

Analysis of the Relation of Accidents and the 88-km/h (55-mph) Speed Limit on Arizona Highways

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This is a report of an investigation to establish if there is a causal relationship between the reduced number of traffic accidents and traffic fatalities in Arizona in 1974 and the 88-km/h (55-mph) speed limit. All segments of Interstate, U.S., and state highways that, prior to 1974, had posted maximum speed limits in excess of 88 km/h (55 mph) were studied. All data were obtained from the Arizona Department of Transportation highway accident records for 1973 and 1974.

Every traffic accident that occurred in the study area was analyzed. Accidents were classified according to degree of severity: fatal, injury, and property damage only (PDO). Each class was further categorized according to month and light conditions. Light conditions were divided into day, night, and dawn or dusk.

DRIVER

Characteristics of drivers involved in fatal accidents were age, sex, physical condition, and familiarity with the fatal accident location. The age distribution of drivers remained practically unchanged. The proportion of male and female driver involvement remained unchanged. The physical condition of the drivers involved in fatal accidents did not change appreciably during the 2-year study. The proportion of drivers who were familiar with the accident location rose from 51 to 56 percent between 1973 and 1974. The proportion of the drivers who were listed as being unfamiliar with the location dropped from 29 to 27 percent.

VEHICLE

The relative involvement rate for the various categories of motor vehicles did not change appreciably between 1973 and 1974. Pickup trucks and automobiles showed a small decrease in accident involvement, and truck involvement increased from 10.9 to 14.6 percent. It

is surmised that a large number of private vehicles were not driven while commercial trucks continued to operate and, consequently, constituted a relatively larger proportion of the total vehicles exposed to traffic conflicts. The proportion of in-state and out-of-state vehicles that were involved in fatal accidents remained almost constant. The use of seat belts did not contribute in any appreciable way to the decrease of fatal accidents in the study area since use of seat belts declined by 2 percent.

ACCIDENT ENVIRONMENT

The factors that were included in the accident environment category are new vehicle registrations, total vehicles registered in Arizona, passenger cars entering Arizona, Arizona Department of Public Safety speeding citations, and travel on Arizona highways.

New passenger car registrations declined by 27 percent, and new commercial vehicle registrations declined by 29.5 percent. The total number of passenger cars registered in 1974 showed about a 3 percent increase, and commercial vehicles showed a 5 percent increase. The proportion of commercial vehicles to total vehicles remained the same in 1974. The number of passenger cars entering Arizona decreased by about 13 percent (almost 1 million cars) in 1974. The number of speeding citations issued on Arizona highways indicated the intensity of enforcement of the posted speed limits. Speeding citations increased about 13 percent from 1973 to 1974. It was not possible to isolate those speeding citations that were issued in the study area. However, it was assumed that the increase in citations occurred as a result of enforcing the 88-km/h (55-mph) speed limit.

The following data were provided by the Arizona Department of Transportation and indicate that considerable changes occurred in highway speeds and speed distributions for each segment of the highway system per year. Both average passenger car speeds and the standard deviations of the speed distributions decreased. Thus, accident severity and the ratio between fatal accidents and all accidents could be expected to decrease.

Highway	Mean Speed (km/h)		Standard Deviation	
	1973	1974	1973	1974
Interstate	110.6	97.1	13.82	9.31
US	100.8	91.5	12.99	10.24
State	101.3	93.4	13.65	12.19

In 1974, interstate vehicular travel declined about 17 percent and non-Interstate vehicular travel declined almost 20 percent.

FATAL ACCIDENTS

The following data (1) show the relationships between study area and total statewide fatal accidents.

Year	Study Area		Percent
	Area	Arizona	
1973	308	817	37.5
1974	161	658	24.5
Reduction	147	159	

Almost a 50 percent reduction in study area fatal accidents was experienced between 1973 and 1974. The significant reduction in study area fatal accidents accounted for over 92 percent of the total reduction in statewide fatal traffic accidents. Thus, it was concluded that the accident reduction experienced on those Arizona highways affected by the 88-km/h (55-mph) maximum speed limit almost solely accounted for the entire 1974 statewide reduction in fatal accidents. Apparently, highways characterized by lower speed limits and more urban conditions accounted for a larger proportion of total highway fatalities; fatalities on those facilities increased from 29.2 to 42.3 percent, but urban and local travel in 1974 increased as well. Fatalities on highways outside the study area remained constant or slightly increased.

The proportion of multivehicle fatal accidents decreased from 31.8 to 24.2 percent. This reduction might have occurred since there are fewer opportunities for multivehicle collisions when travel is reduced.

On Interstate highways, the fatal accident rate per 160 million vehicle-km (100 million vehicle-miles) dropped from 3.27 to 2.14. On other highways in the study area, the yearly average fatal accident rate dropped from 5.74 to 3.64. The reduction in accident rates presents clear evidence that the fatal accident reductions experienced in 1974 cannot be explained simply by pointing to the reduction in travel. Since every other factor that has been analyzed to this point has demonstrated negligible variation between the 2 years, then it appears reasonable to conclude that the drop in fatal accident rates can be attributed to the decrease in travel speeds and the decrease in speed variation within the traffic stream.

The ratio of injuries to deaths is a measure of the severity of accidents. An increase in the injury-to-death ratio (I/D ratio) means that accidents have become less severe. In this study, the ratio for the study area rose from 9.41 to 11.71. The factors that could account for an increase in the I/D ratio are improvements in vehicle design, improvements in highway design, elimination of roadside hazards, increased use of seat belts, and lowering of impact speeds. All of these factors would tend to make automobile accidents less serious. The first three factors were introduced into the accident environment too slowly and in increments too small to cause a 24 percent increase in the I/D ratio for 1 year. Consequently, it appears that the lowering of impact speeds caused the 24 percent change in the I/D ratio.

Light Condition

The proportion of all nighttime accidents to total accidents in the study area increased from 34.2 to 38.6 percent. This increase may have resulted from an increase in night driving since motorists attempted to drive 1973 distances at 1974 speeds.

ACCIDENT RATES

Although the average number of accidents per 160 million vehicle-km (100 million vehicle-miles) on Interstate and non-Interstate highways in 1973 was almost equal (107.0 and 104.5 respectively), the 1974 rates exhibited distinct differences. The rate of decrease was 36.0 on Interstate highways and only 10.5 on non-Interstate highways. The rate for the entire study area decreased from 105.9 to 81.4 or a 23.4 percent decrease.

CONCLUSIONS

1. Driver characteristics did not affect the 1974 reduction in fatal accidents.
2. Vehicle characteristics did not affect the 1974 reduction in fatal accidents.
3. Traffic-related environmental factors that influence driving conditions and travel patterns changed between 1973 and 1974.
4. All categories of accidents decreased in the study area in 1974. The number of fatal accidents and the number of total accidents had the highest relative decrease on Interstate highways.
5. Interstate highways that had speed limits of 120 km/h (75 mph) in 1973 had the largest decrease in total accident rates. Non-Interstate highways that had speed limits of 104 km/h (65 mph) in 1973 had substantially smaller decreases in injury, PDO, and total accident rates than those on Interstate highways.

Since it has been shown that, other than reduced travel and reduced speeds, no major changes took place in the study area in 1974, the accident reductions are attributed to reduced travel and speed. However, the calculated accident rates removed the effect of variations in travel. Thus, it is concluded that the reductions in fatal, injury, PDO, and total accident rates are attributable to the reduction in speeds and the greater uniformity of speeds within the traffic stream. A major finding of this research is that the reduction of fatal accidents in the study area accounted for over 92 percent of the total reduction in statewide fatal traffic accidents experienced in 1974.

REFERENCE

1. Statistics. Highways Division, Arizona Department of Transportation, Phoenix, 1973-1974.