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TRAFFIC SAFETY FACTS
Research Note

NHTSA

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Estimated Contribution of Peak-Hours Non-Commercial Vehicle Traffic to Fatality Rates

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The COVID-19 pandemic, mitigation efforts such as stay-at-home orders, and ensuing trends such as the rise in working from home, have had substantial impacts on traffic. In March, NHTSA reported that vehicle miles traveled (VMT) decreased 11% from 2019 to 2020, while police-reported crashes decreased 22%. However, fatalities per 100 million VMT increased 21% from 2019 to 2020 (NHTSA, 2022). While fatality rates for 2017, 2018, and 2019 ranged from 1.11 to 1.17 per 100 million VMT, in 2020 the rate was 1.34 fatalities per 100 million VMT. Several explanations for the increased fatality rate have been forwarded, including increases in risky driving behaviors such as speeding and impaired driving (Wagneret al., 2020; Office of Behavioral Safety Research, 2021b), decreased seat belt use rate (Wagner et al., 2020; OBSR, 2021a, 2021b), and reduced law enforcement activity (Wagner et al., 2020). Further, some evidence suggests that older people, who are typically more risk-averse drivers, were less likely to drive during the initial stage of the pandemic, resulting in a higher proportion of risky drivers on the road (Wagner et al., 2020).

Reduced VMT in 2020 relative to previous years likely played a key role in the increased fatality rate. Reductions in traffic volumes are associated with higher average speeds (Kononov et al., 2012). With fewer vehicles on roads, risky drivers are presented with ample opportunity to speed (Wagner et al., 2020), and the perceptual and psychological mechanisms related to speed management for all drivers may be impaired (Tucker & Marsh, 2021). Higher speeds, in turn, can increase the severity of crashes, potentially contributing to increased fatality rates. Notably, the effects of the COVID-19 pandemic on traffic appear to differ from previous economic downturns, such as that resulting from the 2008 financial crisis, which saw decreased traffic volume coupled with a lower fatality rate (Longthorne et al., 2010). The timing and magnitude of changes in traffic volume may then moderate their impact on fatality rates. Here, the author tests whether the increased fatality rate in 2020 may be due, in part, to a decrease in non-commercial vehicle travel during traditional "peak" or high-volume travel times.

This study explores the contribution of peak-hours non-commercial vehicle traffic to the overall fatality rate. Using data from the 2017 Fatality Analysis Reporting System (FARS) and the 2017 National Household Travel Survey (NHTS), as well VMT data from the Federal Highway Administration (FHWA), the author estimates a 2017 fatality rate that excludes peak-hours non-commercial vehicle traffic. The author hypothesizes that the fatality rate for peak-hours non-commercial vehicle traffic will likely be lower than the fatality rate for all vehicles at all hours. Further, the author expects the 2017 fatality rate that excludes peak-hours non-commercial vehicle traffic will more closely resemble the fatality rate observed for 2020 of 1.34 per 100 million VMT (NHTSA, 2022) than the 2017 fatality rate for all traffic of 1.17 per 100 million VMT.

Method and Results

This study estimated VMT by hour to develop separate peak and non-peak fatality rates. NHTS data can provide hourly VMT estimates for vehicle travel made by private vehicles, such as automobiles, SUVs, vans, pickups, and motorcycles. However, the VMT statistic historically used to determine fatality rates (NHTSA, 2018, 2022) is FHWA's VM-1 statistic. FHWA estimates VM-1 using State-reported Highway Performance and Monitoring System data, fuel consumption data, vehicle registration data, other data such as the R. L. Polk vehicle data, and a host of modeling techniques

(Office of Highway Policy Information, 2019). Unlike the NHTS, VM-1 does not allow for a breakdown by hour of travel. Thus, this study first used NHTS data to estimate VMT by hour for non-commercial vehicles (automobiles, SUVs, vans, pickups, motorcycles). These hourly estimates were then used to scale FHWA VMT data. Finally, the scaled FHWA VMT data and FARS data were used to estimate fatality rates for peak and non-peak periods. The most recent NHTS data available are from 2017, and the next most recent NHTS data are from 2009; analyses were therefore restricted to 2017. It should be noted that the accuracy of VMT estimates obtained is adversely affected by differing definitions of non-commercial traffic between NHTS, FHWA, and FARS. While NHTS identifies both vehicle body type and trip purpose, FHWA and FARS only identify vehicle body type. The author therefore based the definition of "non-commercial" traffic on body type alone, allowing for the greatest similarity in definitions between the three datasets. Vehicles included for analyses were those most closely matching FHWA classes 1, 2, and 3 (FHWA, 2014): passenger cars, including sedans, coupes, station wagons, and SUVs; motorcycles; and other two-axle, four-tire, single-unit vehicles. However, this approach might incidentally include vehicles from those classes being used for commercial purposes.

NHTS data were first used to estimate VMT by hour for passenger vehicles. Trip start time and day of week variables were used to identify trips occurring during peak and non-peak hours. The author defined peak hours as 6 – 9 a.m. and 3 – 6 p.m. Monday to Friday. Non-peak hours then include all weekend hours, and weekday hours except 6 – 9 a.m. and 3 – 6 p.m. The percentage of non-commercial vehicle VMT occurring during each hour for weekdays and all days are shown in Figure 1. Morning peak hours accounted for 21.6% of weekday VMT, while evening peak hours accounted for 26.8% of weekday VMT; peak hours combined accounted for almost half (48.4%) of weekday VMT, and a little over one-third (35.9%) of all VMT in 2017.

Table 1
NHTS and FHWA Estimated Millions of VMT, 2017

	VMT
FHWA Total	3,212,347
FHWA Passenger Vehicles	2,897,528
NHTS Passenger Vehicles	2,105,881
FHWA Passenger Vehicles Non-Peak	1,857,456
NHTS Passenger Vehicles, Non-Peak	1,349,972
FHWA Passenger Vehicles Peak	1,040,071
NHTS Passenger Vehicles, Peak	755,909
FHWA Passenger Vehicles Weekend	747,461
NHTS Passenger Vehicles, Weekend	543,244

The estimated total non-commercial VMT for 2017 produced from NHTS data was 2,105,882 million miles, 95% CI [2,017,769; 2,193,995]. This was lower than the 2017 FHWA VM-1 for light-duty (i.e., passenger) vehicles, as given in Table 1, with a difference of 791,646 million miles. The author therefore used the distribution of passenger vehicle VMT obtained from NHTS data to estimate peak and non-peak VMT adjusted from the FHWA VM-1 estimated light-duty total, such that:

FHWA Peak VMT
= (FHWA Passenger VM – 1
÷ NHTS Passenger VMT)
× NHTS Peak Passenger VMT

And:

FHWA Non-Peak VMT
= (FHWA Passenger VM – 1
÷ NHTS Passenger VMT)
× NHTS Non-Peak Passenger VMT

These VMT estimates were then used in conjunction with FARS data to produce estimated peak and non-peak fatality rates for 2017, as shown in Table 2. The fatality rate for peak hours, 0.504 per 100 million VMT, was substantially lower than that for non-peak hours, 1.273 per 100 million VMT. Unlike typical fatality rates published by NHTSA, note that these fatality rates include non-commercial vehicle occupants only; pedestrians, bicyclists, and commercial (large or heavy-duty) vehicle occupants are excluded.

Table 2
Estimated Fatalities per 100 million VMT, 2017

	Estimated VMT (in Millions)	Estimated Fatalities	Fatalities per 100 Million VMT
Peak	1,040,072	5,237	0.504
Non-peak	1,857,456	23,652	1.273
Weekend	747,461	12,018	1.608
Total	**2,897,528**	**28,889**	**0.997**

Note: Peak hours include 6 – 9 a.m. and 3 – 6 p.m., weekdays only. Non-peak hours include all weekend hours, and weekday hours except 6 – 9 a.m. and 3 – 6 p.m. Weekend includes all hours, Saturdays and Sundays only.

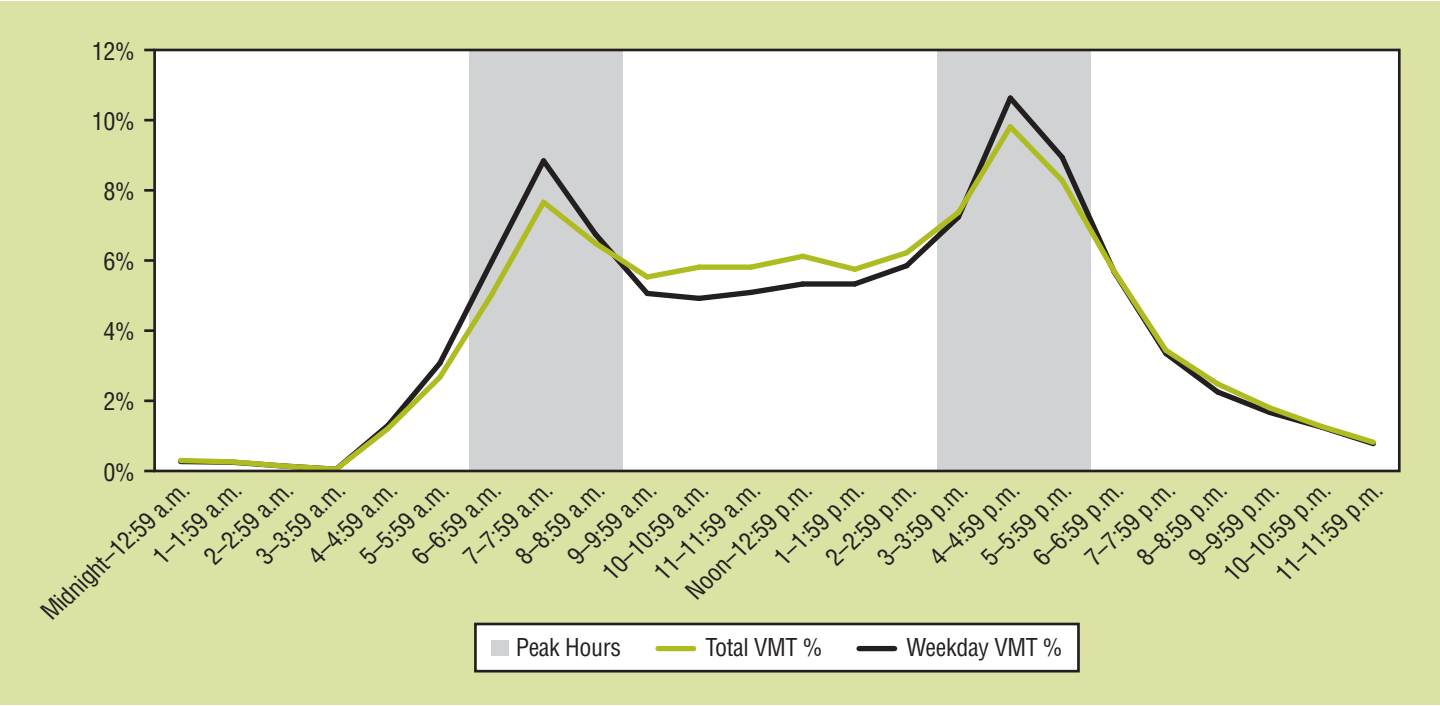
The estimated peak-hours non-commercial VMT was then subtracted from the total FHWA estimated light-duty VM-1. Similarly, the estimated peak-hours non-commercial vehicle fatalities were subtracted from the total FARS estimated non-commercial vehicle occupant fatalities. These reduced VMT and fatalities estimates were then used to produce a fatality rate that excluded peak-hours non-commercial vehicle VMT and fatalities. The fatality rate for 2017 excluding peak-hours non-commercial vehicle VMT and fatalities was 1.48 per 100 million VMT.

Conclusions

The author estimated that in 2017 the fatality rate for non-commercial vehicles during peak hours (6 – 9 a.m. and 3 – 6 p.m. on weekdays) was .50 per 100 million VMT, while the fatality rate for non-commercial vehicles at non-peak hours (all days) was 1.27 per 100 million VMT. The peak-hours fatality rate was, as expected, lower than the non-peak hours rate. This outcome was expected because, as previously noted, lower traffic volumes are associated with higher speeds, and thus more severe crashes. Excluding peak-hours non-commercial vehicle traffic, 2017 had a fatality rate of 1.48 per 100 million VMT. By comparison, 2020 had an overall fatality rate of 1.34 per 100 million VMT (NHTSA, 2022). It therefore appears likely that the reduction in peak-hours non-commercial vehicle traffic resulting from the COVID-19 pandemic contributed, to some extent, to 2020's increased fatality rate relative to previous years. However, absent NHTS or other data providing the hourly distribution of VMT during 2020, it is not possible to attribute the increased fatality rate to changes in peak-hours non-commercial VMT with absolute certainty. Other possible contributing factors that were affected by the COVID-19 pandemic, such composition of traffic and presence of law enforcement, likely played a role as well and warrant further investigation.

This study is limited by certain dissimilarities between the FARS, NHTS, and FHWA datasets. Namely, NHTS is conducted relatively infrequently. As such, while overall VMT and FARS data are available for more years, it is not possible to generate hourly VMT estimates absent NHTS data, the next most recent of which are from 2009.

Figure 1
Percentage of Estimated VMT per hour (2017 NHTS Data)



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This research note and other general information on highway traffic safety may be found at: https://rosap.ntl.bts.gov/

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