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Estimating Motorcycle Miles Traveled From State Vehicle Inspection Records

To follow trends in motorcycle safety, it is necessary to have high-quality data on motorcycle exposure, crashes, and crash outcomes. Of these, motorcycle exposure may be the most challenging to measure. However, the ability to evaluate safety countermeasures requires reliable and accurate exposure data. This ability is important, given that motorcyclists comprised 14 percent of all traffic fatalities and 17 percent of all occupant (driver and passenger) fatalities in 2019.¹ Exposure data, combined with crash data, reveal trends over time, across locations, and allow comparisons to other vehicle types.

Obtaining exposure measures is challenging for any vehicle types and motorcycles are no exception. In fact, quantifying motorcycle exposures may be more difficult than it is for most vehicle types given that motorcycles are smaller, lighter, and have smaller axles. Motorcyclist travel patterns are unique as well, having a higher percentage of weekend travel than do passenger vehicles. Commonly used measures of motorcycle exposure are the number of registered motorcycles and vehicle miles traveled (VMT). As exposure measures, each has its strengths and weaknesses. The number of registered motorcycles is a good indicator of the popularity of motorcycles but does not provide the number and types of trips, miles traveled, or traffic and road conditions. VMT is generated at the State level, based on vehicle and traffic counts, and adjusted by modeling to take into account overall traffic patterns; however, VMT may not capture motorcycle traffic as well as it does for larger vehicles.

Study Objective

Considering the historic challenges to estimating motorcycle miles traveled, the present study examined an alternative measure of motorcycle VMT, by using odometer readings from safety inspection records. Aggregate odometer readings were obtained from motorcycle safety inspection data from three States and used as the basis to examine the distances ridden by motorcycles and to calculate VMT in each of the three States. The VMT based on the odometer data was compared to the VMT based on the “Annual Vehicle Distance Traveled in Miles” published by the USDOT Highway Statistics Series.²

¹ National Center for Statistics and Analysis. (2021, April). Motorcycles: 2019 data (Traffic Safety Facts. Report No. DOT HS 813 112). National Highway Traffic Safety Administration.

Methodology

The data consisted of 3 years of vehicle information and odometer readings as recorded on digital vehicle inspection records from Hawaii, North Carolina, and Virginia. Total annual VMT in each State was estimated by multiplying the mean annual mileage per motorcycle by the number of registered motorcycles in a year.

The final datasets included the following.

- Hawaii’s dataset includes 81,132 inspection records for 24,680 motorcycles from November 1, 2013, to December 31, 2016.
- North Carolina’s dataset includes 962,095 inspection records for 297,874 motorcycles, from January 1, 2012, to December 31, 2016.
- Virginia’s dataset includes 595,143 inspection records for 239,549 motorcycles, from August 1, 2012, to September 8, 2017.

Results

Annual mileage. The analysis found a mean mileage of about 2,000 miles per year in each of the study States, but the median mileage in each study State was less than 1,000 miles per year. As the current study examined odometer readings for most of the motorcycles in each study State, the sample would include both frequent and infrequent riders. The findings suggest that the annual motorcycle mileage was skewed in each State dataset, with many motorcycles having been ridden only a few miles each year. The analysis also found that the number of motorcycles inspected each year was smaller than the number of motorcycles registered in the State.

Estimates of VMT. Motorcycle VMT was calculated as the sum of the mileage for motorcycles having had more than one inspection. These estimates were compared to estimates of annual motorcycle VMT calculated for each study State using data published by the Federal Highway Administration (FHWA) in the Highway Statistics Series³ including Table VM-2 “Vehicle

² Office of Highway Policy Information - Policy | Federal Highway Administration www.fhwa.dot.gov/policyinformation/

Miles of Travel by Functional System” and Table VM-4 “Distribution of Annual Vehicle Distance Traveled.” Table VM-2 shows the total miles traveled by State, and Table VM-4 shows the percentage that different vehicle types contribute to the total mileage by road type. (The States in the study provided registration data separately from the inspection data.)

As shown in the following tables, VMT estimates based on odometer data differ from VMT based on the Highway Statistics Series. The FHWA-based VMT is higher than the odometer-based VMT for North Carolina and Hawaii, but it is lower than the odometer-based VMT for Virginia. The reasons for these differences are not clear, but one obvious difference is that the Highway Statistics Series cover all traffic including from out-of-State vehicles, whereas the odometer-based VMT only include motorcycles that were registered in the State and that were inspected.

Table 1. Mean Annual VMT Based on Odometer Data and FHWA Data, Number of Registered Motorcycles, Hawaii

Hawaii	2014	2015
Mean Annual VMT, Odometer Data	2,064	1,943
Odometer-based VMT	78 million	64 million
VMT based on FHWA Data	113 million	138 million
No. of Registered Motorcycles	37,771	32,831

Table 2. Mean Annual VMT Based on Odometer Data and USDOT Data, Number of Registered Motorcycles, North Carolina

North Carolina	2013	2014	2015
Mean Annual VMT, Odometer Data	1,898	1,821	1,839
Odometer-based VMT	363 million	344 million	353 million
VMT based on FHWA Data	713 million	731 million	622 million
No. of Registered Motorcycles	191,162	188,675	192,034

Table 3. Mean Annual VMT Based on Odometer Data and FHWA Data, Number of Registered Motorcycles, Virginia

Virginia	2013	2014	2015	2016
Mean Annual VMT, Odometer Data	2,266	2,033	1,990	2,064
Odometer-based VMT	432 million	408 million	406 million	419 million
VMT based on FHWA Data	289 million	281 million	261 million	Not available
No. of Registered Motorcycles	190,456	200,558	204,089	202,766

³ The Highway Statistics Series present annual statistical information at www.fhwa.dot.gov/policyinformation/statistics.cfm



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Discussion

The results showed that mean annual mileage per motorcycle was consistent year-to-year, and that motorcycles on average were ridden about 2,000 miles each year. This distance is lower than the mileage reported in self-report studies, suggesting that self-reports may be an overestimation. Also, the annual motorcycle mileage was skewed, with a large proportion of motorcycles having been ridden for very few miles each year.

It is possible to calculate motorcycle distance traveled using odometer data from safety inspections, but these records are not feasible as a regular source of VMT and may produce estimates that vary significantly from estimates using other, more established methods.

The information in this Traffic Tech and the final report are presented to share research findings and it is not a recommendation to use inspection data as a strategy for computing VMT. There are signification limitations to using inspection records to calculate VMT. Inspection records are not widely available (few States require motorcycle safety inspections) and thousands of the inspection records used in this study had missing or erroneous odometer data. Finally, the interpretation of odometer-based VMT is problematic given that the inspected motorcycles may have accrued mileage out-of-state. However, a key finding of the current study is that most motorcycles were ridden relatively infrequently, each year, and in each State.

Full Report

Kirley, B., Wang, Y., Foss, R., Harrell, S., & Goodwin, A. (in press). *Estimating motorcycle miles traveled from state vehicle inspection records* (Report No. DOT HS 813 288). National Highway Traffic Safety Administration.

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