73	3	3,424.7
Roberts	648	22	3,420.8
Real	2,630	89	3,384.0
Wise	51,986	1,627	3,130.3
Kent	503	16	3,114.6

CRIS

Crash Counts

From 2015 to 2020, there were 48,331 crashes involving a motorcycle with an average of 8,055 crashes annually (see Figure 5). During the same period, there were 2,157,646 crashes involving a passenger car with an average of 359,608 crashes annually.

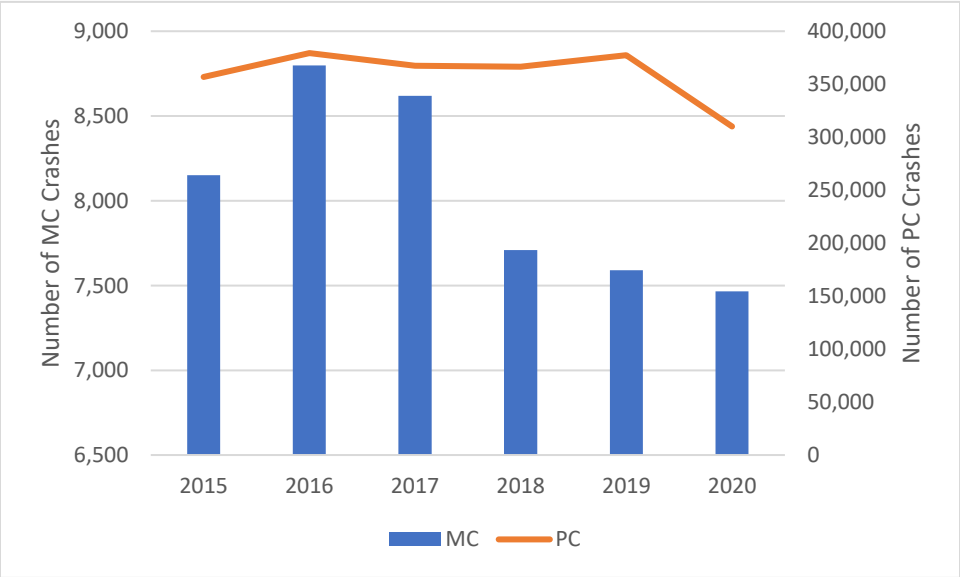


Figure 5. Motorcycle- and Passenger-Car–Involved Crashes by Year.

The team mapped motorcycle crashes in Texas (see Figure 6). Most of the crashes were in the large metropolitan areas of Texas (i.e., Dallas/Fort Worth, Austin/San Antonio, and Houston).

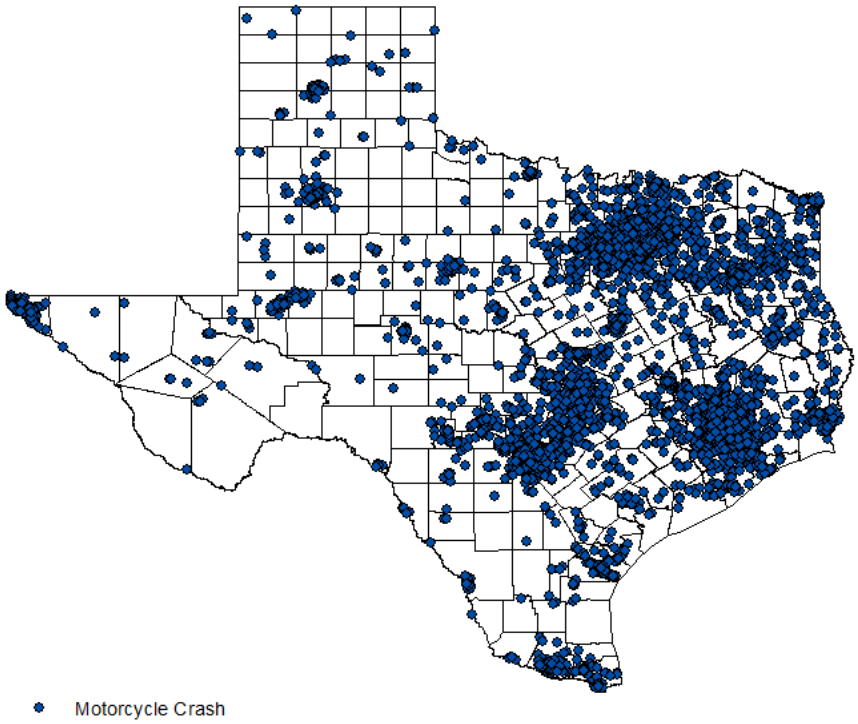


Figure 6. Motorcycle Crashes, 2020.

The motorcycle crash rate per 100,000 driving population was examined (see Figure 7 and Table 2). Accounting for the driving population, the higher rates are in largely rural areas. This is highlighted in Table 2, which lists the top 10 counties based on their annual motorcycle crash rates per 100,000 driving population.

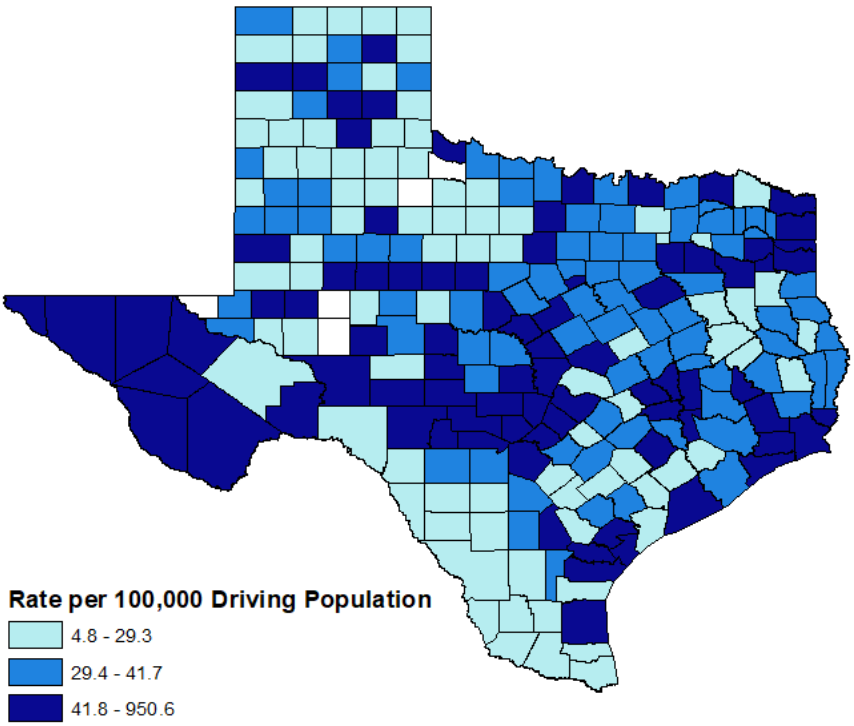


Figure 7. Annual Motorcycle Crash Rate Per 100,000 Driving Population.

Table 2. Top 10 Annual Motorcycle Crash Rates Per 100,000 Driving Population.[1]

County	Population 16 Years and Over	Average Number of Crashes	Motorcycle Crash Rate Per 100,000 Driving Population
Real	2,630	25.0	950.6
Bandera	18,895	27.5	145.5
Grimes	22,308	24.8	111.3
Gillespie	21,875	16.8	77.0
Palo Pinto	22,579	16.7	73.8
Burnet	37,658	27.5	73.0
Kendall	34,621	24.7	71.2
Kerr	42,993	30.2	70.2
San Jacinto	22,375	15.7	70.0
Potter	90,103	61.0	67.7

[1]Note: Only included counties with 10 or more crashes.

The motorcycle crash rate per 100,000 registered motorcycle was examined (see Figure 8 and Table 3). Accounting for registered motorcycles, the higher crash rates are largely rural areas. This is also supported in Table 3, which lists the top 10 counties based on their annual motorcycle crash rates per 100,000 registered motorcycles, with the exception of Dallas and

Webb counties. Real, Grimes, Bandera, Potter, and Gillespie (all largely rural areas) are top counties for both motorcycle crash rates per 100,000 driving population and registered motorcycles.

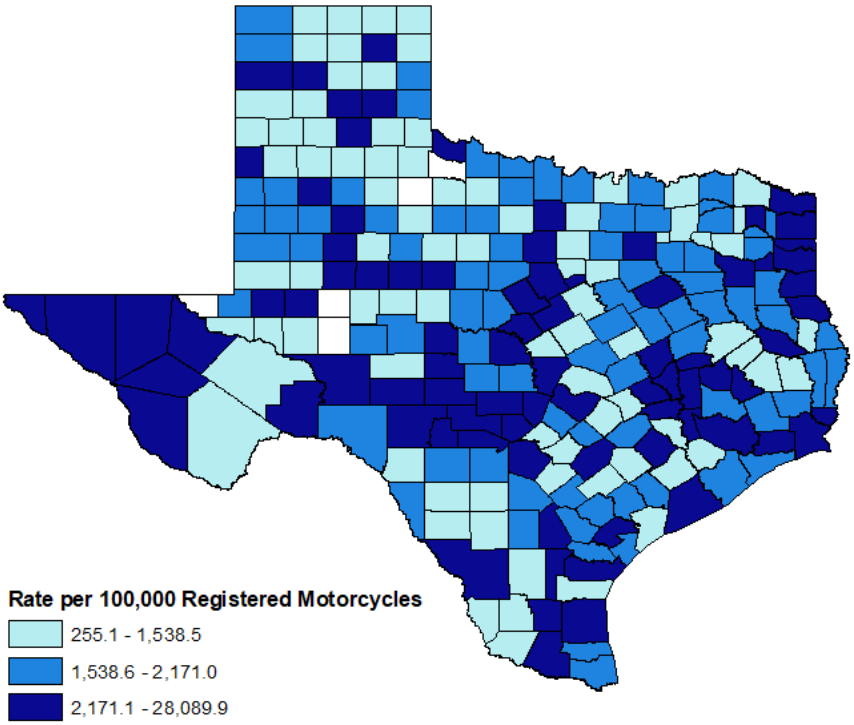


Figure 8. Motorcycle Crash Rate Per 100,000 Registered Motorcycles.

Table 3. Top 10 Motorcycle Crash Rates Per 100,000 Registered Motorcycles.

County	Average Motorcycles Registered	Average Number of Crashes	Motorcycle Crash Rate Per 100,000 Registered Motorcycles
Real	89	25.0	28,089.9
Grimes	500	24.8	4,966.7
Bandera	745	27.5	3,691.3
Colorado	328	11.0	3,353.7
Potter	1,824	61.0	3,344.3
Brazos	2,488	83.0	3,336.0
Dallas	20,649	666.0	3,225.3
Gillespie	538	16.8	3,128.9
Webb	1,834	55.8	3,044.3
Jefferson	2,921	88.8	3,041.2

[1]Note: Only included counties with 10 or more crashes.

Table 4 shows the frequency of crashes involving a motorcycle or passenger car from 2015 to 2020. All crash severities decreased over the time period with the exception of KA motorcycle-involved crashes, which increased by 0.87 percent (n=19 crashes).

Table 4. Frequency of Crashes involving a Motorcycle and Passenger Car in Texas, 2015–2020.[1]

Year	Motorcycle-Involved Crashes			Passenger-Car–Involved Crashes		
	KA	BC	Total	KA	BC	Total
2015	2,207 (27.1%)	4,746 (58.2%)	8,150 (100%)	9,090 (2.5%)	106,274 (29.8%)	356,769 (100%)
2016	2,376 (27%)	5,122 (58.2%)	8,799 (100%)	9,524 (2.5%)	114,162 (30.1%)	379,372 (100%)
2017	2,445 (28.4%)	4,960 (57.6%)	8,618 (100%)	9,371 (2.5%)	109,198 (29.7%)	367,506 (100%)
2018	2,208 (28.6%)	4,360 (56.6%)	7,709 (100%)	8,041 (2.2%)	108,137 (29.5%)	366,642 (100%)
2019	2,116 (27.9%)	4,249 (56%)	7,590 (100%)	8,354 (2.2%)	110,353 (29.3%)	377,244 (100%)
2020	2,226 (29.8%)	4,070 (54.5%)	7,465 (100%)	7,921 (2.6%)	86,817 (28%)	310,113 (100%)

[1]KA=Fatal or Suspected Serious Injury
BC= Non-incapacitating Injury or Possible Injury

Crash and Injury Severity

Crash severity was examined for both motorcycle and passenger car crashes (see Figure 9 and Figure 10).

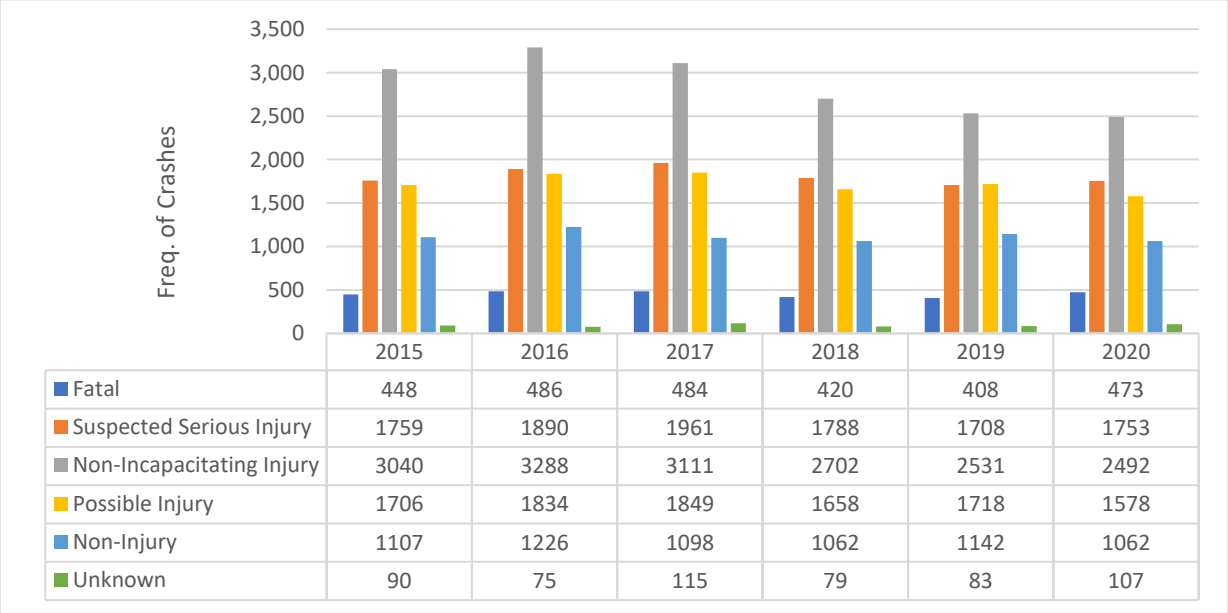
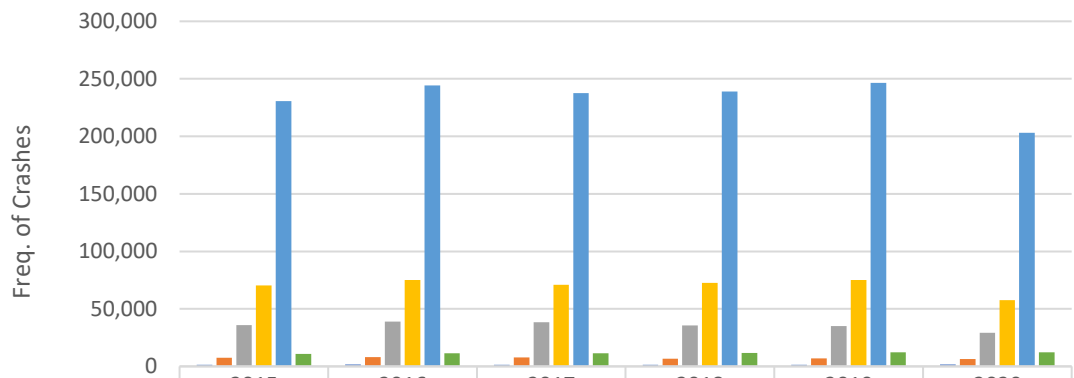


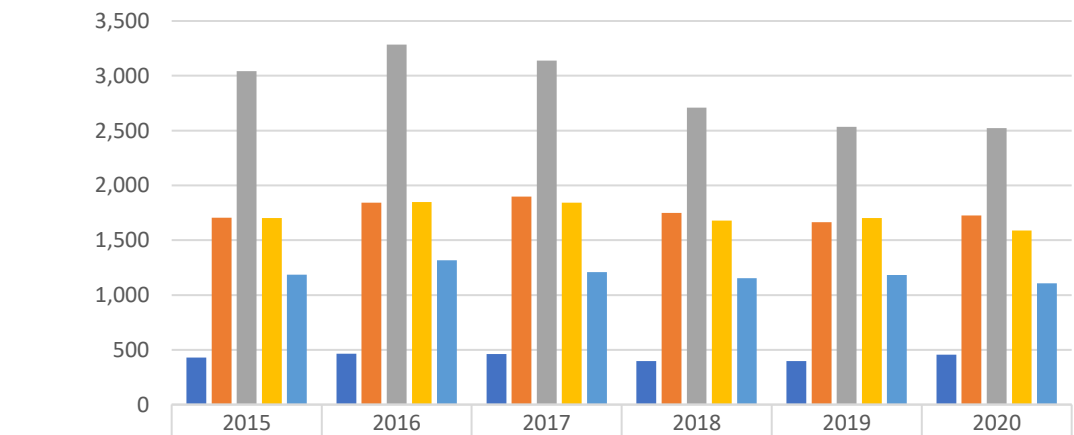
Figure 9. Motorcycle-Involved Crashes by Crash Severity, 2015–2020.



	2015	2016	2017	2018	2019	2020
Fatal	1459	1586	1504	1458	1443	1576
Suspected Serious Injury	7631	7938	7867	6583	6911	6345
Non-Incapacitating Injury	35871	39068	38291	35582	35175	29326
Possible Injury	70403	75094	70907	72555	75178	57491
Non-Injury	230503	244191	237470	238895	246394	203036
Unknown	10902	11495	11467	11569	12143	12339

Figure 10. Passenger-Car–Involved Crashes by Crash Severity, 2015–2020.

The team looked at injury severity for motorcycle operators involved in a motorcycle crash (see Figure 11). On average 5.4 percent of motorcycle operators were fatally injured and 22.1 percent experienced suspected serious injuries from 2015 to 2020.



	2015	2016	2017	2018	2019	2020
Fatal	429	463	461	397	397	456
Suspected Serious Injury	1,705	1,841	1,898	1,749	1,664	1,726
Suspected Minor Injury	3,043	3,284	3,138	2,708	2,533	2,523
Possible Injury	1,703	1,847	1,843	1,678	1,701	1,589
No Apparent Injury	1,185	1,317	1,209	1,153	1,182	1,108

Figure 11. Motorcycle Operator Injury Severity, 2015–2020.

Crash Time

The month that the crash occurred was examined for trends, and the three most frequent months for motorcycle crashes were October (n=4,810), July (n=4,562), and May (n=4,542) (see Figure 12). In comparison, passenger car crashes were most likely to occur in October (n=199,197), November (n=186,767), and December (n=191,311) (see Figure 13).

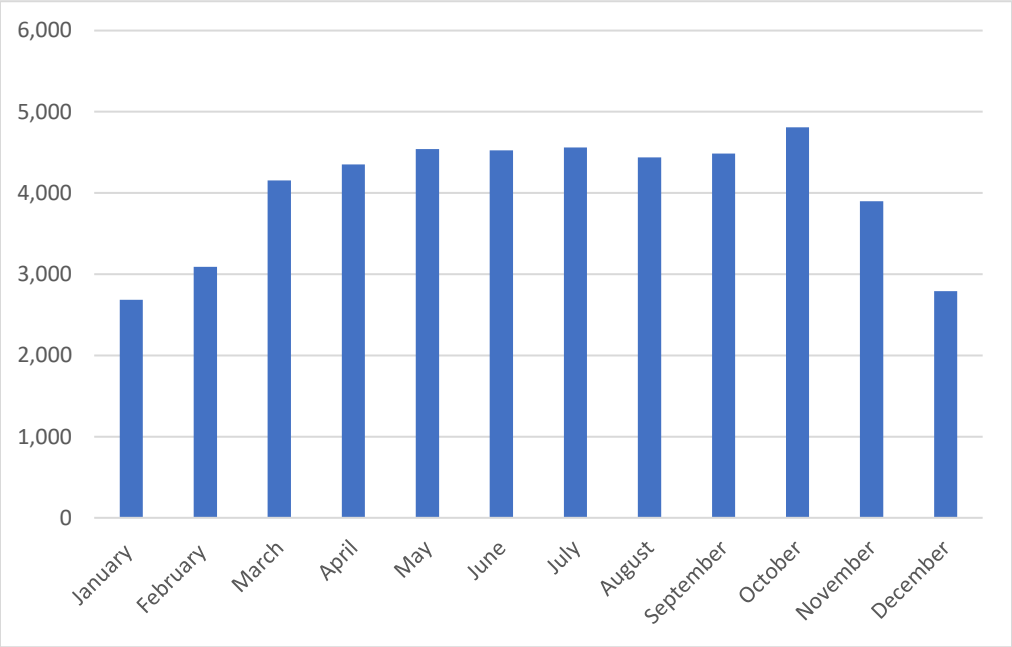


Figure 12. Motorcycle Crashes by Month, 2015–2020.

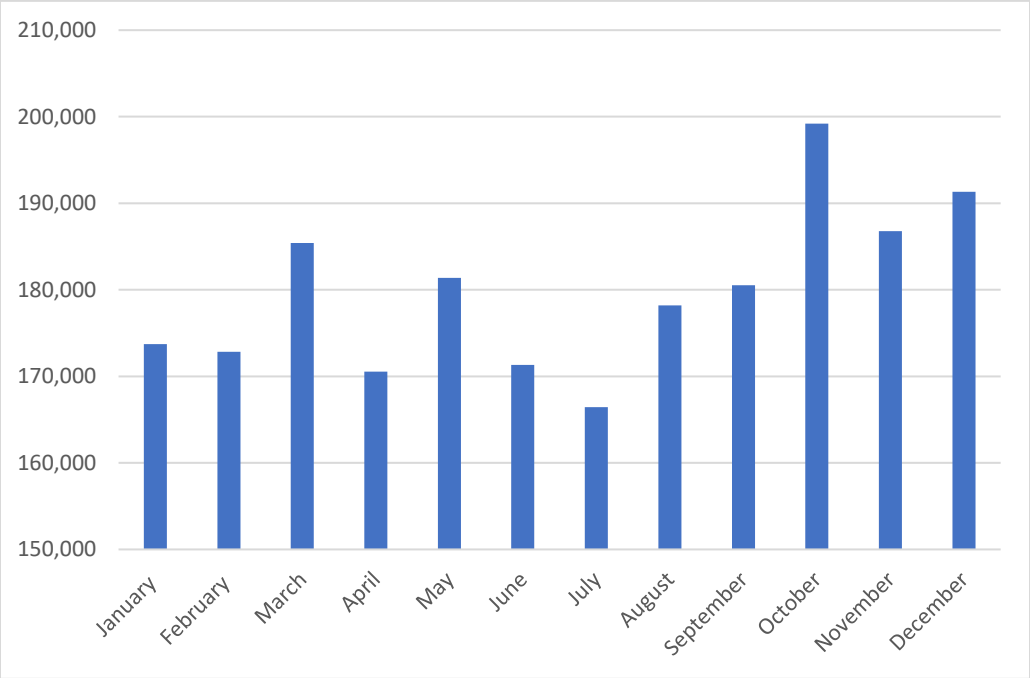
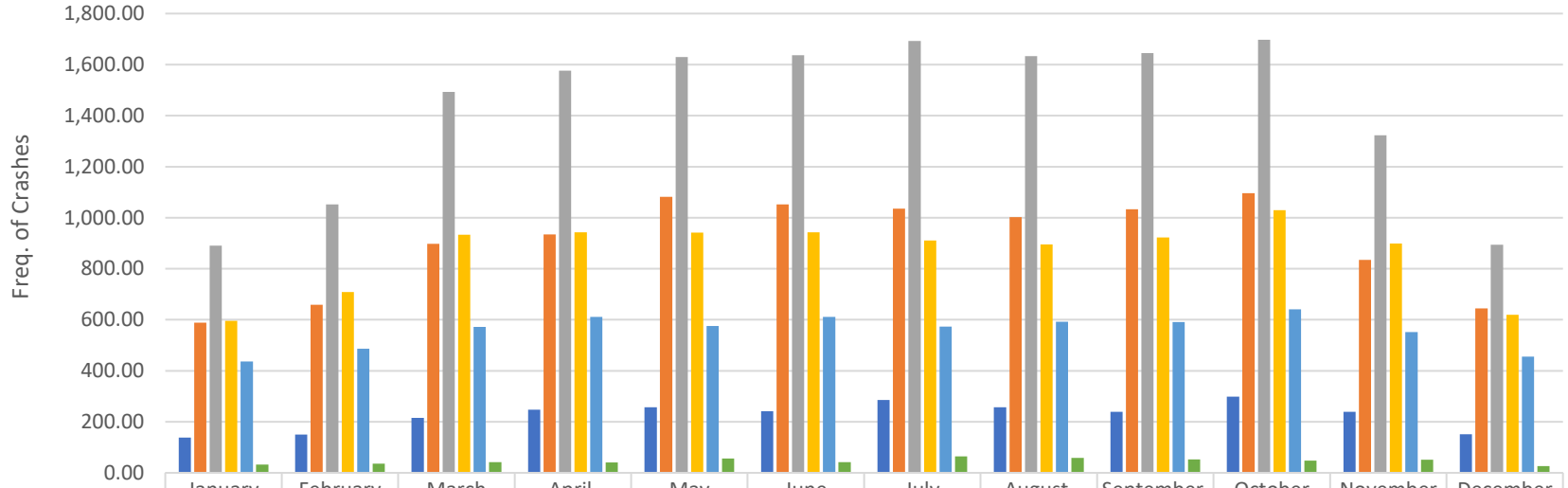


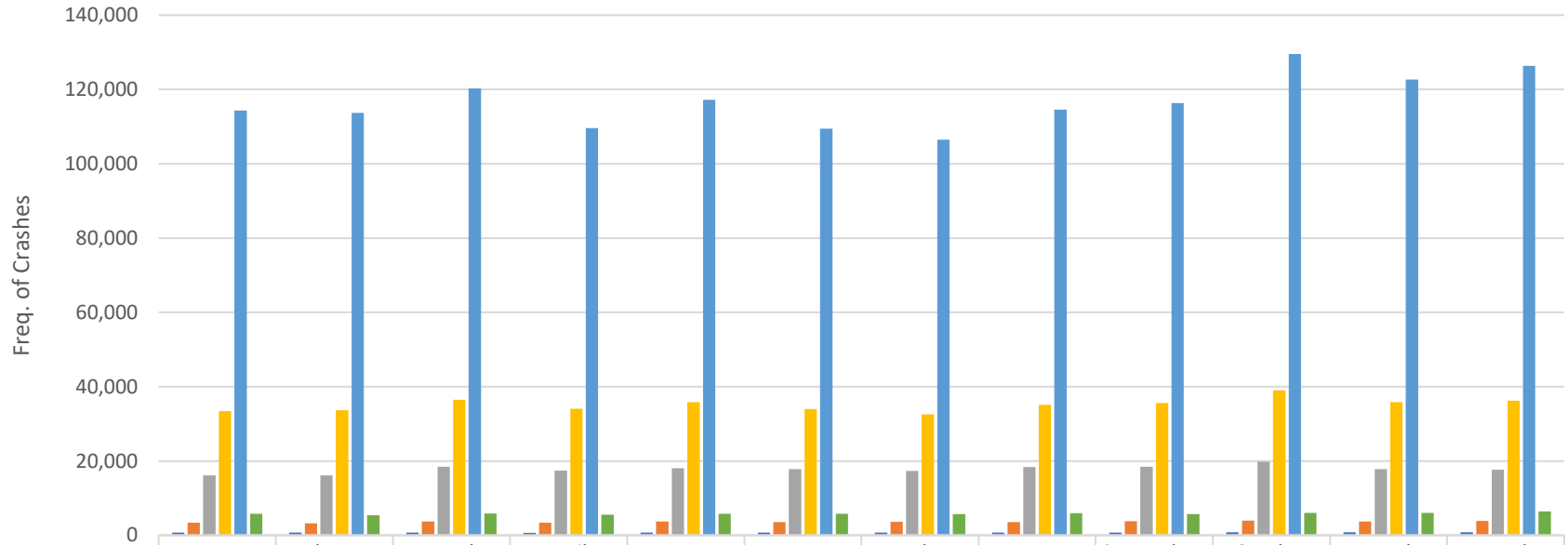
Figure 13. Passenger Car Crashes by Month, 2015–2020.

Month by crash severity was examined for motorcycle crashes and passenger car crashes (see Figure 14 and Figure 15). The top two months for fatal motorcycle crashes were October (n=299) and July (n=286). In comparison, the top months for fatal passenger car crashes were October (n=846) and November (n=830).



	January	February	March	April	May	June	July	August	September	October	November	December
Fatal	138	150	215	247	257	241	286	257	239	299	239	151
Suspected Serious Injury	589	659	898	934	1082	1052	1035	1002	1033	1096	834	645
Non-Incapacitating Injury	891	1052	1493	1576	1630	1637	1693	1633	1645	1697	1323	894
Possible Injury	596	709	933	943	942	943	911	895	923	1029	899	620
Non-Injury	437	486	572	611	575	611	573	592	591	641	552	456
Unknown	32	36	42	41	56	42	64	58	53	48	51	26

Figure 14. Motorcycle Crashes by Month and Severity, 2015–2020.



	January	February	March	April	May	June	July	August	September	October	November	December
Fatal	705	703	743	680	768	763	770	712	712	846	830	794
Suspected Serious Injury	3355	3234	3676	3368	3715	3517	3620	3571	3756	3952	3672	3839
Non-Incapacitating Injury	16132	16126	18407	17359	18061	17810	17311	18387	18432	19821	17818	17649
Possible Injury	33435	33688	36439	34032	35820	33965	32531	35068	35611	39016	35816	36207
Non-Injury	114305	113667	120266	109583	117214	109460	106517	114570	116336	129555	122645	126371
Unknown	5780	5405	5867	5531	5816	5794	5705	5906	5667	6007	5986	6451

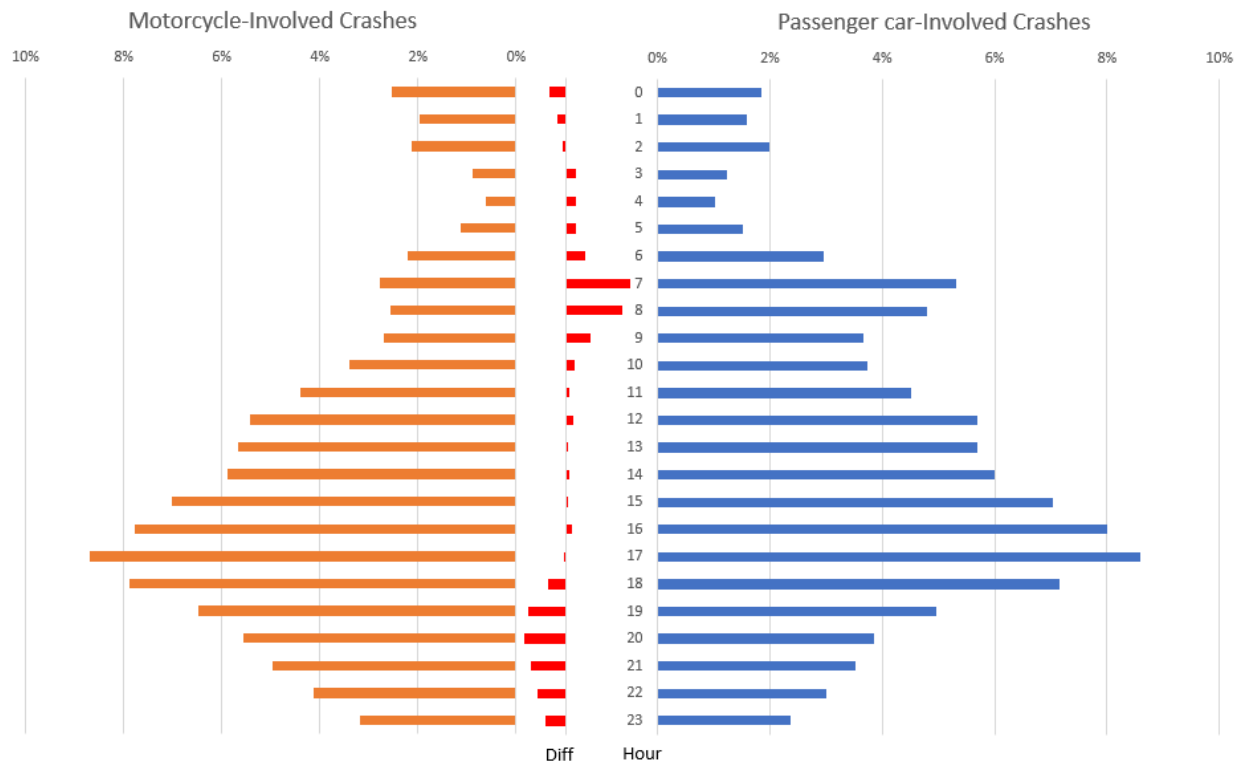
Figure 15. Passenger Car Crashes by Month and Severity, 2015–2020.

The team examined the day of the week of crashes (see Table 5). The top two days for motorcycle crashes were Tuesday (19.6 percent) and Wednesday (16.2 percent), whereas the most common days for passenger car crashes were Sunday (17.0 percent) and Thursday (14.9 percent).

Table 5. Day of Week of Crashes, 2015–2020.

Day of Week	MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%
Sunday	7,627	15.8%	366,277	17.0%
Monday	5,446	11.3%	300,506	13.9%
Tuesday	9,453	19.6%	298,667	13.8%
Wednesday	7,846	16.2%	242,505	11.2%
Thursday	6,367	13.2%	321,671	14.9%
Friday	5,660	11.7%	311,075	14.4%
Saturday	5,932	12.3%	316,945	14.7%
Sum	48,331		2,157,646	

Hour of crashes were examined (see Figure 16). Both motorcycle- and passenger car-involved crashes occurred from 4:00 p.m. to 7:00 p.m. However, there was also an increased percentage of passenger car crashes during morning hours (7:00 a.m. to 8:00 a.m.). There were higher percentages of motorcycle crashes during night hours (6:00 p.m. to 1:00 a.m.) compared to passenger car crashes.



Note: Diff = Difference in motorcycle and passenger car percentages. If the bar extends to the left, the motorcycle percentage is greater. Conversely if the bar extends to the right, the passenger car percentage is greater.

Figure 16. Hour of Motorcycle and Passenger Vehicle Crashes, 2015–2020.

Single-Vehicle versus Multi-vehicle

The number of vehicles involved in crashes was examined (see Table 6). The majority of all crashes were multi-vehicle crashes (involving two or more vehicles). Overall 36.6 percent of motorcycle crashes were single-vehicle compared to 9.9 percent of passenger car crashes. Most motorcycle and passenger car crashes involved two vehicles, accounting for 55.6 percent and 71.1 percent of crashes, respectively.

Table 6. Motorcycles and Passenger Cars by Number of Vehicles in Crashes, 2015–2020.

Category	Motorcycle		Passenger Car	
	Freq.	%	Freq.	%
Single Vehicle	18,062	36.6%	284,312	9.9%
Two Vehicles Involved	27,452	55.6%	2,045,278	71.1%
Three Vehicles Involved	2,990	6.1%	417,189	14.5%
Four Vehicles Involved	542	1.1%	93,637	3.3%
Five or More Vehicles Involved	342	0.7%	37,506	1.3%
Total	49,388	100.0%	2,877,922	100.0%

Demographics

Motorcycle Crashes

Motorcycle Operators

Age

The most common age group for motorcycle operators involved in crashes in Texas was 25 to 44 years old (44.2 percent; n=21,674) followed by 45 to 59 years old (24.7 percent; n=12,100) and 16 to 24 years old (18.6 percent; n=9,114). Figure 17 shows the distribution of age groups for motorcycle operators involved in a crash.

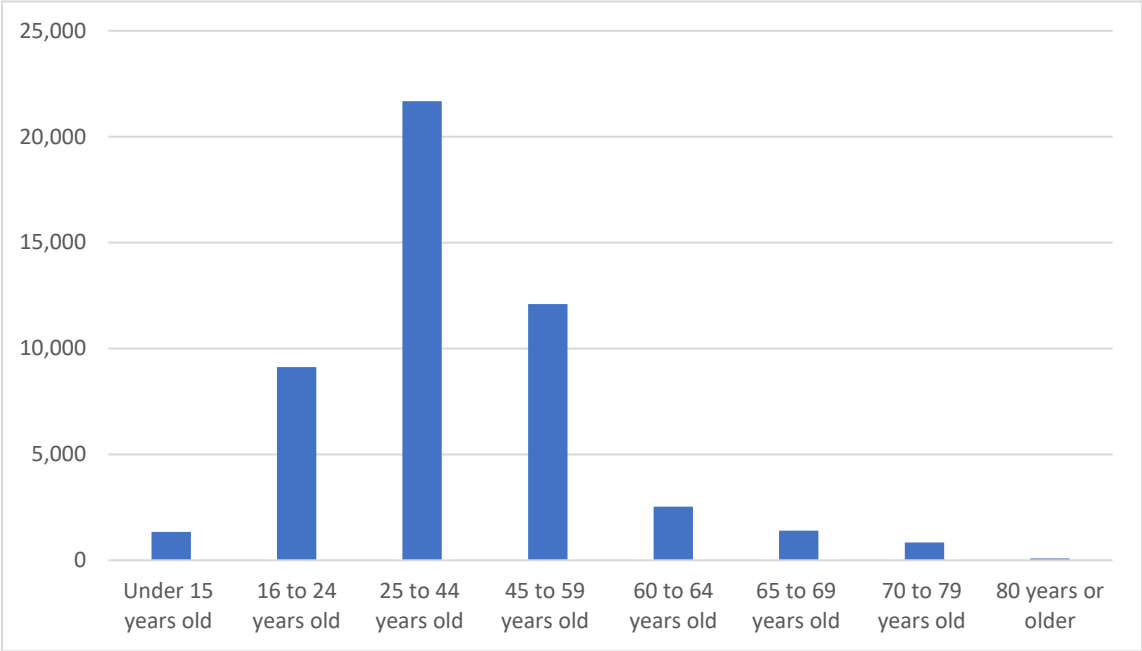


Figure 17. Age Groups of Motorcycle Operators, 2015–2020.

Gender

Figure 18 shows the gender of motorcycle operators involved in crashes. The majority of operators were male, 94.8 percent.

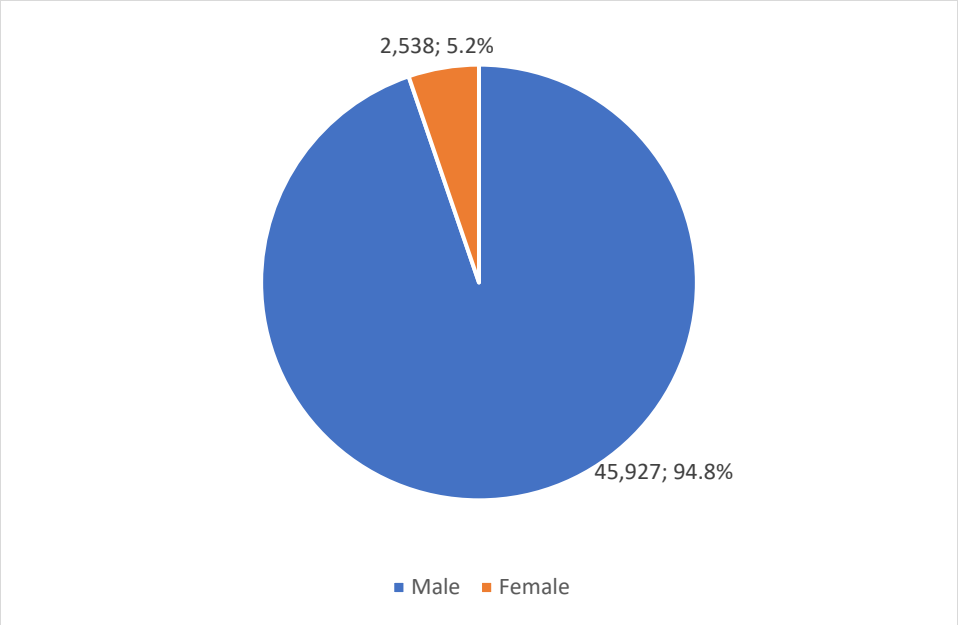


Figure 18. Gender of Motorcycle Operators, 2015–2020.

Licensing Status

Figure 19 displays license compliance for motorcycle operators. Forty-one percent of motorcycle operators involved in a crash did not possess a valid motorcycle license/endorsement.

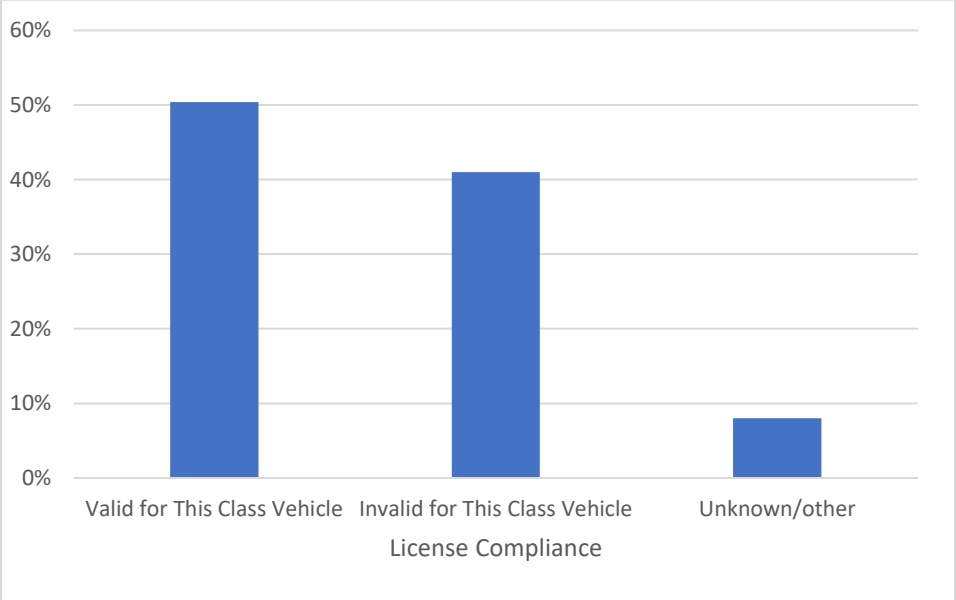


Figure 19. License Compliance of Motorcycle Operators, 2015–2020.

Helmet Use

Helmet use was examined for motorcycle operators involved in a crash (see Figure 20). Slightly more than half of the motorcycle operators were reported to be wearing a helmet.

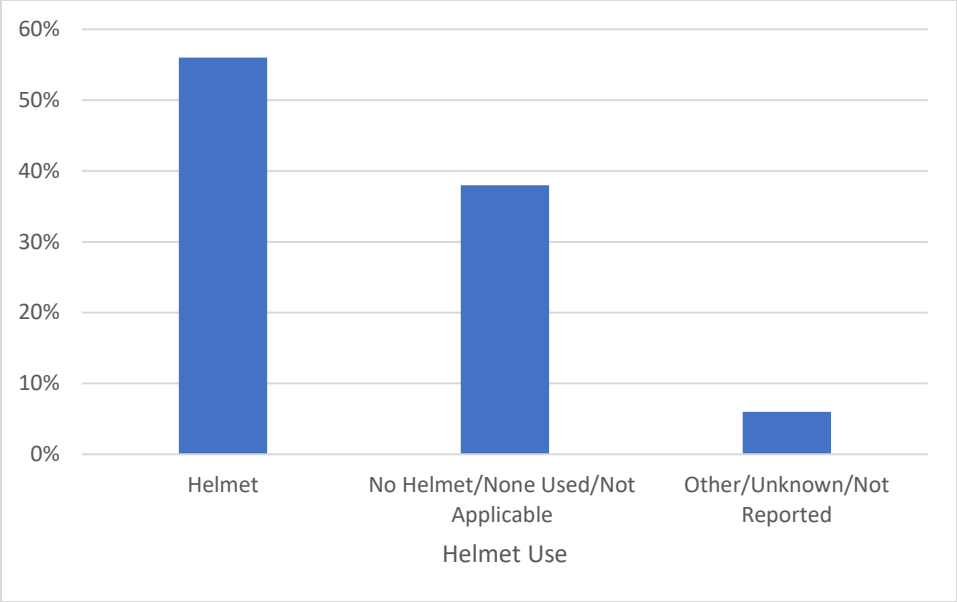


Figure 20. Helmet Status of Motorcycle Operators, 2015–2020.

Passenger Car Crashes

Passenger Car Drivers

Age

The most common age group for passenger car drivers in Texas was 25 to 44 years old (39.4 percent; n=1,636,279) followed by 16 to 24 years old (24.2 percent; n=1,003,394) and 45 to 59 years old (17.9 percent; n=744,389). Figure 21 shows the age groups of passenger car drivers involved in a crash.

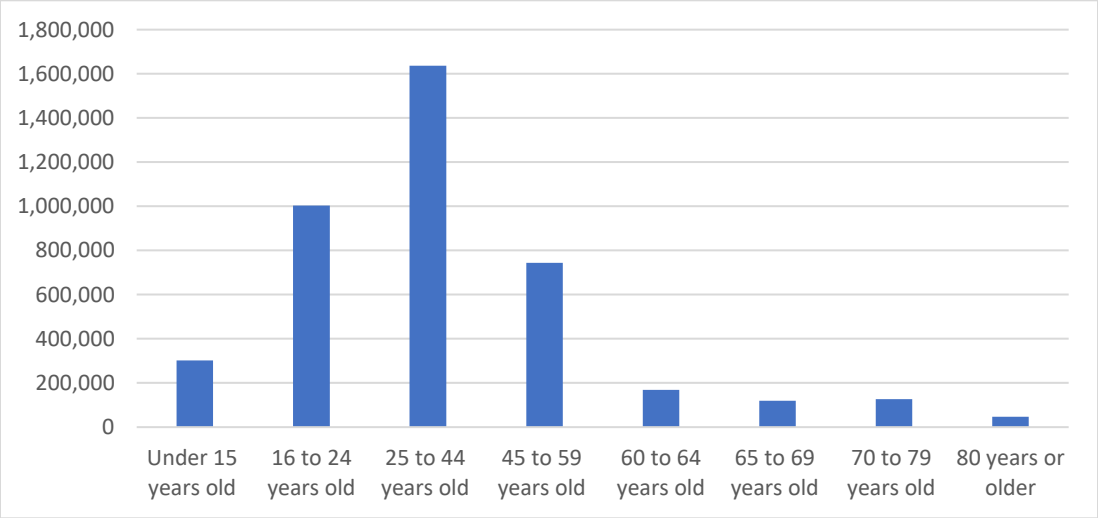


Figure 21. Age Groups of Passenger Car Drivers, 2015–2020.

Gender

Figure 22 shows the gender of passenger car drivers involved in a crash. The majority were male (51.8 percent).

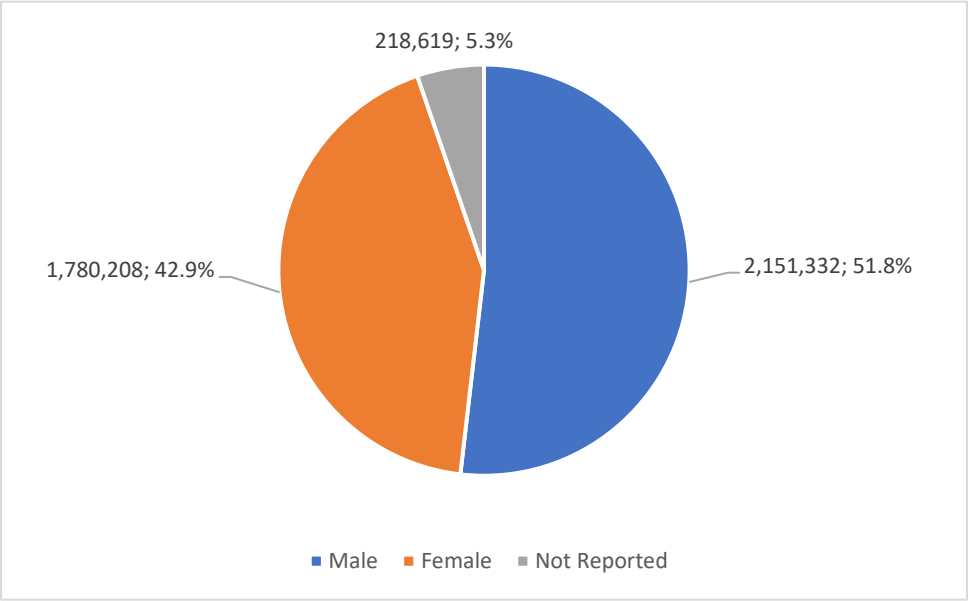


Figure 22. Gender of Passenger Car Drivers, 2015–2020.

Licensing Status

Figure 23 displays license compliance for passenger car drivers. Approximately 77 percent of passenger car drivers had a valid license.

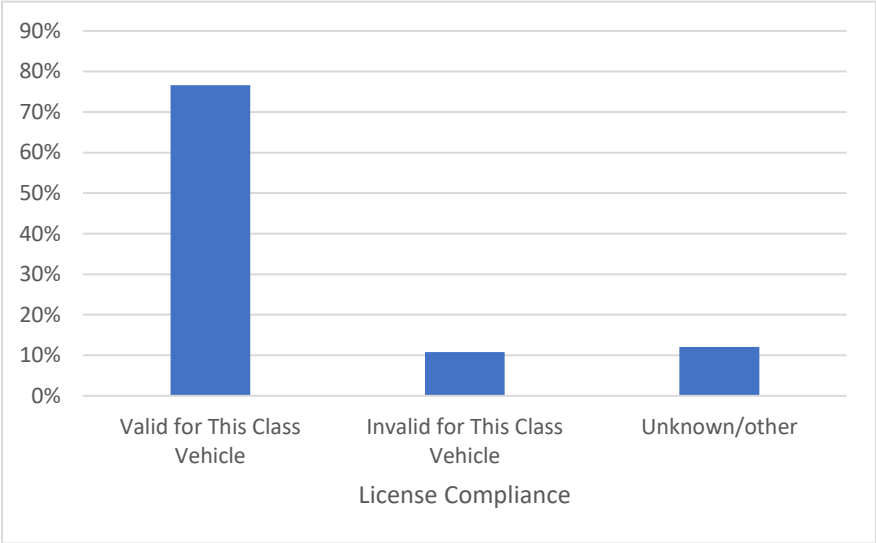


Figure 23. License Compliance of Passenger Car Drivers, 2015–2020.

Crash Factors

Speed Involvement

Speed was examined for crashes. Motorcycle crashes had a higher percentage of speed-related crashes compared to passenger cars, 10.4 percent versus 2.5 percent, respectively (see Figure 24). The percentage is even higher when restricted to fatal and suspected serious injury crashes, 16.5 percent versus 7.0 percent, respectively.

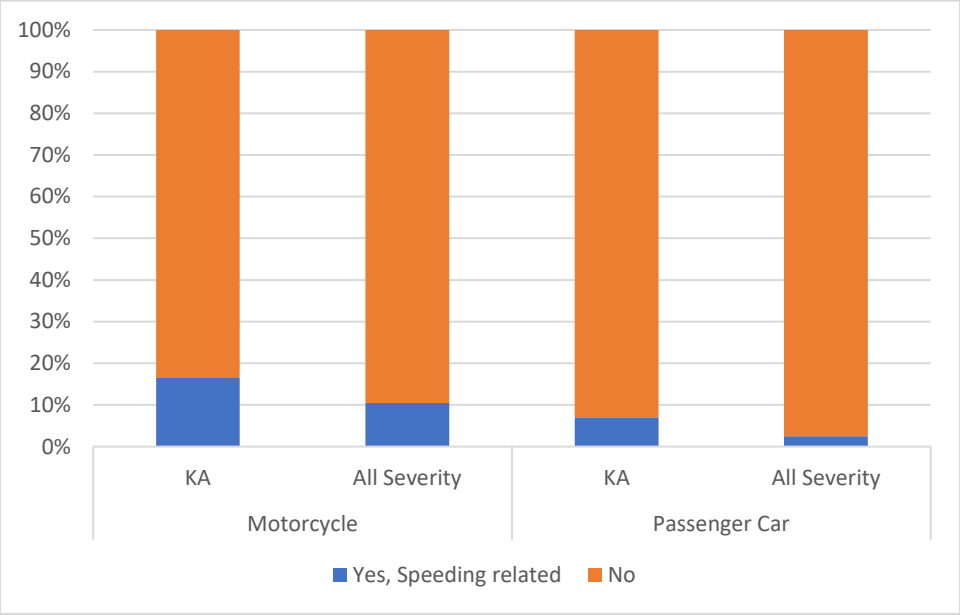


Figure 24. Speed Involvement of Crashes by Crash Classification, 2015–2020.

Impairment

Impairment was examined for crashes. (Note that most crashes have an unknown/missing impairment status in CRIS data.)

Drug

Overall motorcycle crashes had a higher percentage of involving a drug-impaired driver compared to passenger car crashes, 1.2 percent versus 0.1 percent, respectively (see Table 7).

Table 7. Drug Impairment Status of Crashes, 2015–2020.

Driver Impaired	Motorcycle		Passenger Car	
	Freq.	%	Freq.	%
Yes	577	1.2%	4,713	0.1%
No	761	1.6%	4,065	0.1%
Unknown/Missing	47,743	97.3%	4,141,381	99.8%
Total	49,081		4,150,159	

Alcohol

Blood alcohol concentration (BAC) values were examined for crashes, and motorcycle crashes had a higher percentage of alcohol-impaired drivers compared to passenger car crashes, 2.5 percent versus 0.9 percent, respectively (see Table 8).

Table 8. Alcohol Impairment Status of Crashes, 2015–2020.

Driver Impaired	Motorcycle Freq.	Motorcycle %	Passenger Car Freq.	Passenger Car %
Positive BAC	1,226	2.5%	37,466	0.9%
No Alcohol	969	2.0%	9,862	0.2%
Unknown	46,502	94.7%	4,085,551	98.4%
Missing	384	0.8%	17,280	0.4%
Total	49,081		4,150,159	

Distraction

The project team examined distraction and found that 6.3 percent of motorcycle operators were found to be distracted compared to 10.2 percent of passenger car drivers (see Figure 25).

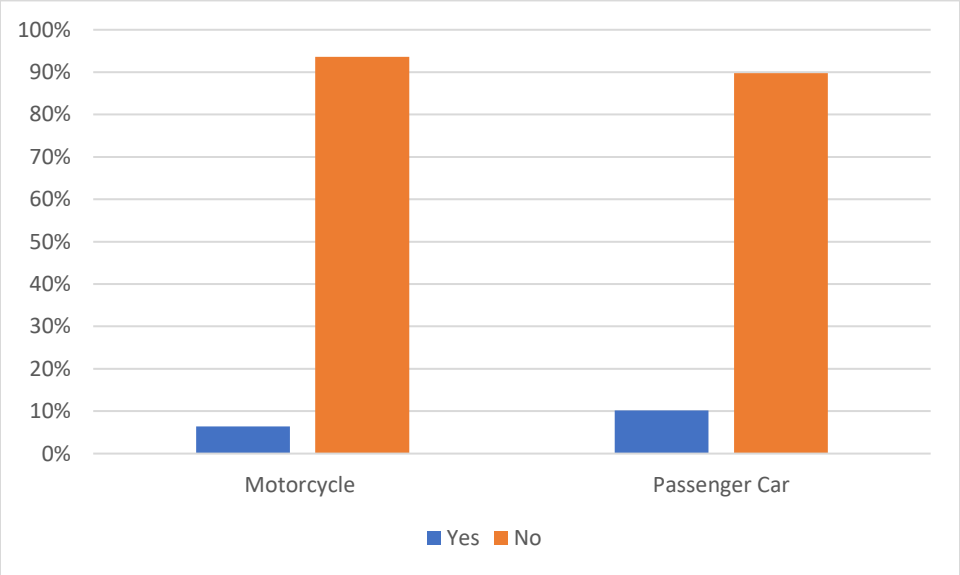


Figure 25. Distraction Status of Crashes, 2015–2020.

Types of driver distraction were analyzed. The most common reported category was "Distraction" for both motorcycle operators and drivers of passenger cars; however, motorcyclists had lower percentages of "Inattention" and "Cellular Phone Related" compared to passenger car drivers (see Table 9).

Table 9. Selected Attributes of Driver Distraction in Crashes, 2015–2020.

Category	Motorcycle		Passenger Car	
	Freq.	%	Freq.	%
Inattention (Inattentive)	79	2.5%	35,504	12.0%
Distraction	3,039	96.7%	256,773	87.1%
Cellular-Phone–Related	35	1.1%	14,741	5.0%
Total (Driver Distracted)	3,142	100.0%	294,784	100.0%

Driver-Related Factors

Table 10 displays the frequency of selected driver-related factors. The top factor was "Failed to Control Speed" for both motorcycle and passenger car crashes. Motorcyclists had lower percentages of "Failed to Control Speed," "Unsafe Speed," and "Driver Inattention" compared to passenger car drivers.

Table 10. Selected Driver-Related Factors in Crashes, 2015–2020.

Top Five Driver-Related Factors	Motorcycle		Top Five Driver-Related Factors	Passenger Car	
	Freq.	%		Freq.	%
Failed to Control Speed	7,963	16.5%	Failed to Control Speed	399,814	18.5%
Unsafe Speed	4,373	9.0%	Driver Inattention	257,371	11.9%
Animal on Road—Wild	3,353	6.9%	Changed Lane When Unsafe	115,767	5.4%
Driver Inattention	3,048	6.3%	Failed to Drive in Single Lane	100,647	4.7%
Changed Lane When Unsafe	2,520	5.2%	FTYROW—Turning Left	1,00,028	4.6%

Environmental Factors

Weather

For motorcycle crashes, a higher percentage occurred during clear weather compared to passenger car crashes (see Table 11). This may be due to motorcycle operators choosing to ride during nicer weather.

Table 11. Weather Conditions of Crashes, 2015–2020.

Weather	Motorcycle		Passenger Car	
	Freq.	%	Freq.	%
Clear	40,381	79.3%	1,588,737	68.5%
Rain	1,435	2.2%	199,527	8.0%
Sleet, Hail	10	0.0%	2,609	0.2%
Snow	5	0.0%	2,811	1.1%
Fog, Smog, Smoke	139	0.5%	9,613	1.1%
Severe Crosswinds	84	0.2%	984	0.1%
Blowing Sand, Soil, Dirt	12	0.0%	503	0.0%
Other	14	0.1%	844	0.1%
Cloudy	6,165	11.3%	343,328	15.0%
Other/Unknown	86	6.5%	8,690	5.8%
Total	6,165	100.0%	2,157,646	100.0%

Surface Condition

Both motorcycle and passenger car crashes were most likely to occur on dry surface conditions (data not shown). However, motorcyclists had a higher percentage compared to passenger cars, 93.5 percent versus 85.6 percent (data not shown).

Light Condition

The team examined lighting condition for crashes (see Table 12). Most crashes occurred during daylight; however, motorcycle crashes had a slightly lower percentage of "Daylight" crashes compared to passenger cars, 64.9 percent versus 68.3 percent, respectively. Motorcycle crashes also had a slightly higher percentage occurring in "Dark—Not Lighted" conditions compared to passenger car crashes, 11.6 percent versus 8.2 percent, respectively.

Table 12. Lighting Conditions of Crashes, 2015–2020.

Lighting Condition	Motorcycle		Passenger Car	
	Freq.	%	Freq.	%
Daylight	31,373	64.9%	1,473,984	68.3%
Dark—Not Lighted	5,619	11.6%	176,947	8.2%
Dark—Lighted	9,825	20.3%	436,352	20.2%
Dawn	356	0.7%	20,450	0.9%
Dusk	811	1.7%	24,784	1.1%
Dark—Unknown Lighting	276	0.6%	16,262	0.8%
Other/Not Reported/Unknown	54	0.1%	7,480	0.3%
Total	48,331	100.0%	2,157,646	100.0%

Intersections

Intersection status was examined for crashes. Motorcycles had a higher percentage of not occurring at an intersection compared to passenger vehicle crashes (see Figure 26).

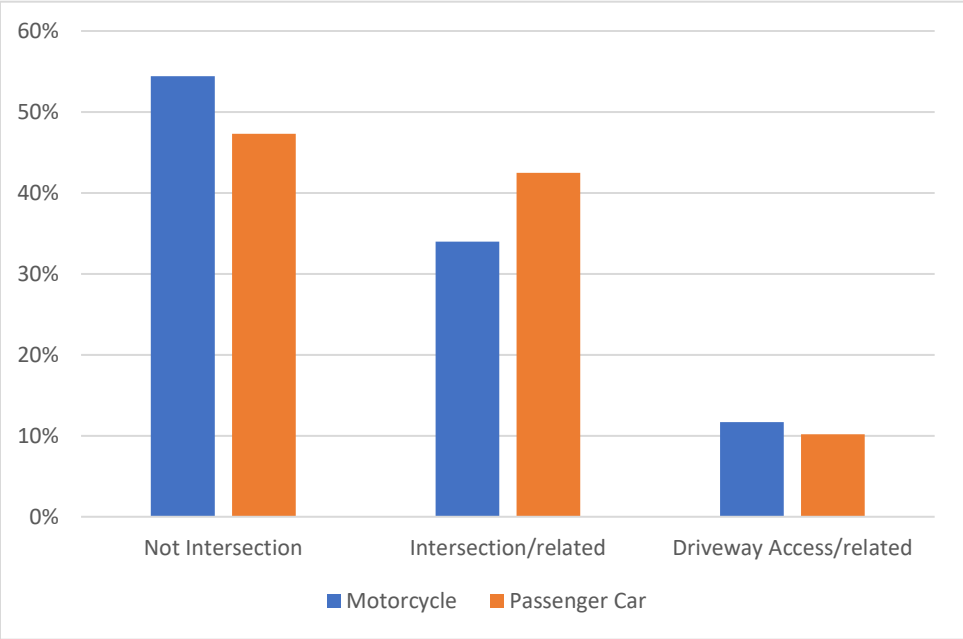


Figure 26. Intersection Status of Crashes, 2015–2020.

Intersection Crashes by Age

Figure 27 shows the age of motorcycle operators and passenger car drivers involved in intersection-related crashes. Motorcycle operators had a slightly higher percentage of being 25 to 44 years old compared to passenger car drivers.

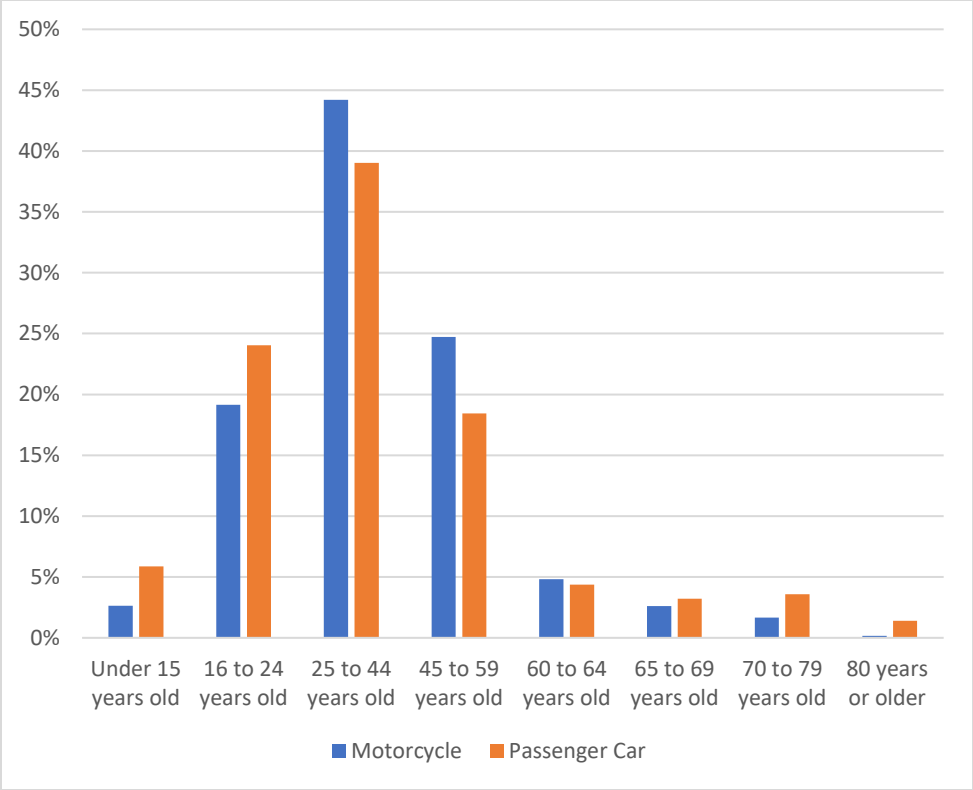


Figure 27. Age Groups of Motorcycle Operators and Passenger Car Drivers in an Intersection-Related Crash, 2015–2020.

Intersection Crashes by Light Condition

Lighting condition was examined for intersection-related crashes. Motorcycle-involved crashes had a higher percentage of occurring in "Dark" lighting conditions compared to passenger car crashes, 32.9 percent versus 27.7 percent, respectively (see Table 13).

Table 13. Lighting Conditions of Intersection-Related Crashes, 2015–2020.

Light Condition	MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%
Day	11,007	67.0%	660,224	72.0%
Dark	5,395	32.9%	254,301	27.7%
Total	16,420		916,631	

Intersection Crashes by Day of Week

Motorcycle intersection-related crashes had a higher percentage of occurring on weekdays compared to intersection-related passenger car crashes (see Table 14).

Table 14. Day of Week of Intersection-Related Crashes, 2015–2020.

Day	MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%
Sunday	2,435	14.8%	99,274	10.8%
Monday	1,928	11.7%	129,290	14.1%
Tuesday	2,050	12.5%	134,666	14.7%
Wednesday	2,127	13.0%	136,137	14.9%
Thursday	2,248	13.7%	138,475	15.1%
Friday	2,646	16.1%	154,321	16.8%
Saturday	2,986	18.2%	124,468	13.6%
Total	16,420		916,631	

Intersection Crashes by Crash Type

The team examined the top crash types for intersection-related crashes. The most common crash type for motorcycle crashes was one motor vehicle going straight while the top for passenger car crashes was angle/both going straight (see Table 15).

Table 15. Top Five Crash Types for Intersection-Related Crashes, 2015–2020.

MC-Involved Crashes			PC-Involved Crashes		
Crash Type	Freq.	%	Crash Type	Freq.	%
One Motor Vehicle—Going Straight	3,226	19.6%	Angle—Both Going Straight	255,581	27.9%
Angle—Both Going Straight	2,891	17.6%	Same Direction—One Straight and One Stopped	194,036	21.2%
Opposite Direction—One Straight and One Left Turn	2,863	17.4%	Opposite Direction—One Straight and One Left Turn	136,110	14.8%
Same Direction—One Straight and One Stopped	1,723	10.5%	Angle—One Straight and One Left Turn	62,543	6.8%
Angle—One Straight and One Left Turn	1,268	7.7%	Same Direction—Both Going Straight—Rear-End	52,022	5.7%
Total	16,420		Total	916,631	

Intersection Crashes by Traffic Control Device

As expected, motorcycle-involved crashes had a higher percentage of having no traffic control device compared to passenger car crashes, possibly due to motorcycles being less visible than passenger cars (see Figure 28).

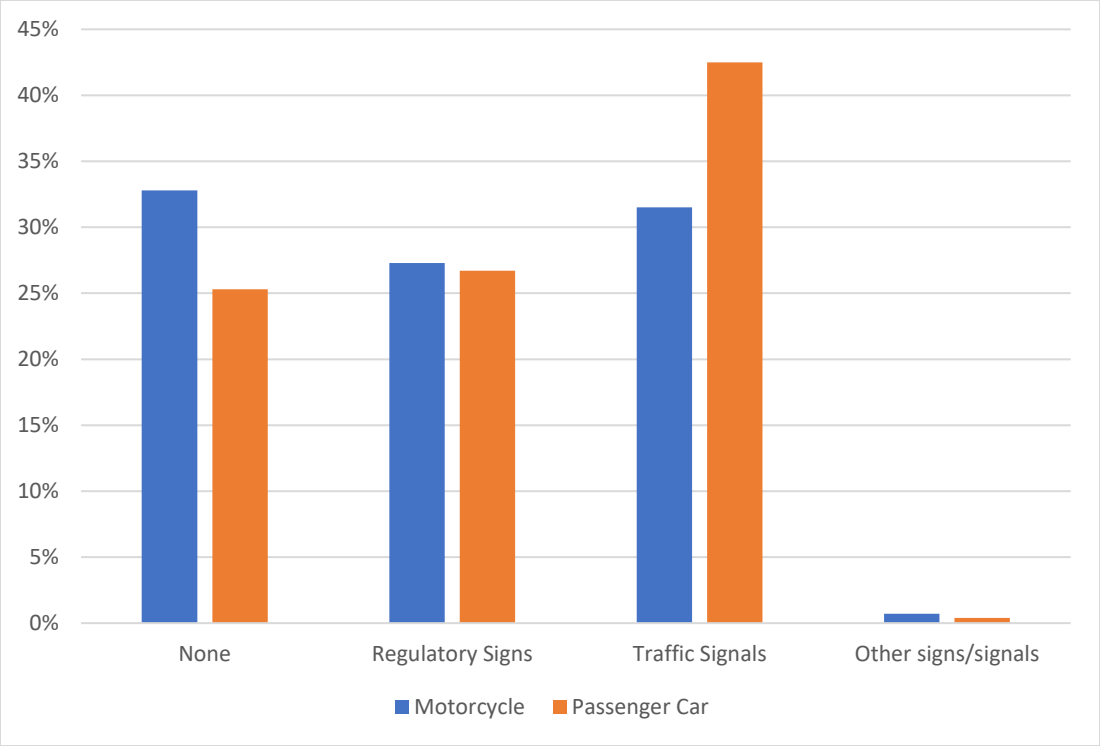


Figure 28. Traffic Control Device of Intersection-Related Crashes, 2015–2020.

Trafficway

The trafficway was examined for crashes as shown in Table 16. Motorcycle crashes had a lower percentage occurring on divided roadways with four or more lanes, compared to passenger car crashes, 27.7 percent versus 30.7 percent, respectively.

Table 16. Trafficway of Crashes, 2015–2020.

Category	MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%
Two Lane, Two Way	7,320	15.1%	149,382	6.9%
Four or More Lanes, Divided	13,373	27.7%	662,232	30.7%
Four or More Lanes, Undivided	5,091	10.5%	229,840	10.7%
Total	48,331	100.0%	2,157,646	100.0%

Curve

Curve involvement was examined for crashes. All curve categories of motorcycle-involved crashes were more likely than for passenger cars (see Table 17).

Table 17. Curve Involvement in Crashes, 2015–2020.

Category	MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%
Straight, Level	34,341	71.1%	1,806,262	83.7%
Straight, Grade	3,892	8.1%	152,716	7.1%
Straight, Hillcrest	1,150	2.4%	42,011	1.9%
Curve, Level	5,566	11.5%	95,487	4.4%
Curve, Grade	2,664	5.5%	40,840	1.9%
Curve, Hillcrest	520	1.1%	9,164	0.4%
Total	48,331	100.0%	2,157,646	100.0%

Additional Analyses

Rear-End Crashes

The team conducted a deep dive analysis of rear-end crashes in 2019. In 2019 there were 850 crashes with a manner of collision of "same direction—both going straight—rear end" involving at least one motorcycle (see Figure 29). The crashes involved 907 motorcycles that were identified as being involved in the first harmful event that resulted in a rear-end crash. Thirty-five percent (n=317) of the motorcycles were rear-ended by another vehicle; those are classified as "rear ended." Sixty-five percent (n=590) of the motorcycle operators rear-ended another vehicle; those are classified as "not rear ended."

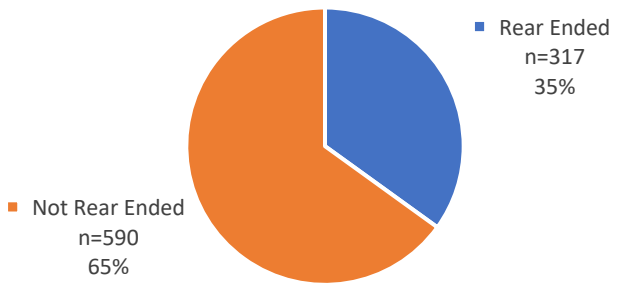


Figure 29. Rear-End Crash Status, 2019.

The percentage of the motorcycle operators, based on whether they were rear-ended or not, was the same, but of the riders that rear-ended a vehicle, 21 percent sustained a suspected serious injury as compared to 15 percent of motorcycle operators that were rear-ended by another vehicle. They also had a slightly higher percentage of suspected minor and possible injuries. In the group of operators that was rear-ended by another vehicle, 29 percent were not injured. Figure 30 shows the percentage of operators by their injury severity based on the rear-end crash classification.

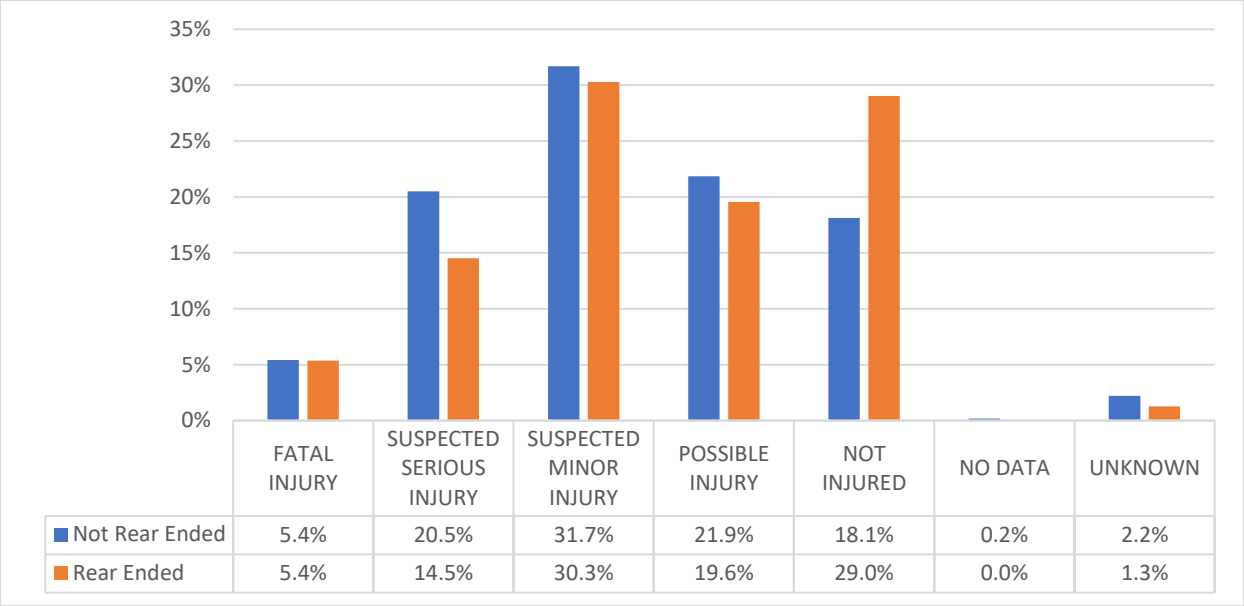


Figure 30. Percentage of Motorcycle Operators by Injury Severity and Rear-End Classification, 2019.

The rear-end crashes most often occurred not in relation to an intersection. However, for the motorcycles that were rear-ended, a higher percentage, 18.9 percent, were in an intersection-related crash, compared to 10.8 percent of the not-rear-ended. Table 18 lists the percentage of motorcycles by rear-end crash classification and intersection relation.

Table 18. Percentage of Motorcycles by Intersection Relation and Rear-End Classification, 2019.

Intersection Relation	Not-Rear-Ended	Rear-Ended	Total
Driveway Access	5.1%	5.4%	**5.2%**
Intersection-Related	10.8%	18.9%	**13.7%**
Non-intersection	84.1%	75.7%	**81.1%**
Total	**100.0%**	**100.0%**	**100.0%**

The high percentage of non-intersection-related crashes is consistent with the roadway system data in that 40.6 percent of the crashes occurred on interstates and state highways, where there is less of a chance of a roadway intersection. Table 19 lists the percentage of motorcycles by the roadway system on which they crashed and their rear-end classification.

Table 19. Percentage of Motorcycles by Intersection Relation and Rear-End Classification, 2019.

Roadway System	Not-Rear-Ended	Rear-Ended	Total
Interstate	28.6%	24.3%	27.1%
Local Road/Street	22.7%	23.0%	22.8%
State Highway	13.2%	13.9%	13.5%
US Highway	13.4%	12.3%	13.0%
Farm to Market	8.5%	10.7%	9.3%
State Loop	5.3%	4.7%	5.1%
Toll Road	4.2%	2.5%	3.6%
County Road	2.5%	5.4%	3.5%
Spur	0.5%	1.3%	0.8%
Business US	0.3%	0.6%	0.4%
Ranch Road	0.2%	0.6%	0.3%
Business Interstate	0.0%	0.3%	0.1%
Ranch to Market	0.2%	0.0%	0.1%
Business FM	0.0%	0.3%	0.1%
Business State	0.2%	0.0%	0.1%
Park Road	0.2%	0.0%	0.1%
Total	**100.0%**	**100.0%**	**100.0%**

Looking at the number of motorcycles that crashed on each type of roadway system and whether the motorcycles were rear-ended or not, it was found that on the roadway system with the larger counts of motorcycles involved in rear-end crashes, a motorcycle was more likely to rear-end another vehicle. Table 20 lists the percentage of motorcycles by rear-end classification and the roadway system on which they crashed and the total number of motorcycles.

Table 20. Percentage of Motorcycle Operators by Rear-End Classification and Roadway System, 2019.

Roadway System	Not-Rear-Ended	Rear-Ended	Total Percentage	Total Motorcycles
Interstate	68.7%	31.3%	100.0%	246
Local Road/Street	64.7%	35.3%	100.0%	207
US Highway	66.9%	33.1%	100.0%	118
State Highway	63.9%	36.1%	100.0%	122
Farm to Market	59.5%	40.5%	100.0%	84
State Loop	67.4%	32.6%	100.0%	46
Toll Road	75.8%	24.2%	100.0%	33
County Road	46.9%	53.1%	100.0%	32
Spur	42.9%	57.1%	100.0%	7
Business US	50.0%	50.0%	100.0%	4
Ranch to Market	100.0%	0.0%	100.0%	1
Business State	100.0%	0.0%	100.0%	1
Ranch Road	33.3%	66.7%	100.0%	3
Park Road	100.0%	0.0%	100.0%	1
Business FM	0.0%	100.0%	100.0%	1
Business Interstate	0.0%	100.0%	100.0%	1
Total	**65.0%**	**35.0%**	**100.0%**	**907**

Motorcycle operators that rear-ended another vehicle are usually assigned a crash contributing factor by law enforcement. Of the 590 motorcycle operators that rear-ended another vehicle, 514 operators were assigned one or more contributing factors. Of the 70 contributing factors listed on the *CR-3 Texas Crash Report*, only 21 of the contributing factors were assigned to the motorcycle operators that rear-ended another vehicle. Of the count of contributing factors assigned, 54.1 percent were "failed to control speed." An example of when this contributing factor might be assigned would be when a motorcycle is following another vehicle that slows or stops for congestion ahead and the motorcycle operator fails to slow down, and rear-ends the vehicle ahead of him/her. Table 21 lists the contributing factors assigned to the motorcycle operators that rear-ended another vehicle and the percentage of the total.

Table 21. Contributing Factors Assigned to Motorcycle Operators That Rear-Ended Another Vehicle, 2019.

Crash Contributing Factor	Count of Contributing Factors	Percentage of Contributing Factors
Failed to Control Speed	356	54.1%
Driver Inattention	77	11.7%
Followed Too Closely	77	11.7%
Faulty Evasive Action	30	4.6%
Unsafe Speed	24	3.6%
Changed Lane When Unsafe	23	3.5%
Other (Explain in Narrative)	19	2.9%
Under Influence—Alcohol	15	2.3%
Speeding (Overlimit)	10	1.5%
Failed to Drive in Single Lane	9	1.4%
Distraction in Vehicle	3	0.5%
Turned When Unsafe	2	0.3%
Failed to Pass to Left Safely	2	0.3%
Road Rage	2	0.3%
Failed to Pass to Right Safely	2	0.3%
Ill (Explain in Narrative)	2	0.3%
Passed in No Passing Lane	1	0.2%
Failed to Signal Or Gave Wrong Signal	1	0.2%
Pedestrian FTYROW to Vehicle	1	0.2%
FTYROW—Yield Sign	1	0.2%
Parked And Failed to Set Brakes	1	0.2%
Total	658	100.0%

Failure to control speed may be more of an issue on roadways with higher speed limits. Of the operators that rear-ended another vehicle, 43.9 percent were on a roadway with a speed limit between 55 and 65 mph. In comparison, 33.1 percent of the operators that were rear-ended were on a roadway with the same speed limit. Table 22 lists the percentage of motorcycle operators by speed limit group and rear-end classification. Table 22. Percentage of Motorcycle Operators by Speed Limit Group and Rear-End Classification, 2019.

Speed Limit Group	Not-Rear-Ended	Rear-Ended	Total
35 mph or less	12.9%	19.2%	15.1%
40–50 mph	24.2%	25.9%	24.8%
55–65 mph	43.9%	33.1%	40.1%
70 mph or higher	14.2%	15.5%	14.7%
Unknown	4.7%	6.3%	5.3%
Total	**100.0%**	**100.0%**	**100.0%**

Ninety-four percent of the rear-end crashes involving a motorcycle occurred on a straight, not curved, roadway. Whether the motorcycle rear-ended another vehicle or was rear-ended, the crash most likely occurred on a straight roadway.

Of the 907 motorcycle operators, 93.9 percent (852) were male. Motorcycle operators aged 21- to 29-years-old made up the largest percentage of operators involved in a rear-end crash. Females have a higher percentage of riders in the 20-to-21 and 50-to-64 age group, as compared to males. Table 23 lists the percentage of operators by age group and gender.

Table 23. Percentage of Motorcycle Operators by Age Group and Gender involved in a Rear-End Crash, 2019.

Age Group	Female	Male	Total
Under 15	0.0%	0.1%	0.1%
Age 15–20	4.4%	5.0%	5.0%
Age 21–29	33.3%	29.9%	30.1%
Age 30–39	15.6%	22.9%	22.5%
Age 40–49	17.8%	17.3%	17.3%
Age 50–64	26.7%	19.4%	19.7%
Age 65–79	2.2%	4.1%	4.0%
Age 80+	0.0%	0.1%	0.1%
No Data	0.0%	1.2%	1.1%
Total	100.0%	100.0%	100.0%

Note: 2019 does not include operators with unknown age.

Comparing the male-to-female motorcycle riders, it was found that 65.3 percent of the male operators rear-ended another vehicle, where 57.8 percent of the female operators did the same. Women were less likely to rear-end another vehicle.
Table 24 lists the percentage of each gender by their rear-end classification.

Table 24. Percentage of Motorcycle Operators by Gender and Rear-End Classification, 2019.

Gender	Not-Rear-Ended	Rear-Ended	Total
Female	57.8%	42.2%	100.0%
Male	65.3%	34.7%	100.0%
Total	**64.9%**	**35.1%**	**100.0%**

Narrative Review

Rear-end narratives for 2019 were examined. Bigrams found the most common two words were control speed (46.2 percent), which indicates that almost half of rear-end crashes had something to do with speed (see Table 25).

Table 25. Rear-End Narrative Bigrams, 2019.

Bigram	Number of Narratives (%)
control speed	375 (46.2%)

fail control	362 (44.6%)
speed struck	127 (15.6%)
struck rear	102 (12.6%)
struck back	81 (10.0%)
bound block	71 (8.7%)
rate speed	64 (7.9%)
rear end	63 (7.8%)
high rate	63 (7.8%)
direct behind	58 (7.1%)

The team produced a word cloud for 2019 rear-end narratives (see Figure 31). Consistent with the bigrams analysis, speed appears to be an important term used in these narratives.

Figure 31. Rear-End Crash Narrative Word Cloud in 2019.

Next, the narratives were flagged based on keywords for multiple topic areas as described in the methods section (see Table 26). Speed-related key terms were the most common followed by reference to fault.

Table 26. Flagged Rear-End Narratives by Topic Area in 2019.

Topic	Number of Narratives Flagged (%)
Distraction	25 (3.1%)
Speed	426 (52.5%)
Intersection-Related	48 (5.9%)
FTYROW	6 (0.7%)
Fault	104 (12.8%)
Visibility	39 (4.8%)
Impairment	21 (2.6%)

Charge Exploratory Analysis

Reported charges for motorcycle crashes were examined and split by driver status (e.g., motorcyclists, vehicle driver). There were 32,054 classified charges for the crashes. Of these, 61.3 percent were motorcyclists who received a charge associated with the crash and 38.7 percent were for drivers involved in a motorcycle crash.

Table 27 summarizes the charges by driver classification for motorcycle-involved crashes. The top three charge classifications for motorcyclists were speed (20.5 percent; n=4,036), no insurance/failed to maintain financial responsibility (19.5 percent; n=3,834), and no motorcycle license (15.8 percent; n=3,116). Note that 14.1 percent of motorcyclists were found to have no license, which may be indicative of no motorcycle endorsement, but this information could not be obtained from the charge field. The top three charge classifications for passenger vehicle drivers were FTYROW (35.5 percent; n=4,401), no license (17.5 percent; n=2,170), and no insurance/failed to maintain financial responsibility (10.0 percent; n=1,241).

Comparing motorcyclists and other drivers, motorcyclists had higher percentages of speeding, impairment, and failing to drive in a single lane, whereas motorcyclists had lower percentages of FTYROW, unsafe lane changes, and running or disregarding signs or signals.

Another important finding from the pilot charge review is that 0.4 percent of motorcycle charges indicated the vehicle involved was an all-terrain vehicle (ATV) or an off-highway vehicle (OHV), which are often difficult to obtain from structured crash data alone.

Table 27. Charges Classified by Driver Classification, 2015–2020.

Charge Category	# of Motorcyclists (% of Motorcyclist Charges)	# of Drivers (% of Driver Charges)
Other/Unclassified	869 (4.4%)	701 (5.7%)
ATV/OHV on Roadway	77 (0.4%)	4 (0.0%)
Driving in Improper Location	34 (0.2%)	13 (0.1%)
Fail to Drive in Single Lane	504 (2.6%)	150 (1.2%)
Drive on Improved Shoulder	63 (0.3%)	5 (0.0%)
Drove Wrong Way/Wrong Side	53 (0.3%)	41 (0.3%)
Possession of Drugs or Paraphernalia	86 (0.4%)	35 (0.1%)
Open Container	7 (0.0%)	10 (0.1%)
Impairment	1,061 (5.4%)	457 (3.7%)
Hit and Run	4 (0.0%)	3 (0.0%)
Improper/Unsafe Start	13 (0.1%)	27 (0.2%)
U-turn	3 (0.0%)	36 (0.3%)
Fixed Object	19 (0.1%)	11 (0.1%)
Unsafe Movement/Reckless Driving/Fail to Maintain Control	120 (0.6%)	71 (0.6%)
Load Issue	3 (0.0%)	25 (0.2%)
No Helmet	153 (0.8%)	1 (0.0%)
Vehicle Defect	30 (0.2%)	21 (0.2%)
No Headlights/Lights	23 (0.1%)	5 (0.0%)
Ran/Disregard Red Light/Stop Sign/Traffic Control Device/Officer	314 (1.6%)	368 (3.0%)
Followed Too Closely/Failed to Maintain Clear Distance	254 (1.3%)	155 (1.3%)
No License	2,776 (14.1%)	2,170 (17.5%)
License Restriction	57 (0.3%)	61 (0.5%)
No Motorcycle License	3,116 (15.8%)	7 (0.1%)
FTYROW	374 (1.9%)	4,401 (35.5%)
Back When Unsafe	0 (0.0%)	140 (1.1%)
Passed Unsafe/Disregard No Passing Zone	249 (1.3%)	52 (0.4%)
Unsafe Lane Change	201 (1.0%)	634 (5.1%)
Speed	4,036 (20.5%)	1,061 (8.6%)
Turn	84 (0.4%)	444 (3.6%)
No Insurance/Failed to Maintain Financial Responsibility	3,834 (19.5%)	1,241 (10.0%)
Unregistered/Uninspected Vehicle	1,510 (7.7%)	213 (1.7%)

Motorcycle VMT

Table 28 presents the estimation of Texas motorcycle VMT using the method described above in the methods section. Specifically, the average of the annual mileages calculated as a function of the proportion of total VMT attributable to motorcycles is shown for each travel survey and as a combination of the two. The two estimates are combined by taking the average (midpoint) of the two proportions of the total VMT (NHTS and TxDOT TSP), applied to total VMT to generate the estimated motorcycle VMT. Therefore, the "combined" values are not an average of the individual survey values, even though they all use the same number of registered motorcycles and total VMT in their respective calculations.

Table 28. 2019 Texas Statewide Motorcycle VMT (millions).

Data Source	Average Annual Motorcycle Mileage	Annual Motorcycle VMT (millions)
TxDOT TSP	5,665	1,899
NHTS	2,436	817
TxDOT TSP and NHTS Combined	3,681	1,234

The team determined causes of estimate decreases from 2014 to 2016 resulted from reductions in motorcycle registrations, as well as changes in the NHTS estimates (see Table 29). From 2016 to 2021 there was an additional reduction in motorcycle registrations, which resulted in additional decreases.

Table 29. Comparison of Texas Statewide Motorcycle VMT (millions).

	2021		2016			2014		
Data Source	Average Annual Motorcycle Mileage	Annual Motorcycle VMT (millions)	Average Annual Motorcycle Mileage	Annual Motorcycle VMT (millions)	Percent Decrease from 2016 to 2021	Average Annual Motorcycle Mileage	Annual Motorcycle VMT (millions)	Percent Decrease From 2014 to 2021
TxDOT TSP	5,665	1,899	5,665	2,139	11.2%	5,665	2,496	14.3%
NHTS	2,436	817	2,436	920	11.2%	3,373	1,486	38.1%
TxDOT TSP and NHTS Combined	3,681	1,234	3,681	1,390	11.2%	4,224	1,861	25.3%

VMT RATES

The average annual motorcycle VMT was used to calculate crash rates per 100 million VMT for 2019 (see Table 30). The motorcycle fatal crash rate per 100 million VMT is 29.9 times higher for motorcycles compared to the rate for all vehicles in 2019.

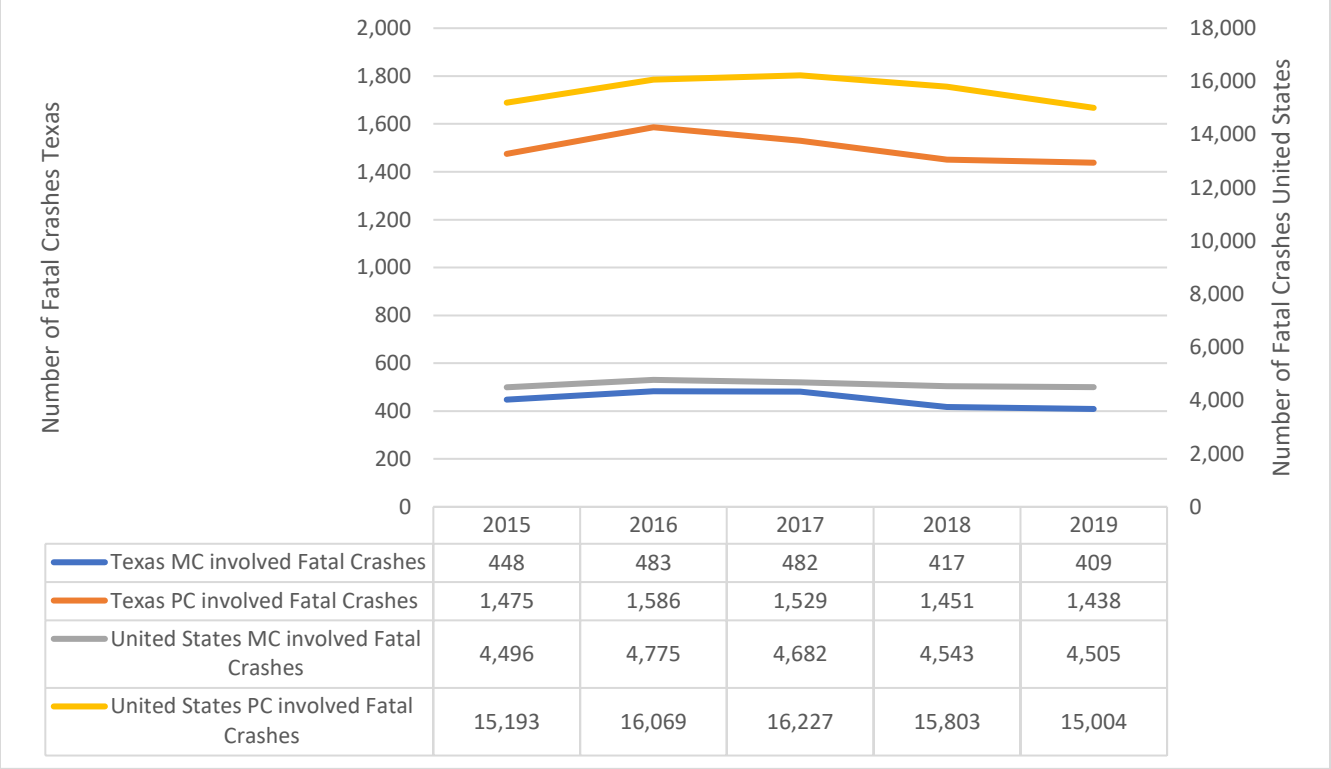
Table 30. Crash and Injury Rates Per 100 Million VMT for Motorcycles versus All Vehicles for Texas, 2019.

	VMT	Fatal Crash Rate	Suspected Serious Injury Crash Rate	Fatal and Suspected Serious Injury Crash Rate	Total Crash Rate
Motorcycles	1,234,042,832	32.9	138.4	171.3	608.6
All Vehicles	288,226,726,953	1.1	4.5	5.6	195.1

FARS

Crash Counts

From 2015 to 2019, there were 2,239 fatal motorcycle crashes in Texas and 23,001 fatal motorcycle crashes in the United States. Figure 32 displays the number of fatal crashes involving motorcycles and passenger cars. The number of fatal crashes involving a motorcycle in Texas increased between 2015 and 2016 and then decreased. From 2015 to 2019, there was a net 8.7 percent decrease in fatal motorcycle crashes. A similar trend was observed for fatal passenger car crashes with a 2.5 percent decrease during the period. Similar to Texas, there was an increase in fatal motorcycle crashes in the rest of the United States (i.e., excluding Texas) from 2015 to 2016 but immediately began to decrease in 2017. In the rest of the United States, there was a 0.2 percent increase in fatal motorcycle crashes from 2015 to 2019. Conversely, there was a 1.2 percent decrease in the number of fatal passenger car crashes over the same period.



	2015	2016	2017	2018	2019
Texas MC involved Fatal Crashes	448	483	482	417	409
Texas PC involved Fatal Crashes	1,475	1,586	1,529	1,451	1,438
United States MC involved Fatal Crashes	4,496	4,775	4,682	4,543	4,505
United States PC involved Fatal Crashes	15,193	16,069	16,227	15,803	15,004

Figure 32. Frequency of Fatal Crashes involving Motorcycles and Passenger Cars in Texas and the United States (excluding Texas), 2015–2019.

The team mapped fatal motorcycle crashes by state (see Figure 33). The three highest states based on counts were Florida (n=1,899), California (n=1,781), and Texas (n=1,756).

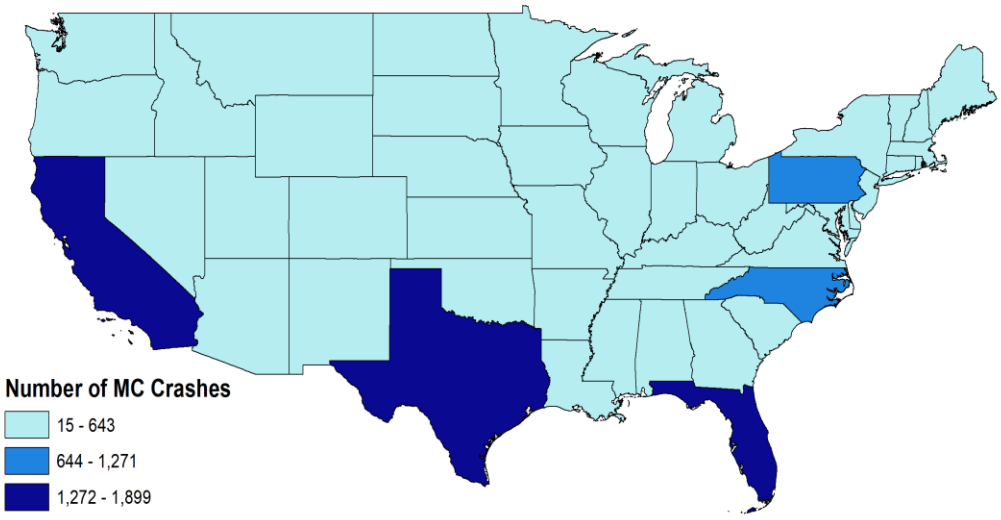


Figure 33. Fatal Motorcycle Crashes by State, 2015-2019 (Only Showing Contiguous States).

The motorcycle crash rate per 100,000 driving population was examined (see Figure 34 and Table 31). The motorcycle crash rate per 100,000 driving population was 7.09 for the United States as a whole (data not shown). The top 10 states are shown below. Texas does not fall into this list, but does have a higher crash rate per 100,000 driving population (8.1 per 100,000) compared to the U.S. average.

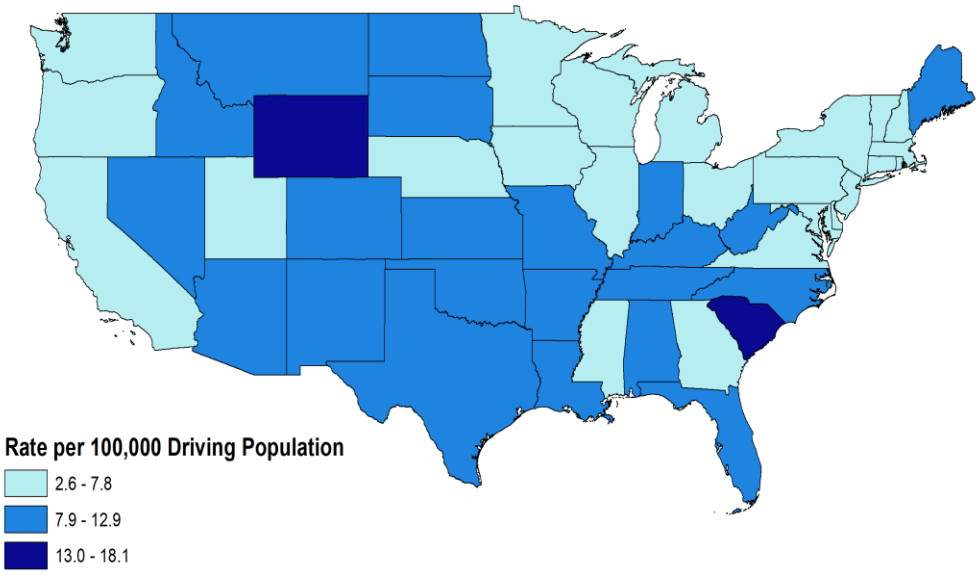


Figure 34. Fatal Motorcycle Crash Rate Per 100,000 Driving Population (Only Showing Contiguous States).

Table 31. Top 10 States Motorcycle Crash Rates Per 100,000 Driving Population.

State	Population 16 Years and Over	Number of Crashes	Motorcycle Crash Rate Per 100,000 Driving Population
Wyoming	459,282	83	18.1
South Carolina	4,044,398	563	13.9
South Dakota	679,043	83	12.2
Arkansas	2,374,747	287	12.1
Montana	847,280	100	11.8
Florida	17,201,999	1,899	11.0
Oklahoma	3,080,177	333	10.8
New Mexico	1,661,646	178	10.7
Tennessee	5,377,153	572	10.6
Kentucky	3,553,869	358	10.1

The motorcycle crash rate per 100,000 registered motorcycle was examined (see Figure 35 and Table 32). The motorcycle crash rate per 100,000 registered motorcycle was 216.6 per 100,000 for the United States (data not shown). The top state based on registered motorcycle was Louisiana followed by Texas. Interestingly, South Carolina, Florida, and Kentucky were on both top 10 lists for driving population and registered motorcycle rates.

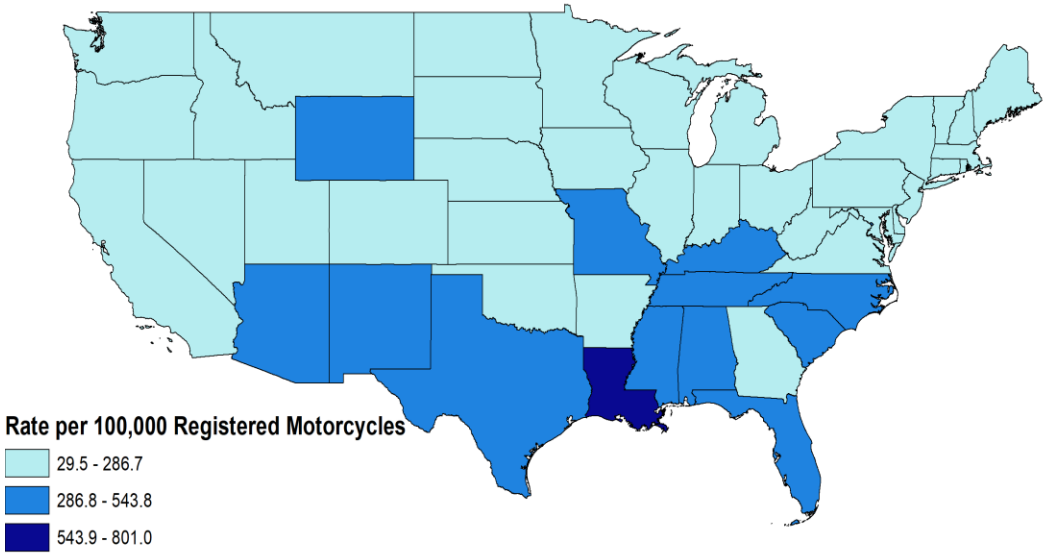


Figure 35. Fatal Motorcycle Crash Rate Per 100,000 Registered Motorcycles (Only Showing Contiguous States).

Table 32. Top 10 States Motorcycle Crash Rates Per 100,000 Registered Motorcycles.

State	Average Motorcycles Registered	Number of Crashes	Motorcycle Crash Rate Per 100,000 Registered Motorcycles
Louisiana	3,682,698	330	801.0
Texas	21,736,238	1,756	499.8
South Carolina	4,044,398	563	483.2
Mississippi	2,354,101	150	476.1
North Carolina	8,233,448	689	366.8
District of Columbia	579,127	15	344.7
Arizona	5,600,921	547	340.8
Florida	17,201,999	1,899	321.2
Kentucky	3,553,869	358	319.1
Missouri	4,881,733	431	317.0

Injury Severity

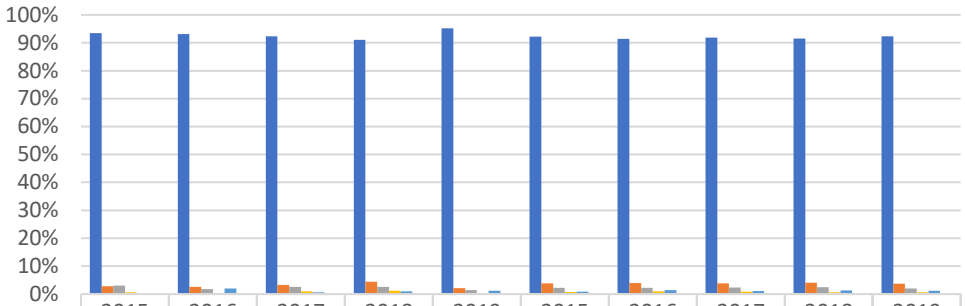
Injury severity was examined for motorcycle operators and motorcycle passengers involved in crashes. The majority of operators involved were fatally injured (91.9 percent), whereas approximately 50.2 percent of motorcycle passengers were fatally injured (see Table 33).

Table 33. Injury Severity for Motorcycle Operators and Passengers involved in Fatal Crashes, 2015–2019.

Injury Severity	MC Operators				MC Passengers			
	US (excluded TX)		TX		US (excluded TX)		TX	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Fatal	21,980	91.9%	2,148	93.0%	1,395	53.2%	121	50.2%
Suspected Serious Injury	926	3.9%	70	3.0%	824	31.4%	78	32.4%
Suspected Minor Injury	535	2.2%	53	2.3%	262	10.0%	31	12.9%
Possible Injury	175	0.7%	15	0.6%	71	2.7%	9	3.7%
No Apparent Injury	274	1.1%	22	1.0%	49	1.9%	2	0.8%

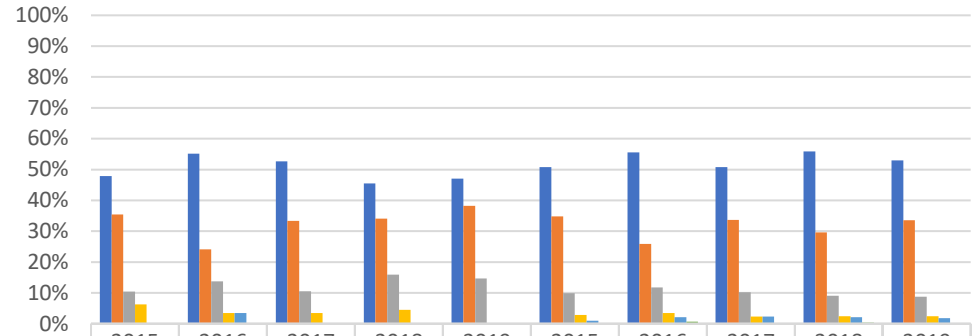
Injured, Severity Unknown	20	0.1%	0	0.0%	9	0.3%	0	0.0%
Total	23,924		2,309		2,621		241	

Injury severity was examined by year for both motorcycle operators and motorcycle passengers (see Figure 36 and Figure 37). Injury severity percentages remained consistent for motorcycle operators, whereas motorcycle passengers experienced an increase in fatalities and injuries over the same period.



	Texas MC Operators					United States MC Operators (excluding TX)				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Fatal	93.5%	93.2%	92.4%	91.0%	95.2%	92.3%	91.4%	91.9%	91.5%	92.4%
Suspected Serious Injury	2.8%	2.6%	3.2%	4.4%	2.1%	3.8%	3.9%	3.8%	4.1%	3.7%
Suspected Minor Injury	3.1%	1.8%	2.6%	2.5%	1.4%	2.3%	2.2%	2.3%	2.4%	2.0%
Possible Injury	0.7%	0.4%	1.0%	1.1%	0.0%	0.7%	0.9%	0.8%	0.6%	0.6%
No Apparent Injury	0.0%	2.0%	0.6%	0.9%	1.2%	0.8%	1.4%	1.0%	1.3%	1.2%
Injured, Severity Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%

Figure 36. Injury Severity for Motorcycle Operators involved in Fatal Crashes, 2015–2019.



	Texas PC Drivers					United States PC Drivers				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Fatal	47.9%	55.2%	52.6%	45.5%	47.1%	50.7%	55.5%	50.8%	55.9%	53.0%
Suspected Serious Injury	35.4%	24.1%	33.3%	34.1%	38.2%	34.8%	25.9%	33.7%	29.7%	33.6%
Suspected Minor Injury	10.4%	13.8%	10.5%	15.9%	14.7%	9.9%	11.8%	10.2%	9.1%	8.8%
Possible Injury	6.3%	3.4%	3.5%	4.5%	0.0%	2.8%	3.4%	2.4%	2.5%	2.4%
No Apparent Injury	0.0%	3.4%	0.0%	0.0%	0.0%	0.9%	2.2%	2.4%	2.1%	1.8%
Injured, Severity Unknown	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%	0.2%	0.4%	0.2%

Figure 37. Injury Severity for Motorcycle Passengers involved in Fatal Crashes, 2015–2019.

Crash Time

Crash day of week was examined. Motorcycle crashes in both Texas and the rest of the United States had higher percentages of occurring on weekends compared to passenger car crashes (see Figure 38). Compared to the rest of the United States during the weekend, Texas had a higher percentage of motorcycle-involved fatalities on Friday and Sunday, but the percentage was higher for the rest of the United States on Saturday.

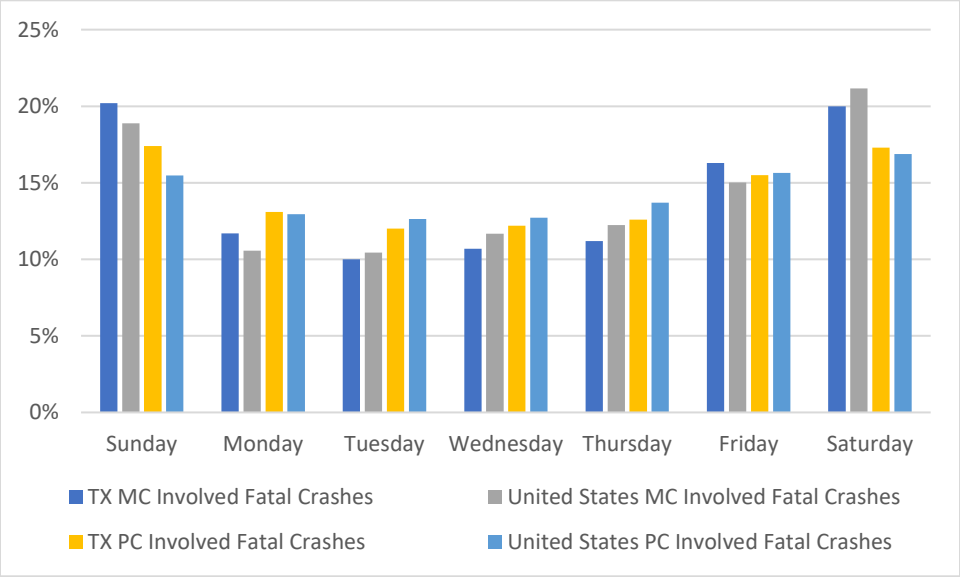


Figure 38. Day of Week in Fatal Crashes in Texas and the United States (excluding Texas), 2015–2019.

The team examined the hour of the crash (see Figure 39). Motorcycle crashes in both Texas and the rest of the United States occurred more frequently in the evening hours compared to passenger cars.

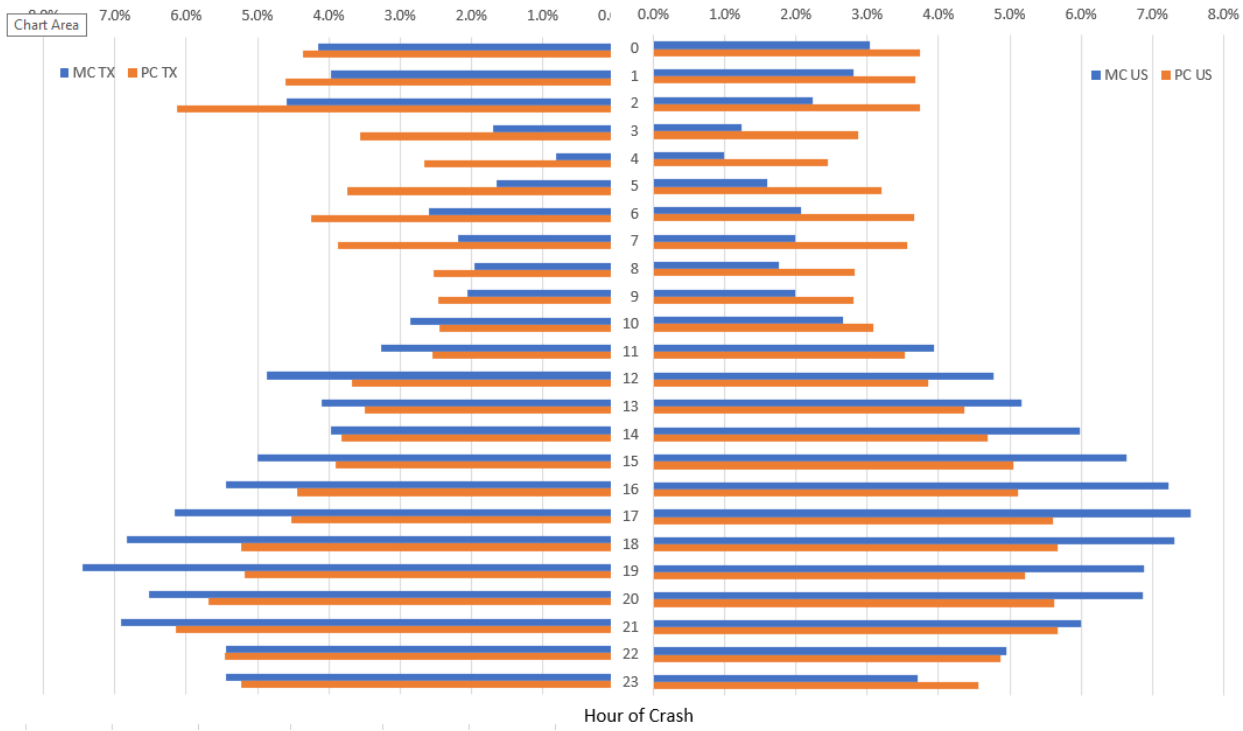


Figure 39. Hour of Crash in Fatal Crashes in Texas and the United States (excluding Texas), 2015–2019.

Single-Vehicle versus Multi-vehicle

The number of vehicles involved in fatal crashes was examined (see Table 34). The majority of crashes were multi-vehicle crashes (involving two or more vehicles). In Texas, 40.0 percent of fatal motorcycle crashes were single-vehicle crashes, compared to 31.5 percent of fatal passenger car crashes. In the rest of the United States, there were similar percentages of single-vehicle fatal motorcycle (37.1 percent) and fatal passenger car (36.1 percent) crashes.

Table 34. Number of Vehicles in Fatal Crashes in Texas and the United States (excluding Texas), 2015–2019.

Category	Texas				United States (excluding Texas)			
	Motorcycle		Passenger Car		Motorcycle		Passenger Car	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Single Vehicle	925	40.0%	2,808	31.5%	8,877	37.1%	33,755	36.1%
Two Vehicles	1,193	51.6%	4,259	47.8%	12,568	52.5%	42,453	45.4%
Three Vehicles	146	6.3%	1,158	13.0%	1,839	7.7%	10,895	11.7%
Four Vehicles	29	1.3%	338	3.8%	429	1.8%	3,433	3.7%
Five or More Vehicles	19	0.8%	353	4.0%	240	1.0%	2,884	3.1%
Total	2,312	100.0%	8,916	100.0%	23,953	100.0%	93,420	100.0%

Demographics

Motorcycle Crashes

Motorcycle Operators

Age

In both Texas and the rest of the United States, the most common age group for motorcycle operators was 25 to 44 years old (42.8 percent and 38.8 percent, respectively) followed by 45 to 59 years old (29.0 percent and 29.3 percent, respectively). Figure 40 shows the age groups of motorcycle operators involved in fatal crashes.

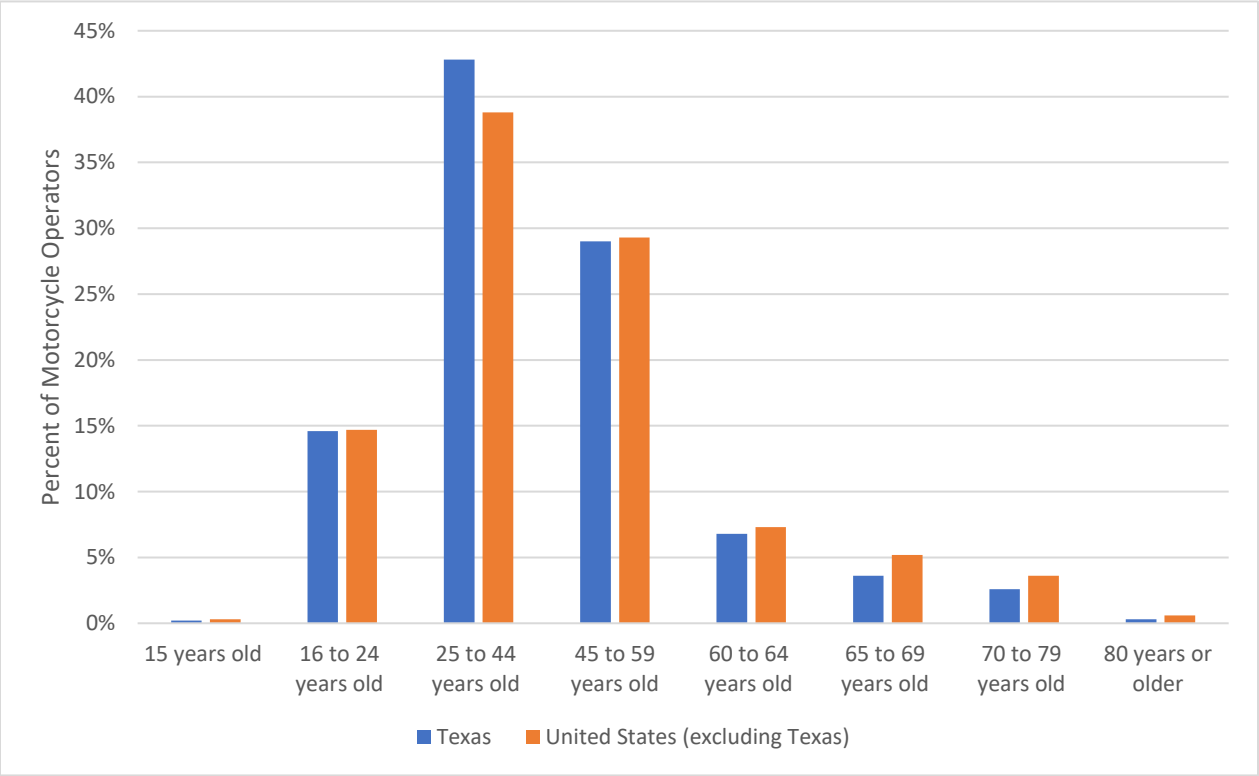


Figure 40. Age Groups of Motorcycle Operators involved in a Fatal Motorcycle Crash, 2015–2019.

Gender

Figure 41 shows the gender of motorcycle operators involved in fatal crashes. The majority of operators were male in both Texas and the rest of the United States, 96.9 percent and 96.3 percent, respectively.

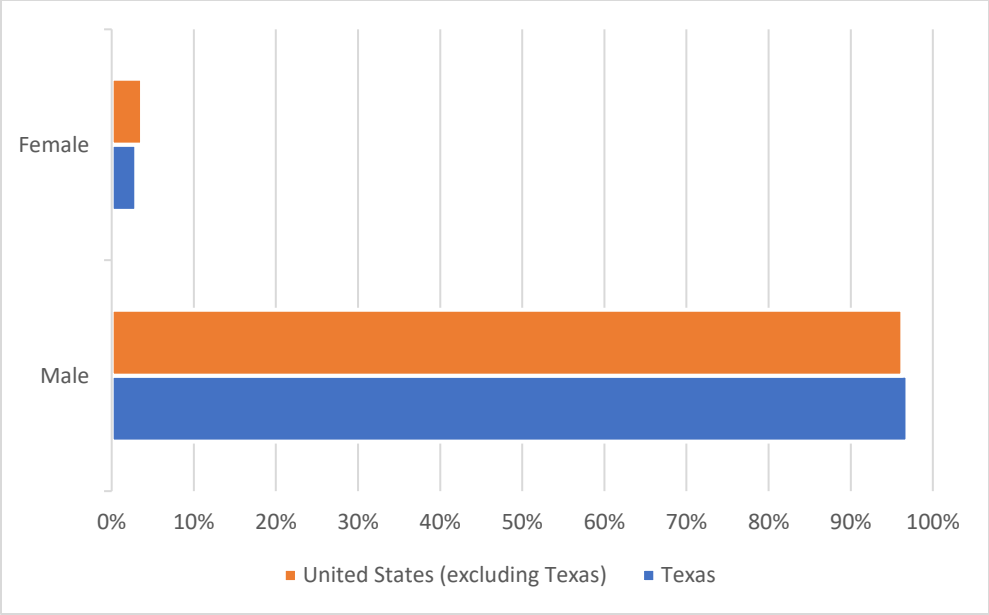


Figure 41. Gender of Motorcycle Operators involved in a Fatal Motorcycle Crash, 2015–2019.

Licensing Status

Figure 42 displays license compliance for motorcycle operators involved in fatal crashes. Interestingly, Texas motorcycle operators had a higher percentage of not possessing a motorcycle endorsement compared to operators in the remaining United States, 38.5 percent versus 27.4 percent, respectively.

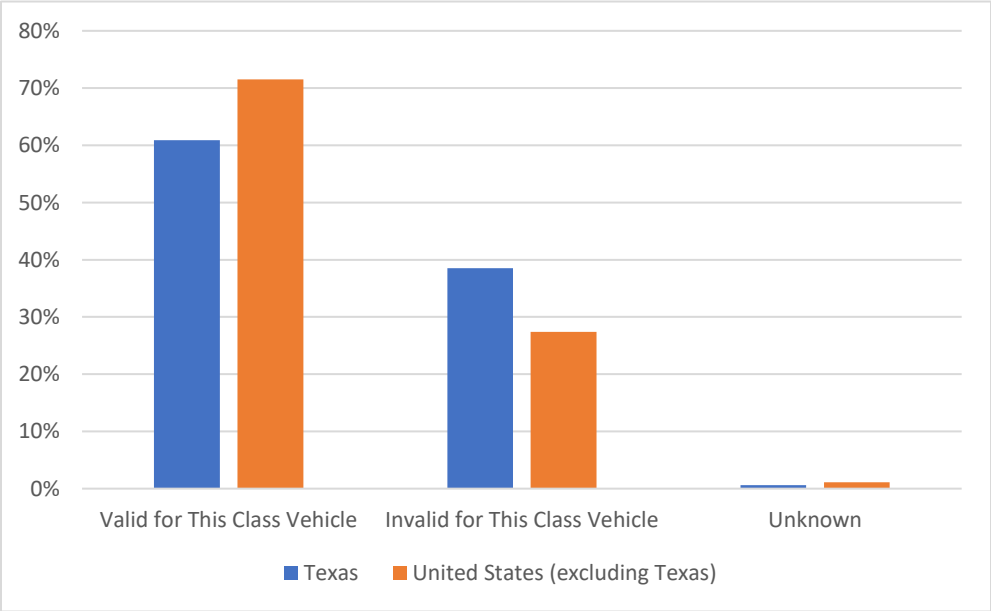


Figure 42. License Compliance of Motorcycle Operators involved in a Fatal Motorcycle Crash, 2015–2019.

Helmet Use

Helmet use was examined for motorcycle operators (see Figure 43). Texas had a lower percent of motorcycle operators wearing a helmet compared to the rest of the United States, 38.5 percent versus 49.1 percent, respectively.

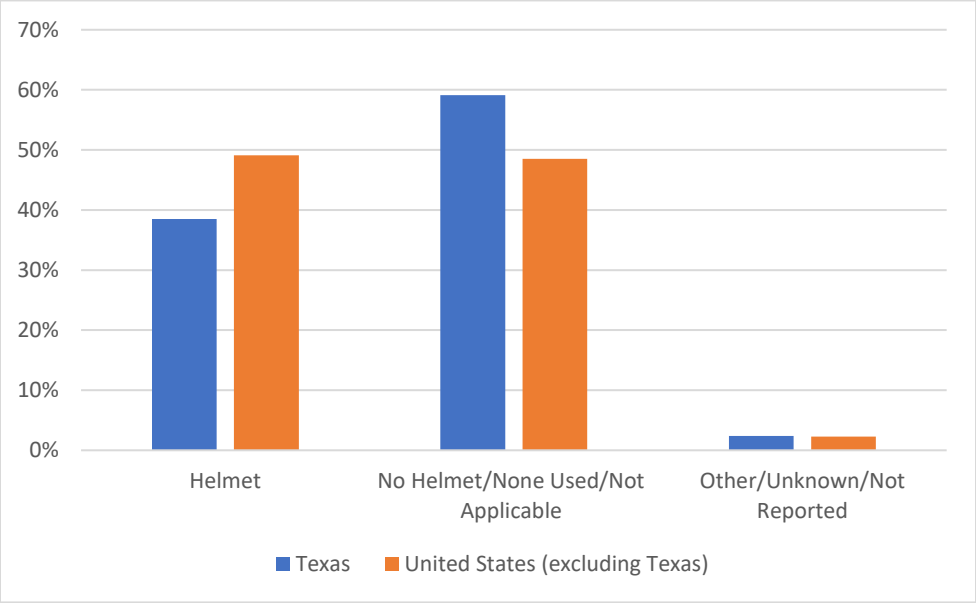


Figure 43. Helmet Status of Motorcycle Operators involved in a Fatal Motorcycle Crash, 2015–2019.

Motorcycle Passengers

Age

In Texas, the most common age group for motorcycle passengers was 25 to 44 years old (42.7 percent). In comparison, the most common age group for motorcycle passengers in the rest of the United States was 45 to 59 years old (34.0 percent). Figure 44 shows the age groups of motorcycle passengers involved in fatal crashes.

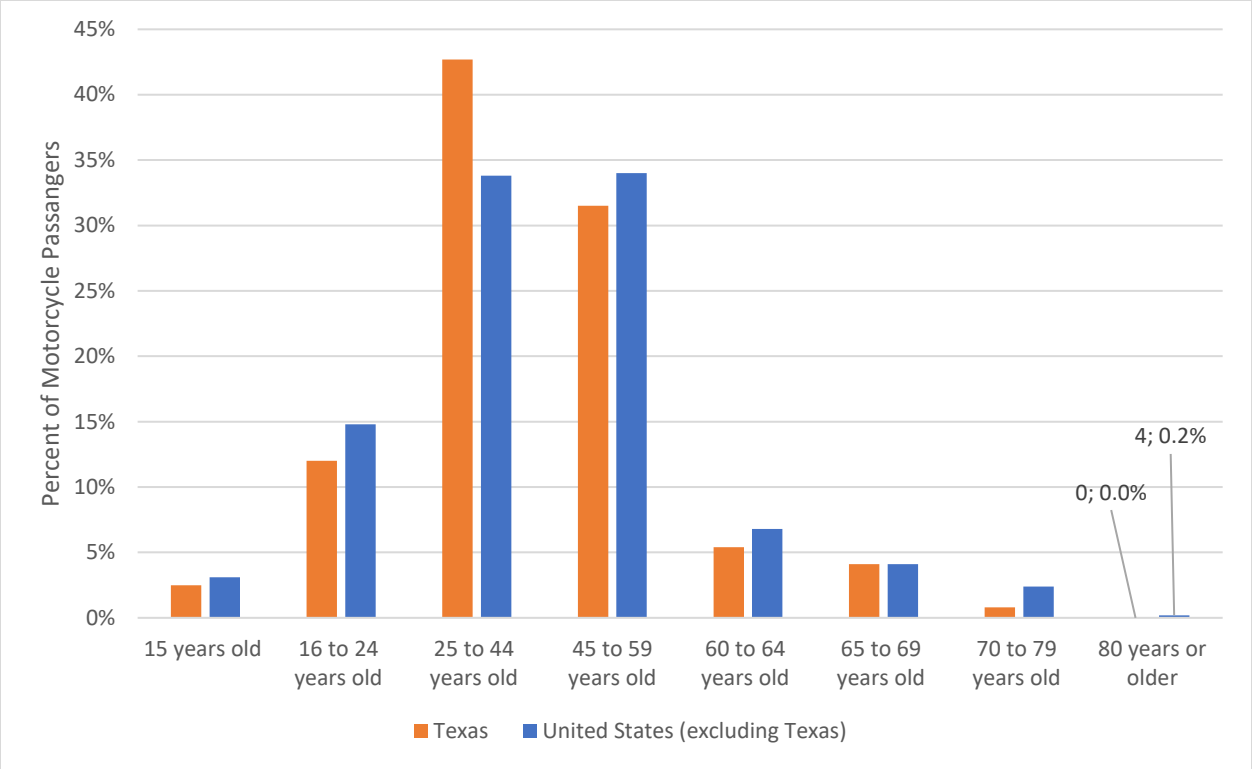


Figure 44. Age Groups of Motorcycle Passengers involved in a Fatal Motorcycle Crash, 2015–2019.

Gender

Figure 45 shows the gender of motorcycle passengers involved in fatal crashes. The majority of passengers were female in both Texas and the remaining United States, 93.8 percent and 90.4 percent, respectively.

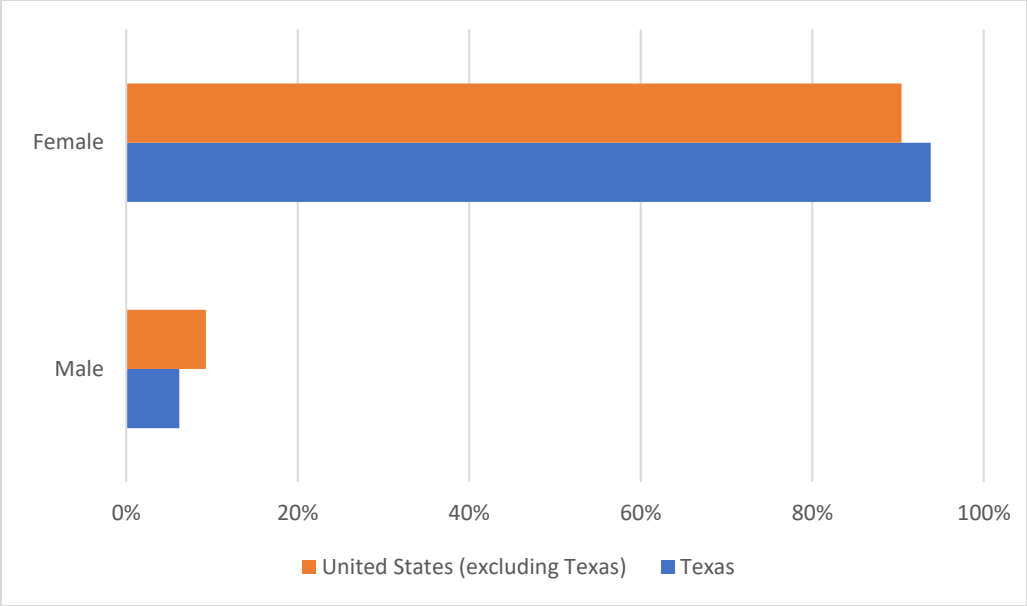


Figure 45. Gender of Motorcycle Passengers involved in a Fatal Motorcycle Crash, 2015–2019.

Helmet Use

Helmet use was examined for motorcycle passengers (see Figure 46). Texas had a lower percent of motorcycle passengers wearing a helmet compared to the United States, 29.0 percent versus 39.9 percent. When compared to operators (see Figure 43), passengers had lower percentages of wearing helmets in Texas and the United States.

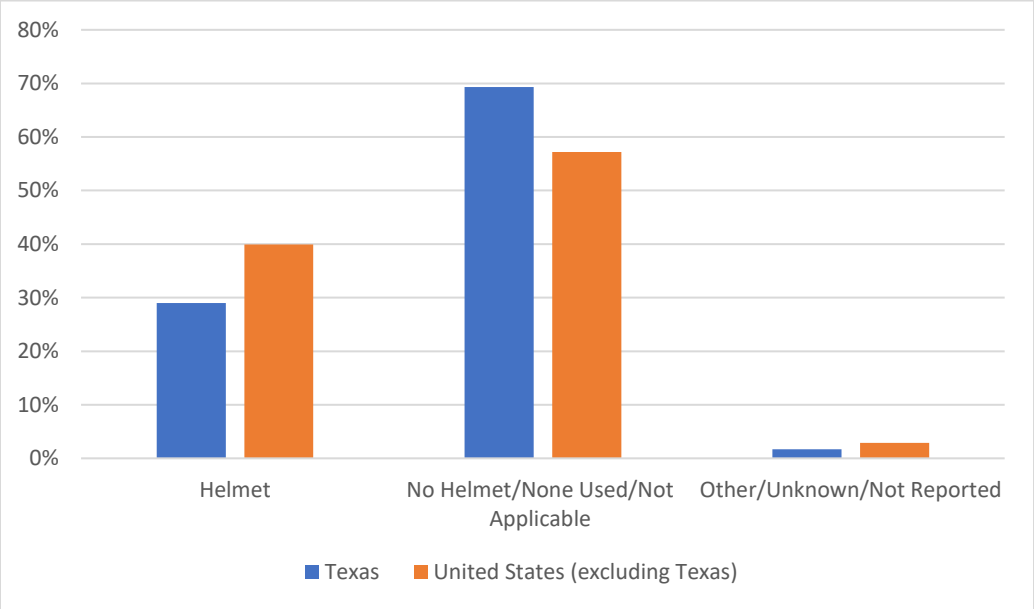


Figure 46. Helmet Status of Motorcycle Passengers involved in a Fatal Motorcycle Crash, 2015–2019.

Passenger Car Crashes

Passenger Car Drivers

Age

In both Texas and the United States, the most common age group for passenger car drivers was 25 to 44 years old (40.5 percent and 36.3 percent, respectively) followed by 16 to 24 years old (27.0 percent and 24.3 percent, respectively). Figure 47 shows the age groups of passenger car drivers involved in fatal crashes.

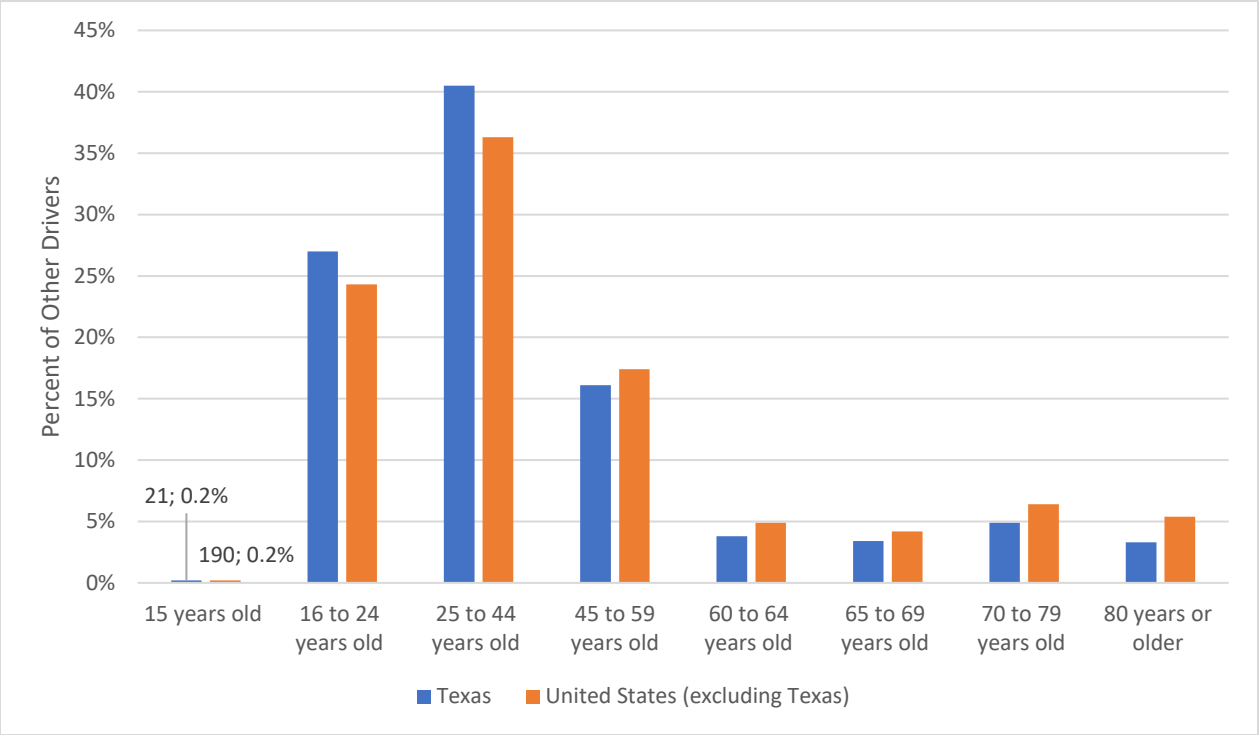


Figure 47. Age Groups of Passenger Car Drivers involved in a Fatal Passenger Car Crash, 2015–2019.

Gender

Figure 48 shows the gender of passenger car drivers involved in fatal passenger car crashes. A majority of drivers were male, 62.2 percent in both Texas and the United States.

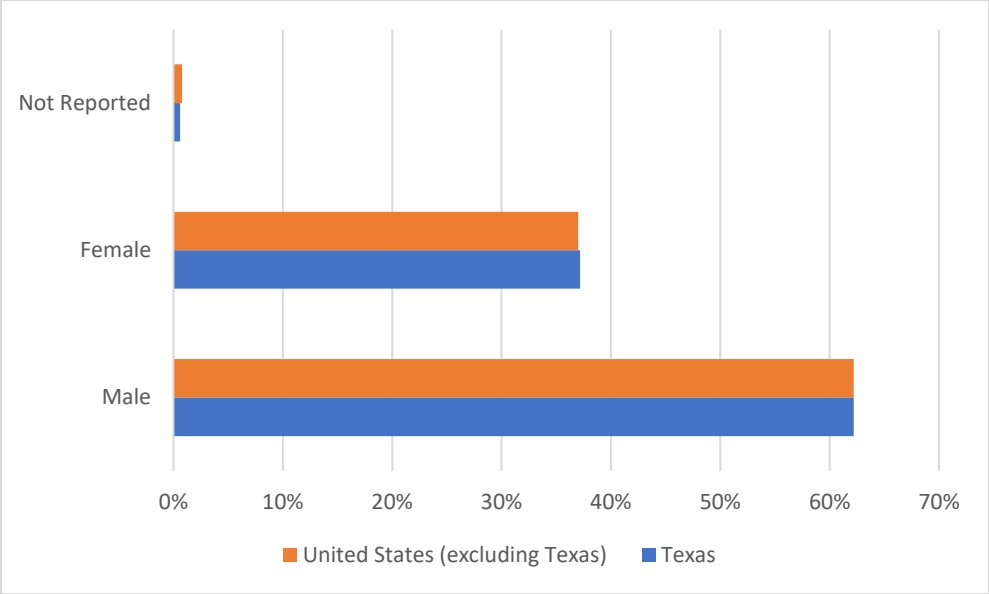


Figure 48. Gender of Other Vehicle Drivers involved in a Fatal Passenger Car Crash, 2015–2019.

Licensing Status

Figure 49 displays license compliance for passenger car drivers involved in fatal passenger car crashes. Interestingly, Texas drivers had a higher percentage of not possessing the proper license for the vehicle class, 22.0 percent versus 13.5 percent, respectively.

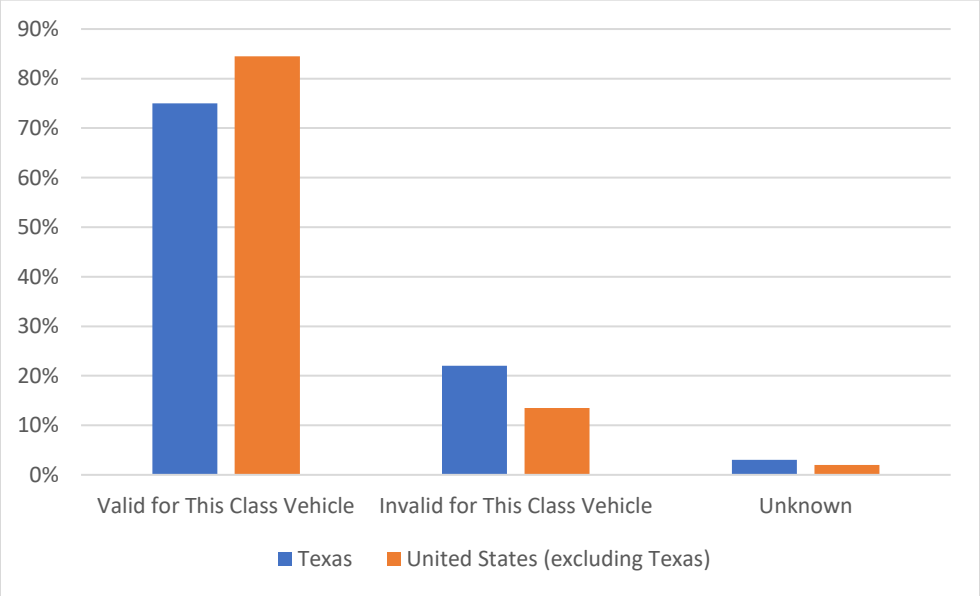


Figure 49. License Compliance of Other Drivers involved in a Fatal Passenger Car Crash, 2015–2019.

Passengers

Age

The most common age group for passengers involved in passenger car fatal crashes was 16 to 24 years old in both Texas and the United States (26.4 percent and 29.8 percent, respectively). Figure 50 shows the age groups of passengers involved in fatal passenger car crashes.

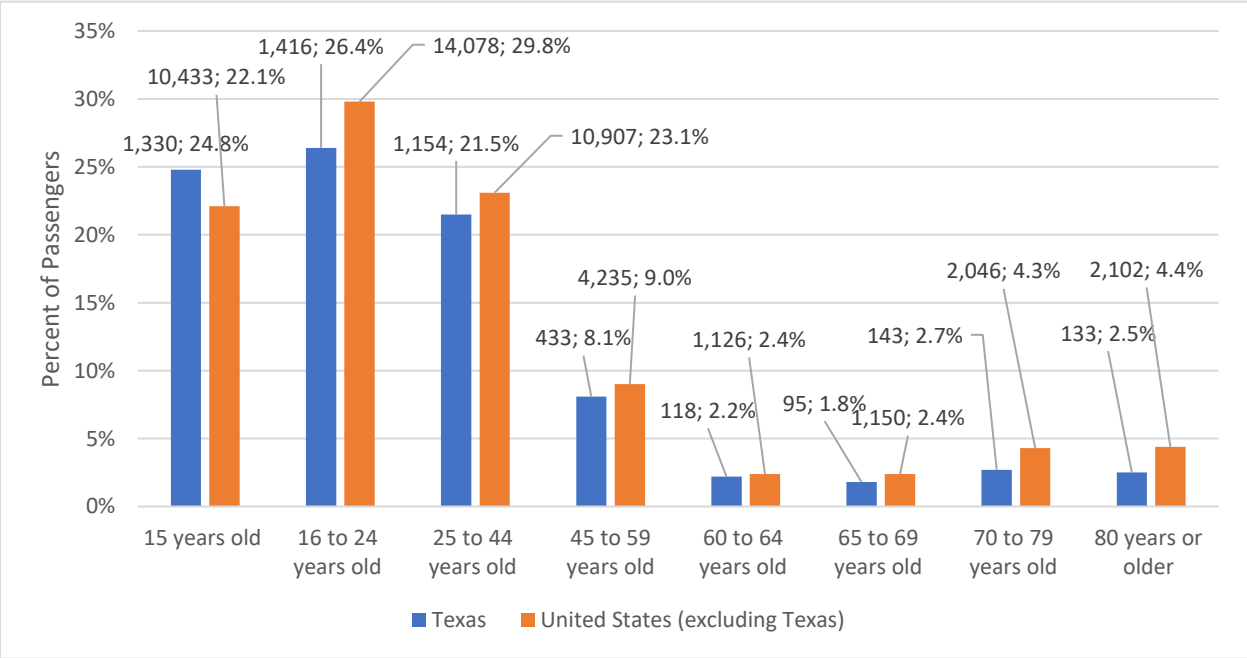


Figure 50. Age Groups of Passengers involved in a Fatal Passenger Car Crash, 2015–2019.

Gender

Figure 51 shows the gender of passengers involved in fatal passenger car crashes. There was a similar distribution of genders in Texas and the rest of the United States with females accounting for slightly more than half of passengers involved.

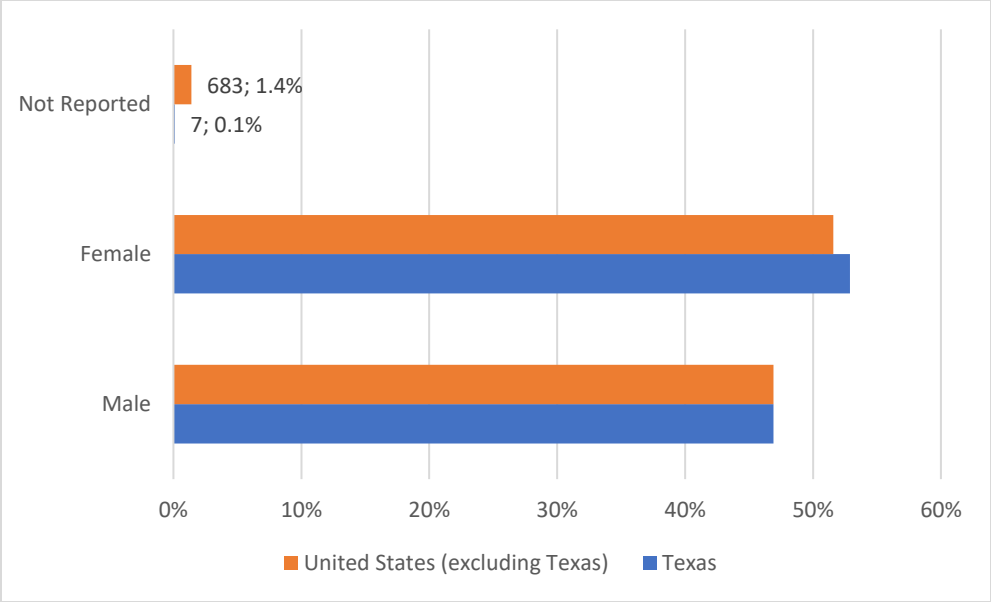


Figure 51. Gender of Passengers involved in a Fatal Passenger Car Crash, 2015–2019.

Crash Factors

Driver Factors

Speed

Speed was examined for fatal motorcycle and passenger car crashes (see Figure 52). Fatal motorcycle crashes had a higher percentage of speed involvement compared to passenger car crashes. Overall 37.5 percent of Texas and 32.1 percent of the remaining U.S. motorcycle-involved fatal crashes involved speed.

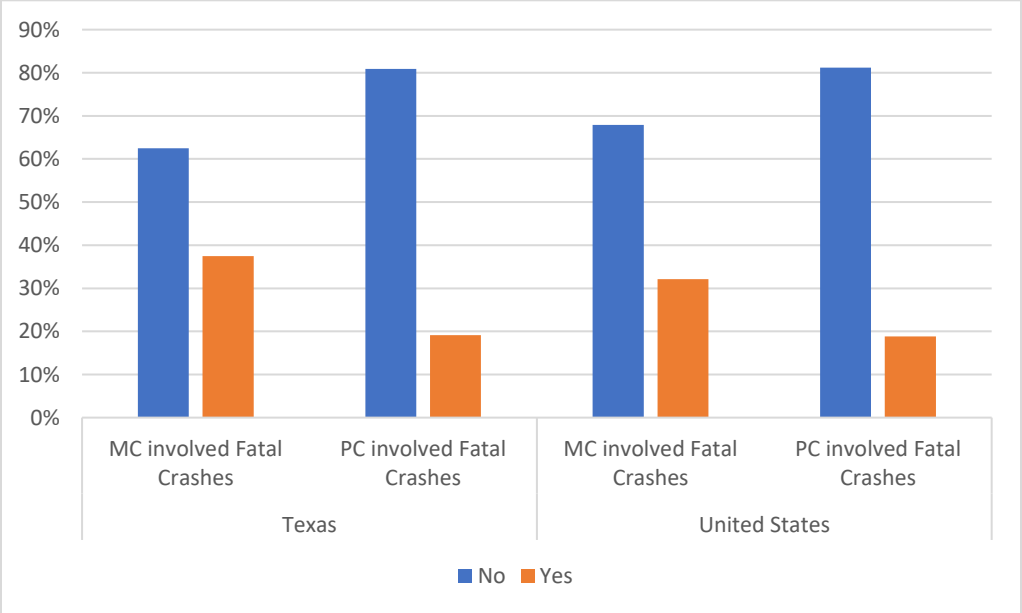


Figure 52. Speeding-Related Fatal Crashes, 2015–2019.

Impairment

Drug

Regarding drug impairment in Texas, fatal motorcycle operators had a higher percent of drug-impaired operators compared to the percent of impaired drivers in fatal passenger car crashes, 12.1 percent versus 10.2 percent, respectively (see Figure 53). However, the opposite was found in the rest of the United States with 8.3 percent of motorcycle operators being drug impaired and 8.1 percent of drivers being drug impaired.

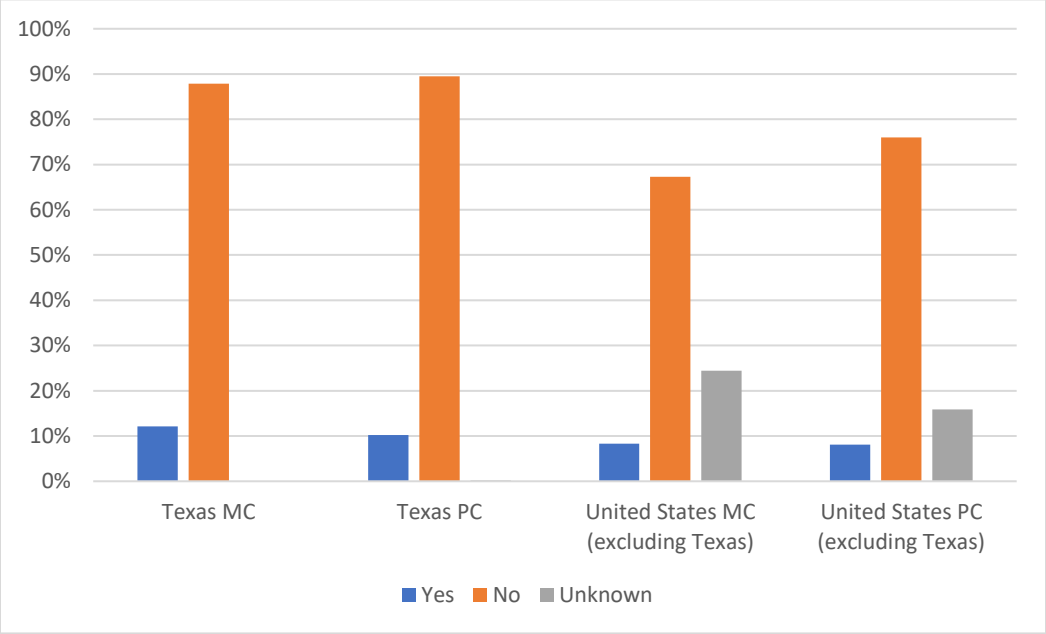


Figure 53. Drug Impairment in Fatal Crashes, 2015–2019.

Alcohol

Alcohol impairment was examined through positive BAC (0.01 or greater) as shown in Figure 54. Interestingly, the percentages for motorcycle operators and passenger car drivers were almost identical in Texas and the rest of the United States. Motorcycle operators had a higher positive BAC value compared to passenger car drivers (25 percent versus 16 percent, respectively).

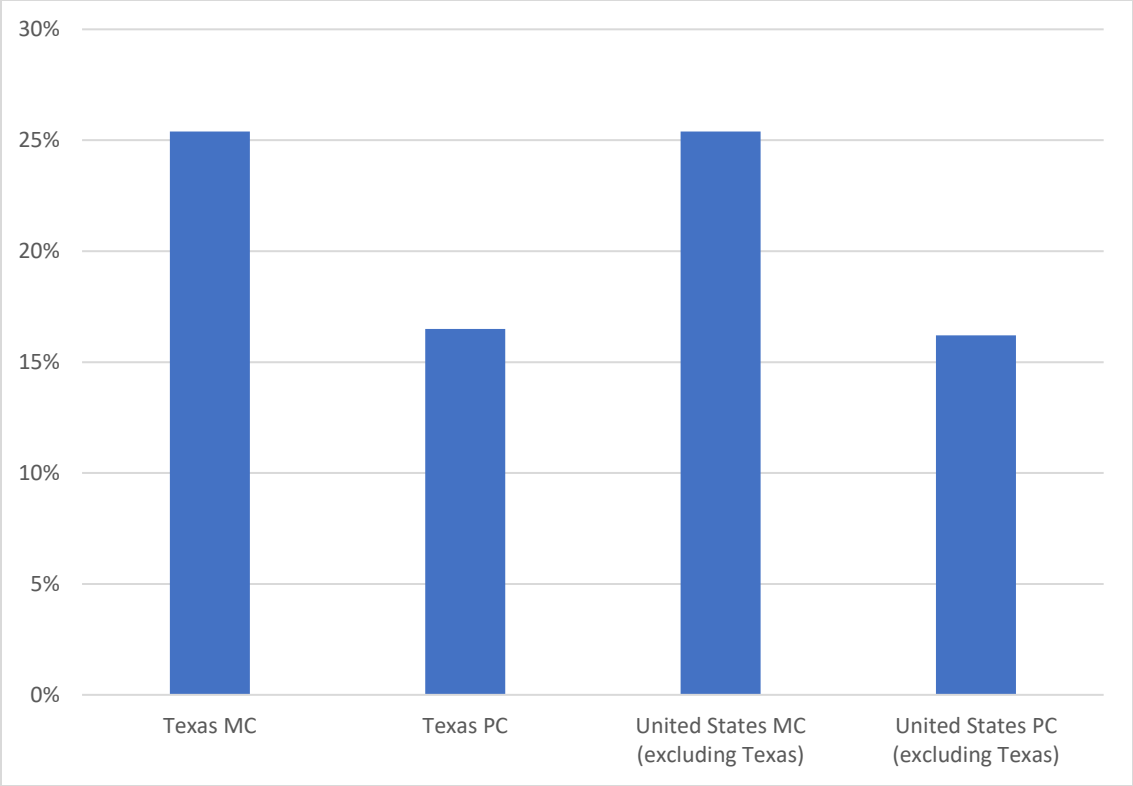


Figure 54. Positive BAC in Fatal Crashes, 2015–2019.

Distraction

The team's examination of distraction found that overall motorcycle operators had lower percentages of distraction compared to passenger car drivers (see Figure 55). In Texas, 5.7 percent of motorcycle operators in fatal motorcycle crashes were distracted, whereas 7.1 percent of drivers in fatal passenger car crashes were distracted. For the remaining United States, percentages of distraction were lower than Texas for both motorcycle operators and passenger car drivers.

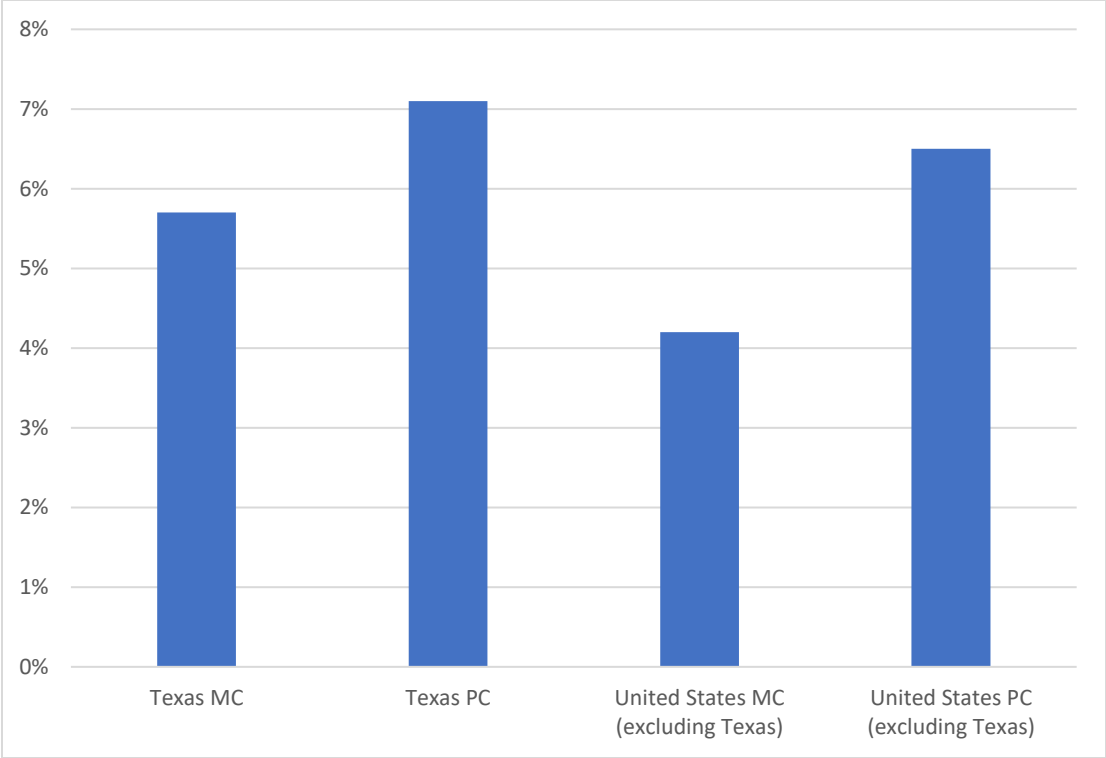


Figure 55. Distraction in Fatal Crashes, 2015–2019.

The most common reported distractions were examined (see Table 35). Interestingly, Texas motorcycle operators had the highest percentage of inattention (88.5 percent). Motorcycle operators in Texas and the remaining United States had lower percentages of the distraction source being cell-phone–related, compared to passenger car drivers.

Table 35. Reported Distractions in Fatal Crashes, 2015–2019.

Distraction	Texas				United States (excluding Texas)			
	Motorcycle		Passenger Car		Motorcycle		Passenger Car	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Inattention (Inattentive), Details Unknown	116	88.5%	344	54.0%	467	46.7%	1,866	30.6%
Distracted by Outside Person, Object or Event	6	4.6%	13	2.0%	126	12.6%	683	11.2%
Distraction (Distracted), Details Unknown	3	2.3%	56	8.8%	109	10.9%	564	9.3%
Other Distraction	2	1.5%	16	2.5%	99	9.9%	386	6.3%
Cellular-Phone–Related	1	0.8%	85	13.3%	29	2.9%	553	9.1%

Driver-Related Factors

The team examined reported driver behaviors (see Table 36). In Texas, the top driver-related factor among motorcycle operators in fatal crashes was improper lane use (6.5 percent), compared to FTYROW of passenger car drivers (7.5 percent). In the remaining United States, the top driver-related factor for motorcycle operators in fatal crashes was careless driving (8.0 percent), compared to improper lane usage of passenger car drivers (10.7 percent).

Table 36. Top Driver-Related Factors in Fatal Crashes, 2015–2019.

Top Five Driver-Related Factors	MC Freq. (%)	Top Five Driver-Related Factors	PC Freq. (%)	Top Five Driver-Related Factors	MC Freq. (%)	Top Five Driver-Related Factors	PC Freq. (%)
Improper Lane Usage	151 (6.5%)	FTYROW	673 (7.5%)	Careless Driving	1,919 (8.0%)	Improper Lane Usage	9,994 (10.7%)
Failure to Obey Actual Traffic Signs, Traffic Control Devices or Traffic Officers, Failure to Observe Safety Zone Traffic Laws	90 (3.9%)	Improper Lane Usage	543 (6.1%)	Improper Lane Usage	1,883 (7.9%)	FTYROW	8,528 (9.1%)
Careless Driving	73 (3.2%)	Failure to Obey Actual Traffic Signs, Traffic Control Devices or Traffic Officers, Failure to Observe Safety Zone Traffic Laws	452 (5.1%)	Operating the Vehicle in an Erratic, Reckless, Careless, or Negligent Manner	1,599 (6.7%)	Careless Driving	5,672 (6.1%)

Police Pursuing This Driver or Police Officer in Pursuit	45 (1.9%)	Over Correcting	293 (3.3%)	Failure to Obey Actual Traffic Signs, Traffic Control Devices or Traffic Officers, Failure to Observe Safety Zone Traffic Laws	847 (3.5%)	Failure to Obey Actual Traffic Signs, Traffic Control Devices or Traffic Officers, Failure to Observe Safety Zone Traffic Laws	4,402 (4.7%)
FTYROW	40 (1.7%)	Careless Driving	237 (2.7%)	FTYROW	622 (2.6%)	Operating the Vehicle in an Erratic, Reckless, Careless, or Negligent Manner	4,328 (4.6%)

Environmental Factors

Weather

Weather was examined in relation to fatal crashes. The percentage of clear weather was higher for motorcycle-involved fatal crashes than for passenger car crashes in both Texas and the rest of the United States (see Figure 56). For other weather conditions (e.g., rain, snow, fog), motorcycle crashes had lower percentages compared to passenger car crashes (data not shown), possibly because motorcyclists tend to avoid riding in bad weather.

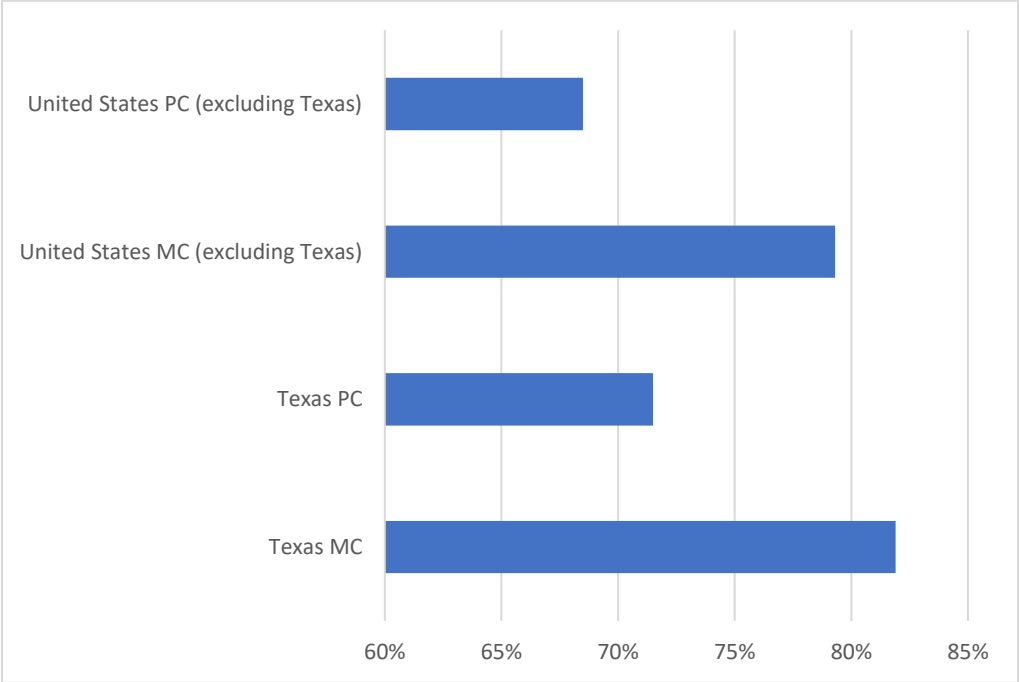


Figure 56. Percent Clear Weather in Fatal Crashes, 2015–2019.

Light Condition

Approximately half of motorcycle crashes in Texas and the United States occurred in daylight compared to approximately 40 percent of passenger car crashes (see Figure 57). This is anticipated since motorcyclists may be less likely to operate under dark conditions.

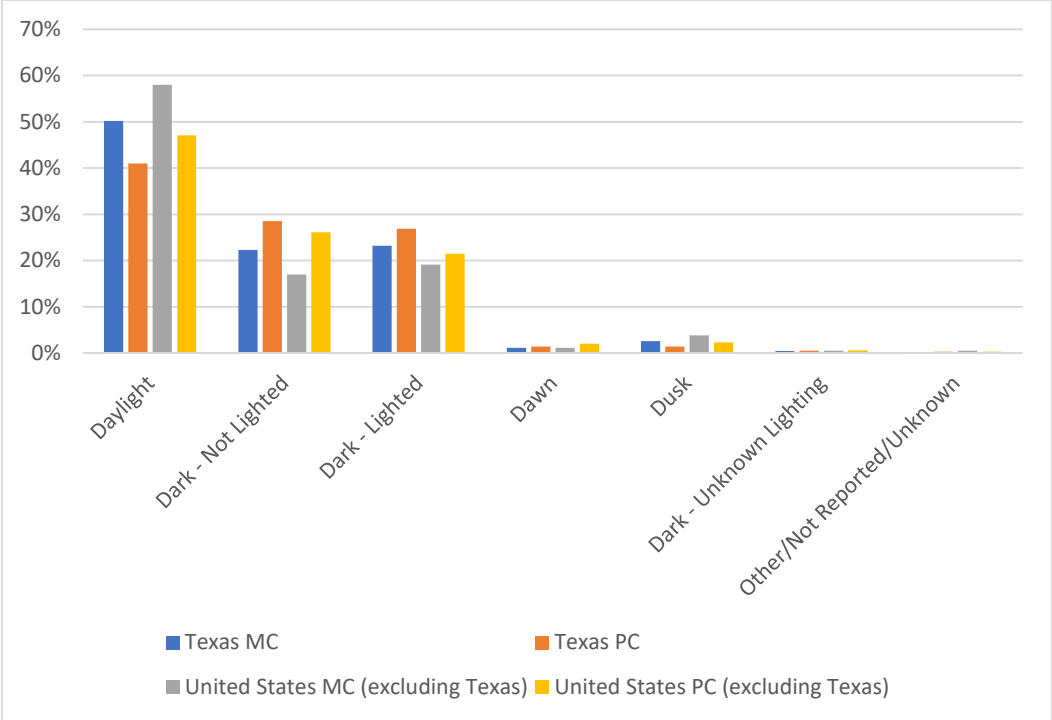


Figure 57. Reported Light Condition in Fatal Crashes, 2015–2019.

Surface Condition

A higher percentage of fatal motorcycle crashes occurred on dry surface conditions compared to fatal passenger car crashes in both Texas and the remaining United States (see Figure 58).

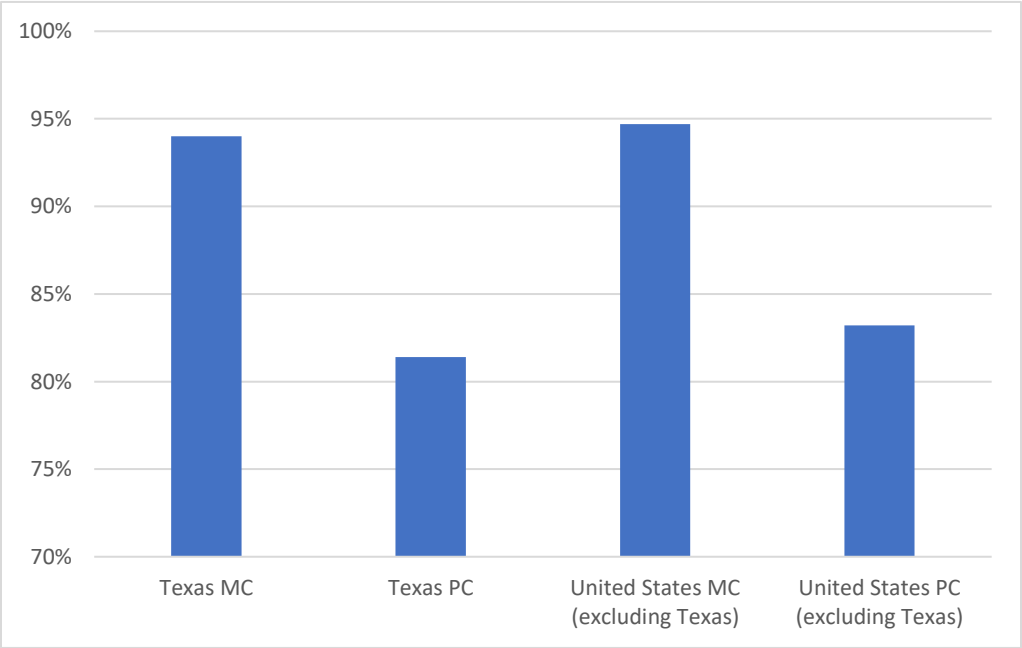


Figure 58. Percent Dry Surface Condition in Fatal Crashes, 2015–2019.

Roadway Factors

Intersection Involvement

Intersection involvement was analyzed for fatal crashes (see Figure 59). Fatal motorcycle crashes had a slightly higher percentage of being intersection-related and driveway-access–related compared to fatal passenger car crashes.

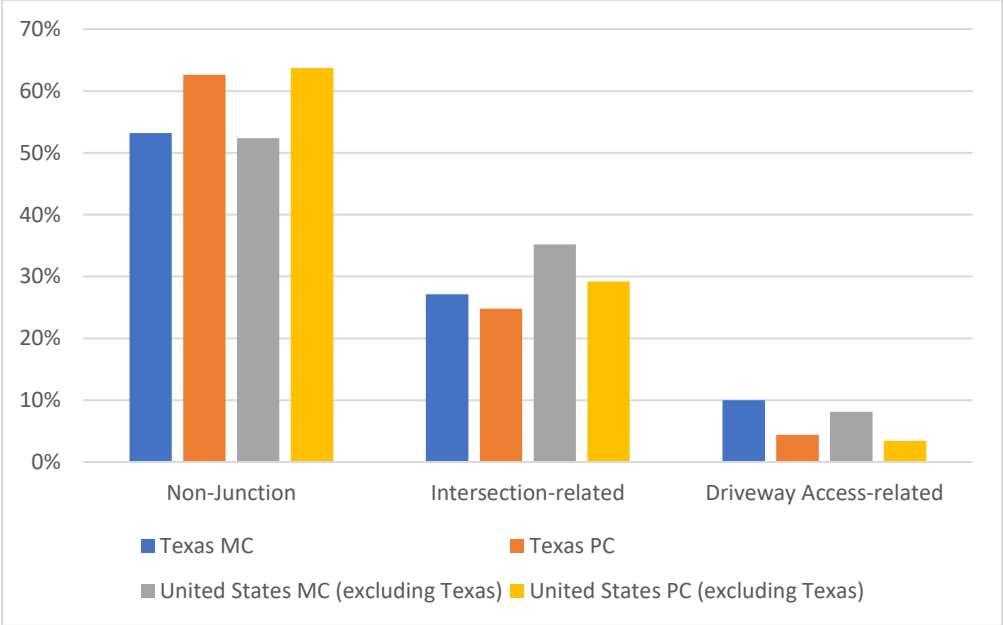


Figure 59. Reported Intersection Involvement in Fatal Crashes, 2015–2019.

Intersection Crashes by Age

The ages of motorcycle operators and passenger car drivers were examined for fatal crashes in Texas and the United States (see Figure 60). Motorcycle operators in both Texas and the remaining United States had higher percentages of 25 to 44 years old, with Texas motorcycle operators having the highest percentage in this age group.

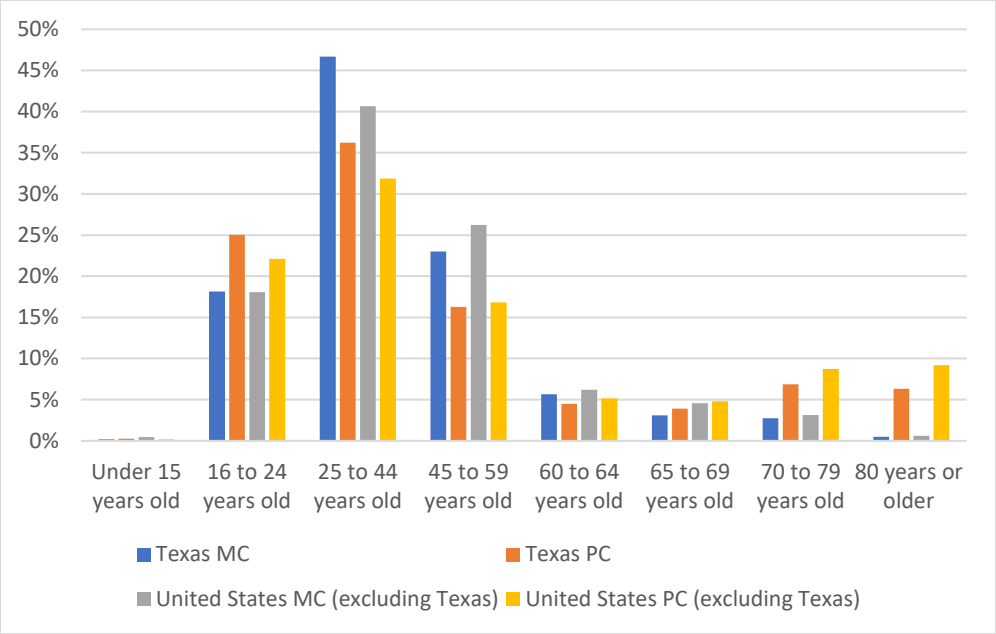


Figure 60. Age Groups of Motorcycle Operators and Passenger Car Drivers in a Fatal Crash, 2015–2019.

Intersection Crashes by Light Condition

Lighting condition was examined for intersection-related fatal crashes. Similar percentages of fatal crashes occurring during dark lighting conditions were found for motorcycle and passenger car fatal crashes in both Texas and the remaining United States (see
Table 37).

Table 37. Lighting Conditions of Intersection-Related Fatal Crashes, 2015–2019.

Light Condition	FARS TX				FARS US (excluding TX)			
	MC-Involved Crashes		PC-Involved Crashes		MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Day	4,831	59.7%	12,796	56.1%	4,831	59.7%	12,796	56.1%
Dark	3,238	40.0%	9,985	43.7%	3,238	40.0%	9,985	43.7%
Total	8,087		22,824		8,087		22,824	

Intersection Crashes by Day of Week

Motorcycle intersection-related fatal crashes had a higher percentage of occurring on weekdays compared to intersection-related passenger car fatal crashes in both Texas and the rest of the United States (see

Table 38).

Table 38. Day of Week of Fatal Intersection-Related Crashes, 2015–2019.

Light Condition	FARS TX				FARS US (excluding TX)			
	MC-Involved Crashes		PC-Involved Crashes		MC-Involved Crashes		PC-Involved Crashes	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Sunday	114	18.8%	304	16.4%	1,304	16.1%	3,070	13.5%
Monday	79	13.0%	253	13.6%	953	11.8%	3,001	13.1%
Tuesday	61	10.1%	226	12.2%	956	11.8%	3,072	13.5%
Wednesday	81	13.4%	249	13.4%	1,005	12.4%	3,045	13.3%
Thursday	72	11.9%	241	13.0%	1,094	13.5%	3,339	14.6%
Friday	82	13.5%	290	15.6%	1,235	15.3%	3,696	16.2%
Saturday	117	19.3%	292	15.7%	1,540	19.0%	3,601	15.8%
Total	606		1,855		8,087		22,824	

Intersection Crashes by Crash Type

Crash type was examined for fatal intersection-related crashes. The top crash type for motorcycle crashes was multi-vehicle: vehicle turn across path, whereas the top crash type for passenger car crashes, the top type was multi-vehicle: vehicle straight paths (see Table 39).

Table 39. Top Three Crash Types for Fatal Intersection-Related Crashes, 2015–2019.

FARS US excluding TX						FARS TX					
Crash Type	MC-Involved Crashes		Crash Type	PC-Involved Crashes		Crash Type	MC-Involved Crashes		Crash Type	PC-Involved Crashes	
	Freq.	%		Freq.	%		Freq.	%		Freq.	%
Multi-vehicle: Vehicle Turn Across Path	3,182	38.2%	**Multi-vehicle: Straight Paths**	7,642	26.4%	**Multi-vehicle: Vehicle Turn Across Path**	211	34.2%	**Multi-vehicle: Straight Paths**	795	34.2%
Multi-vehicle: Straight Paths	1,328	16.0%	**Multi-vehicle: Vehicle Turn Across Path**	5,423	18.7%	**Multi-vehicle: Straight Paths**	144	23.3%	**Multi-vehicle: Vehicle Turn Across Path**	437	18.8%
Multi-vehicle: Vehicle Turn into Path	1,240	14.9%	**Single Vehicle: Forward Impact**	4,217	14.5%	**Multi-vehicle: Vehicle Turn into Path**	87	14.1%	**Single Vehicle: Forward Impact**	268	11.5%
Total	8,320			28,988			617			2,326	

Intersection Crashes by Traffic Control Device

Interestingly, fatal motorcycle-involved crashes had a higher percentage of having no traffic control device, compared to fatal passenger car crashes (see Figure 61).

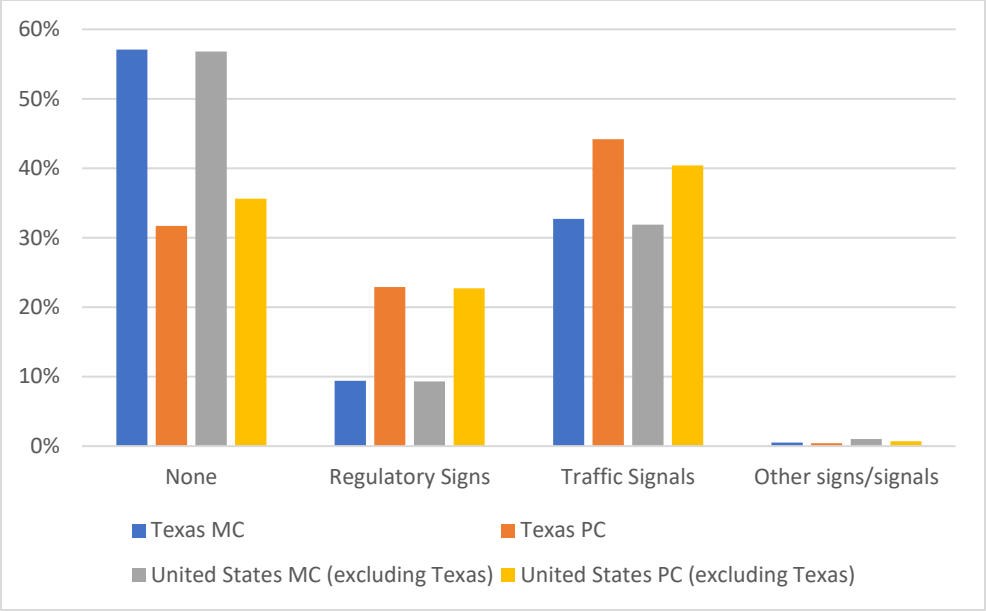


Figure 61. Traffic Control Device of Fatal Intersection-Related Crashes, 2015–2019.

Intersection Crashes by Maneuver Type Table 40 shows the maneuver type reported for fatal intersection-related crashes. Motorcycle-involved crashes had higher percentages of going straight maneuver, passing or overtaking another vehicle, and negotiating a curve, compared to passenger car crashes.

Table 40. Maneuver Type of Fatal Intersection-Related Crashes, 2015–2019.

Maneuver Type	FARS TX				FARS US (excluding Texas)			
	MC		PC		MC		PC	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Going Straight	501	81.2%	1,391	59.8%	6,570	79.0%	16,946	59.8%
Stopped in Roadway	8	1.3%	175	7.5%	119	1.4%	1,753	6.2%
Passing or Overtaking Another Vehicle	21	3.4%	8	0.3%	304	3.7%	179	0.6%
Turning Left	19	3.1%	474	20.4%	323	3.9%	6,534	23.1%
Negotiating a Curve	31	5.0%	68	2.9%	567	6.8%	1,022	3.6%
Total	617		2,326		8,320		28,328	

Trafficway

The most common trafficway reported for fatal crashes was undivided, two-way roadways (see Table 41). Interestingly, the percentage of fatal motorcycle-involved fatal crashes at

undivided, two-way roadways was slightly higher than that of fatal passenger car crashes in both Texas and the remaining United States.

Table 41. Reported Trafficway in Fatal Crashes, 2015–2019.

Type	Texas				United States (excluding Texas)			
	Motorcycle		Passenger Car		Motorcycle		Passenger Car	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Non-trafficway or Driveway Access	11	0.5%	132	1.5%	51	0.2%	579	0.6%
Two-Way, Not Divided	944	40.8%	3,516	39.4%	14,351	59.9%	52,500	56.2%
Two-Way, Divided, Unprotected Median	418	18.1%	1,662	18.6%	4,136	17.3%	17,908	19.2%
Two-Way, Divided, Positive Median Barrier	433	18.7%	2,025	22.7%	2,941	12.3%	14,123	15.1%
One-Way Traffic	135	5.8%	446	5.0%	280	1.2%	855	0.9%
Two-Way, Not Divided, with a Continuous Left-Turn Lane	278	12.0%	942	10.6%	1,536	6.4%	5,846	6.3%
Entrance/Exit Ramp	90	3.9%	156	1.7%	586	2.4%	1,303	1.4%
Not Reported	3	0.1%	36	0.4%	48	0.2%	246	0.3%
Unknown	0	0.0%	1	0.0%	24	0.1%	60	0.1%
Total	2,312	100.0%	8,916	100.0%	23,953	100.0%	93,420	100.0%

Curve

Curve involvement was examined. Motorcycle fatal crashes had a higher percent of curve involvement compared to passenger cars in both Texas and the remaining United States (see Figure 62). Curve-left involvement was the most common curve involvement reported for all crashes, followed closely by curve-right.

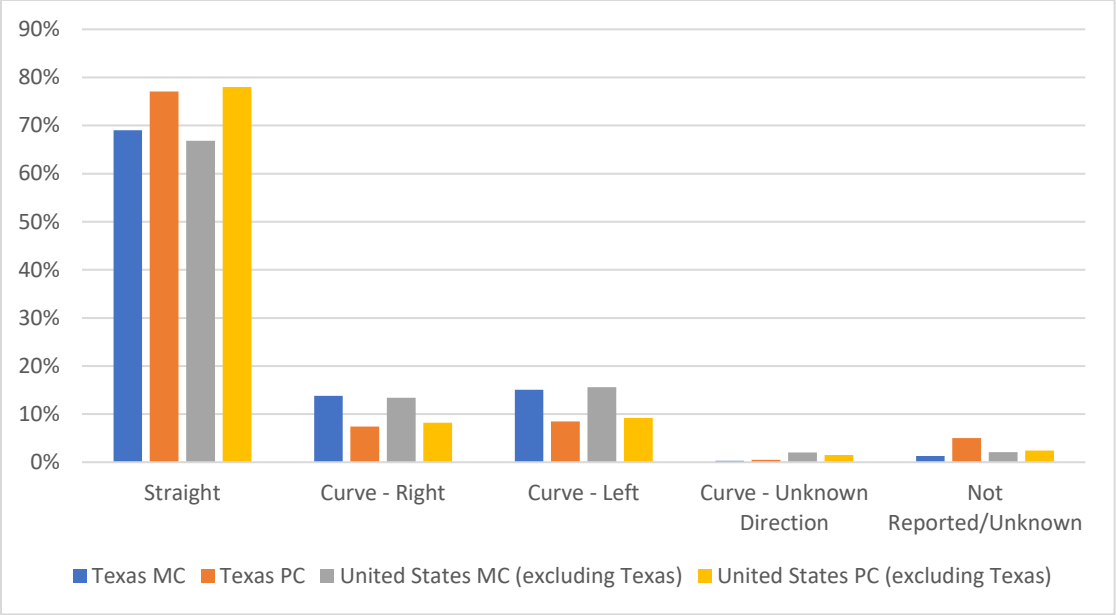
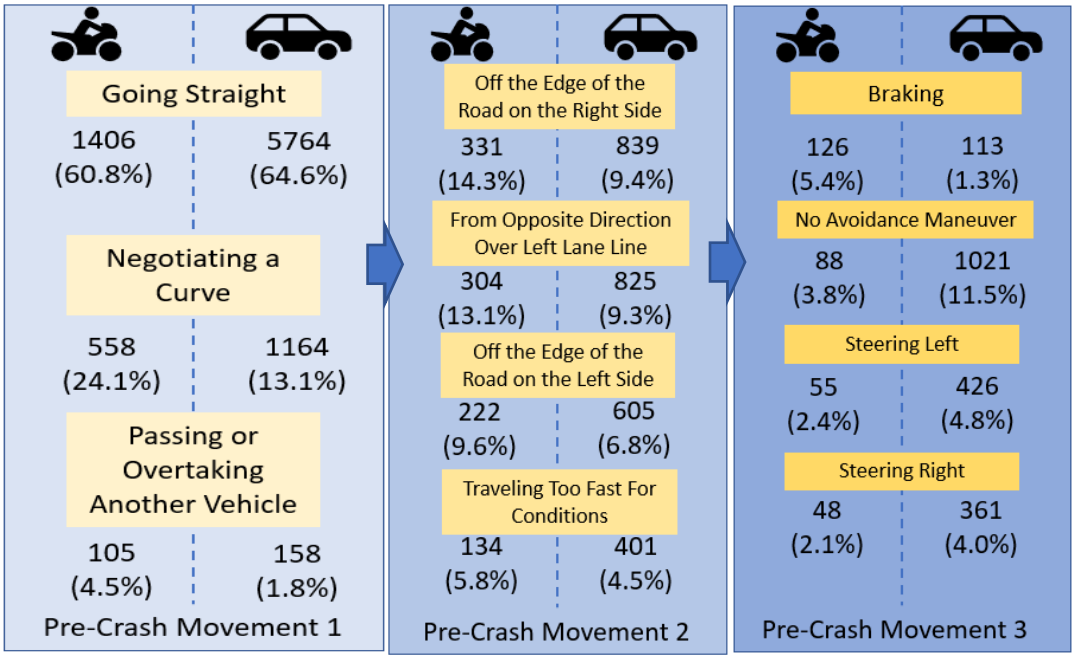


Figure 62. Reported Intersection Involvement in Fatal Crashes, 2015–2019.

Pre-crash Movements

Figure 63 and Figure 64 display the reported pre-crash movement or activity prior to the first harmful event. In Texas and the remaining United States, more than half of motorcycle- and passenger-car–involved fatal crashes occurred while going straight, followed by negotiating a curve.



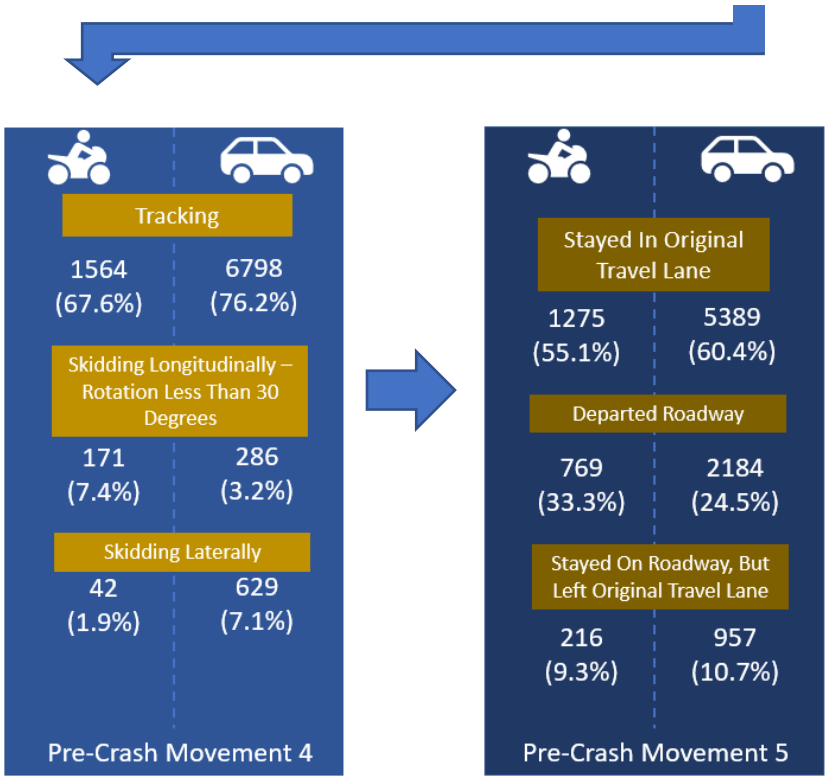
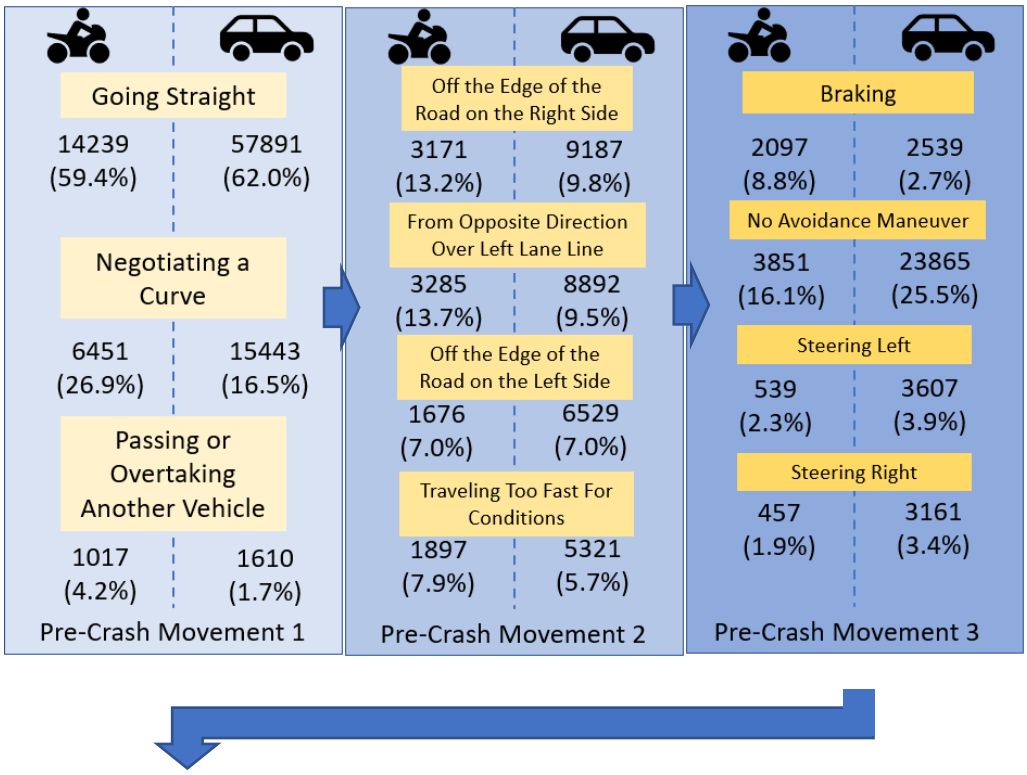


Figure 63. Pre-crash Movements for Texas Fatal Crashes, 2015–2019.



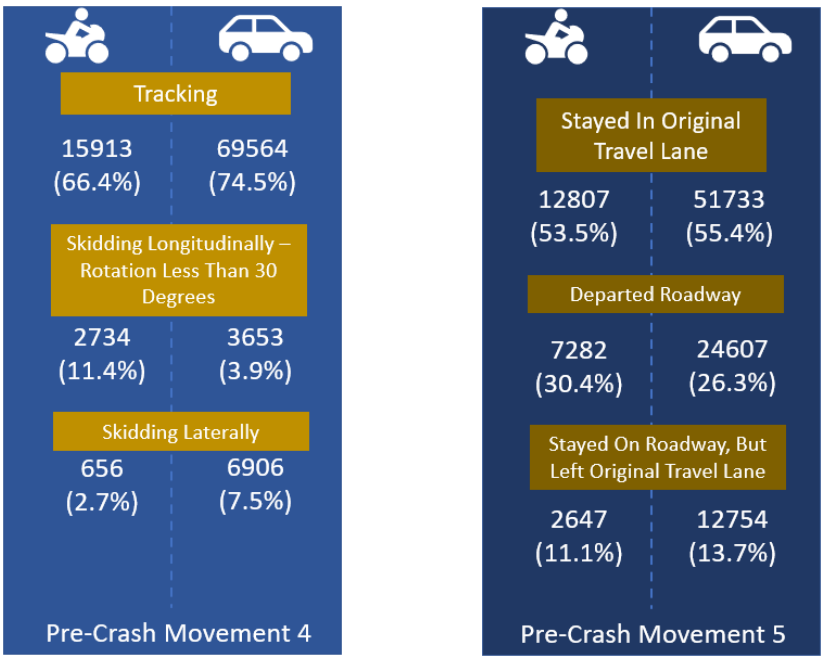


Figure 64. Pre-crash Movements for U.S. Fatal Crashes, 2015–2019.

Crash Types

The predominant fatal crash type for motorcycles and passenger cars was single driver (see Table 42). Findings were similar across Texas and the remaining United States. Among single drivers, right roadside departure was the most frequent type for motorcycles in fatal crashes, as opposed to forward impact for passenger cars involved in fatal crashes. In the multi-vehicle, same direction crash type, the rear-end was the most frequent type for motorcycles as well as passenger cars.

Table 42. Reported Crash Types in Fatal Crashes, 2015–2019.

Category I	Category II	MC	PC	MC	PC
Single Driver	Right Roadside Departure	406 (17.6%)	1,003 (11.2%)	4,176 (17.4%)	12,248 (13.1%)
	Left Roadside Departure	282 (12.2%)	836 (9.4%)	2,383 (9.9%)	9,689 (10.4%)
	Forward Impact	112 (4.8%)	1,251 (14.0%)	1,025 (4.3%)	13,707 (14.7%)
Same Trafficway and Direction	Rear-End	298 (12.9%)	903 (10.1%)	2,287 (9.5%)	6,925 (7.4%)
	Forward Impact	3 (0.1%)	7 (0.1%)	40 (0.2%)	126 (0.1%)
	Sideswipe/Angle	71 (3.1%)	281 (3.2%)	793 (3.3%)	2,490 (2.7%)
Same Trafficway, Opposite Direction	Head-On	76 (3.3%)	1,108 (12.4%)	1,184 (4.9%)	12,282 (13.1%)
	Forward Impact	1 (0.0%)	9 (0.1%)	17 (0.1%)	114 (0.1%)
	Sideswipe/Angle	29 (1.3%)	440 (4.9%)	430 (1.8%)	4,712 (5.0%)
Changing Trafficway, Vehicle Turning	Turn across Path	308 (13.3%)	552 (6.2%)	4,176 (17.4%)	6,542 (7.0%)
	Turn into Path	151 (6.5%)	360 (4.0%)	1,690 (7.1%)	4,437 (4.7%)
Intersecting Paths	Straight Paths	160 (6.9%)	861 (9.7%)	1,437 (6.0%)	7,972 (8.5%)
Total Crashes		2,312	8,916	23,953	93,420

DISCUSSION

This report summarizes a comprehensive, high-level analysis of motorcycle-involved crashes occurring in Texas from 2015 to 2020. It is based on an array of data from various sources, including TxDOT's CRIS for motorcycle and passenger car crashes (2015–2020), crash data from NHTSA's FARS (2015–2019), population estimates from the U.S. Census Bureau and the Texas Demographic Center, TxDOT's Roadway Inventory VMT data tables (2018 and 2019), and the NHTS and TxDOT's TSP. The latter data sources (population, VMT, and household travel surveys) were used in the VMT estimation procedure.

A considerable number of motorcycles is involved in crashes each year. Of particular concern, the number of motorcycle fatalities was decreasing until 2020 when a substantial increase (to 473 fatalities) was observed. Overall, there were 7,465 motorcycle-involved crashes in 2020. More importantly, nearly 30 percent of those crashes involved a death or incapacitating injury. The rate of these severe crashes (30 percent) is over 10 times the rate for passenger cars (less than 3 percent).

In addition to being more frequent and more severe, over 36 percent of all motorcycle crashes in Texas are single-vehicle crashes, compared to less than 10 percent for passenger cars. Similarly, 40 percent of fatal motorcycle crashes in Texas are single-vehicle crashes, while a little over 30 percent of fatal passenger car crashes are single vehicle. Nationwide (the rest of the United States, excluding Texas), the single-vehicle fatal crash percentages are almost equal at 37 percent and 36 percent, respectively.

Thus, regarding crash type, motorcycles usually are at a disadvantage compared to passenger cars (e.g., severity), but not always. Fatal head-on crashes are much less prevalent for motorcycles than for passenger cars (3 percent versus 12 percent in Texas and 5 percent versus 13 percent in the rest of the United States). More generally, regarding crash type, the predominant crash type for motorcycles and passenger cars was single driver. This is true for both Texas and the remaining United States. For single-vehicle crashes, roadside departure (on the right) was the most common fatal crash type for motorcycles, as opposed to forward impact for passenger cars. For multi-vehicle same-direction fatal crashes, the rear-end collision is the most frequent type for both motorcycles and passenger cars. However, motorcycles are twice as likely to have a fatal crash turning across the path as another vehicle, compared to passenger cars (13 percent versus 6 percent and 17 percent versus 7 percent, motorcycles versus passenger cars and Texas versus the remaining United States, respectively). The differences between motorcycles and passenger cars are arguably due to the inherent characteristics of the vehicles. Motorcycles are maneuverable, but hard to see.

Regarding impairment, Texas motorcycle crashes had a higher percentage involving driver drug impairment than passenger car crashes (1 percent versus 0.1 percent, respectively). Texas motorcycle crashes also had a higher percentage of alcohol-impaired drivers compared to passenger car crashes (2.5 percent versus 0.9 percent, respectively).

In Texas, motorcycle crashes had a higher percentage of being speed-related compared to passenger car crashes (10 percent versus 2.5 percent, respectively—16.5 percent versus 7 percent for fatal crashes). Comparing Texas with the rest of the United States, 37.5 percent of Texas fatal motorcycle crashes and 32 percent of the rest of the U.S. fatal motorcycle crashes involved speed. The involvement of speed for fatal passenger car crashes is about 19 percent for Texas and the rest of the United States.

Overall, motorcycle operators had lower distraction rates compared to passenger car drivers. In Texas, 5.7 percent of motorcycle operators in fatal motorcycle crashes were distracted, whereas 7.1 percent of drivers in fatal passenger car crashes were distracted. For the rest of the United States, percentages of distraction were lower than Texas for both motorcycle operators and passenger car drivers (4.2 percent versus 6.5 percent, respectively). Looking at the various types of distraction, Texas motorcycle operators had the highest percentage of inattention (88.5 percent). Motorcycle operators in Texas and the United States had lower percentages of the distraction source being cell-phone–related compared to passenger car drivers.

In conclusion, the frequency of motorcycle crashes and their severity remains catastrophically higher than the frequency and severity of crashes for passenger cars. While many of the safety programs that target DWI, speeding, and other issues benefit all drivers, including motorcycle riders, this crash analysis suggests that targeted safety programs are also required to continue the decrease in deaths toward zero.