EFFECTS OF THE ENERGY CRISIS ON TRAFFIC IN KENTUCKY

by

K. R. Agent
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EXECUTIVE SUMMARY

The "energy crisis" became a reality to motorists during the latter months of 1973. Several major events that were factors during this period are listed in chronological order:

1. Mid-October 1973 - Arab oil embargo began
2. November 7, 1973 - President's energy message
3. December 1, 1973 - gasoline allocation
4. December 1973 - Sunday gas station closing
5. February 1974 - truckers' strike
6. March 1, 1974 - 55-mph speed limit
7. Mid-March 1974 - Arab oil embargo ended

The gasoline shortage became critical after the oil embargo began. The President urged the nation to voluntarily limit travel and to lower driving speeds. Mandatory gasoline allocation to service stations was initiated. With December came "gasless Sundays". Most service stations were closed from 9 p.m. Saturday until Monday morning. The truckers' strike further intensified gasoline shortages. Kentucky speed limits were reduced to 55 mph on March 1. Gasoline again became plentiful upon lifting of the oil embargo, but at a much higher price.

Traffic volumes, speeds, and accidents for the rural highway system (approximately 23,000 miles of roads) in Kentucky were studied. Monthly volumes and accidents, during the period characterized as the "energy crisis" and its after effects, were compared to the data of the corresponding months in the preceding year. The method best illustrated changes occurring during otherwise comparable periods of time.

Traffic volumes first showed a decrease in December 1973 and has continued through June 1974 -- reaching approximately a 7-percent reduction in March 1974. Total travel on rural highways in the last seven months (December through June) has decreased by 3.5 percent and must be viewed as highly significant in light of the 5 percent increase during 1973. Interstates and parkways (toll roads) had the largest decreases in traffic (about 6 percent). The decline in volumes in June 1974 compared to June 1973 may reflect the public's concern for higher gasoline prices and economic uncertainties in general.

Imposition of the 55-mph speed limit placed a definite restraint on traffic speed. Even before then, appeals for conservation started a trend toward reduced speeds. In June 1973, the average speed on interstate highways (previously posted 70 mph) was 68.4 mph for automobiles and 62.6 mph for trucks. Some speed reductions occurred as early as November 1973. In March 1974, after the speed limit was changed, automobile speeds reduced by 12.5 mph and truck speeds reduced 8.8 mph compared with June 1973. Speeds increased again in May. Automobile speeds in July were comparable to those in May, but truck speeds continued to rise; and, for the first time, trucks were traveling faster than automobiles. By July, automobiles were being operated 9.6 mph slower than in the previous year and truck speeds had increased to 3.5 mph under the previous year. On two-lane highways, previously posted 60 mph for daytime and 50 mph for nighttime, the average automobile speed decreased by 3.5 mph under the average for the previous year.

The decreases in traffic speed have been accompanied by greater uniformity in driving speeds. A larger percentage of vehicles were found to be operating within the 10-mph pace, particularly on interstate highways, as compared to the before time.

As shown in Figure S1, the decrease in traffic volume corresponds to a reduced accident rate. Volumes passed through a low in March and rose in April and May; the accident rate reached a low in April. The greatest decrease in accident rate occurred in March 1974 while the volume was fairly steady. The large accident rate decrease, therefore, corresponded with lowering the speed limit to 55 mph on March 1, 1974. Total travel during the seven months (December 1973 through June 1974) decreased by 3.5 percent while the accident rate decreased by 13.6 percent.

All major highway types experienced a decrease in accident rates for almost every month in 1974. January 1974 was an exception for the multi-lane facilities because of the unusually severe weather (snow and ice conditions). Interstate and four-lane, divided (no access control) highways had the largest drop in accident rates.

A summary of accident experience for various highways is presented in Table S1. Fatality and injury rates decreased more than the accident rate (total rural highway system). The most dramatic impact, of course, must be the 179 lives saved between December 1973 and June 1974 (number of fatalities in this period less the number in the same period a year earlier).

The relationship between traffic speed and accident rate for interstate highways is shown in Figure S2 and for two-lane highways in Figure S3. Very limited data points were available in preparing the plots. The plots do, however, illustrate a great decrease in accident rates as traffic speeds decreases. The difference between wet-surface and dry-surface accident rates is significant but is more so on interstate highways than on two-lane highways. Improved wet-pavement skid resistance (traction) at the lower speeds obviously contributed to a reduction in accident rates. Decreased speed, therefore, has a greater effect upon accident rates during wet-surface than during dry-surface conditions.

Although traffic volume and other contributing factors may account for some of the decrease in accident rates since the beginning of the energy crisis, lower traffic speeds certainly stands out as the single, most important reason why accident, fatality, and injury rates decreased.

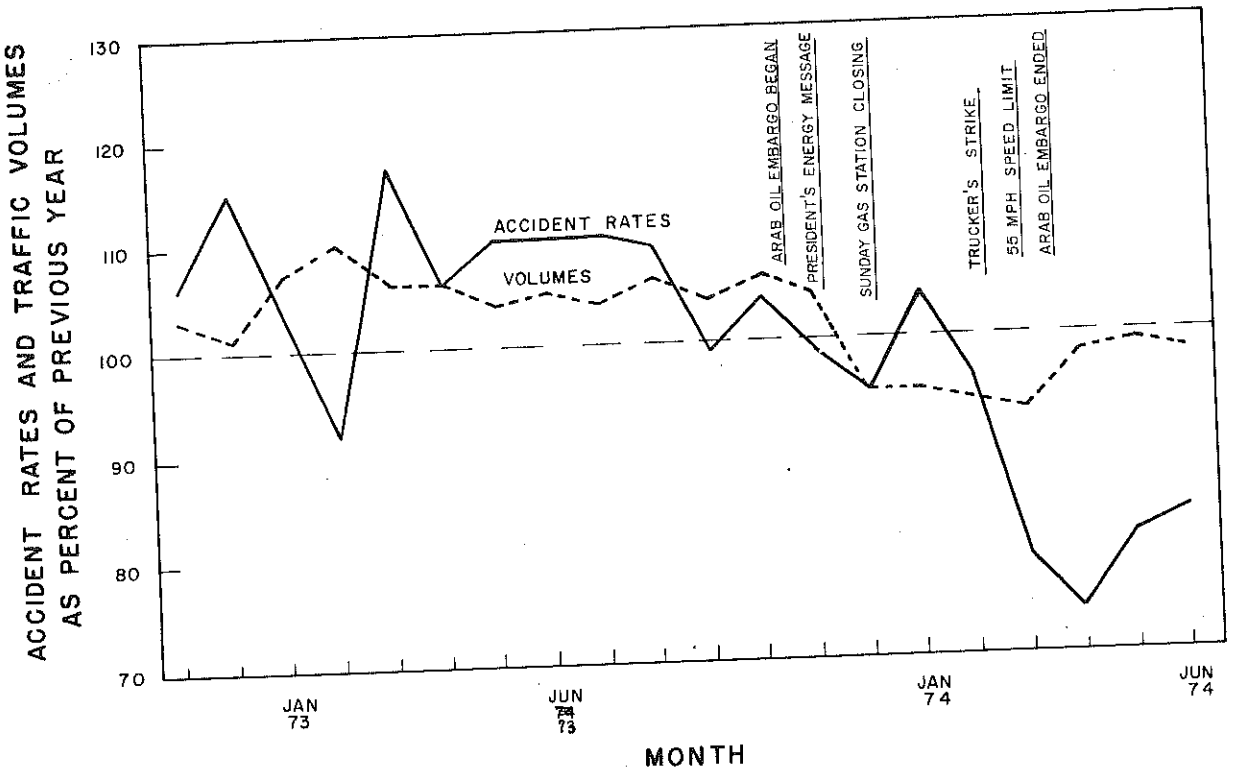

Figure S-1. **Comparison of Monthly Accident Rates and Volumes to Corresponding Month in Preceding Year (Total Rural Highway System).**

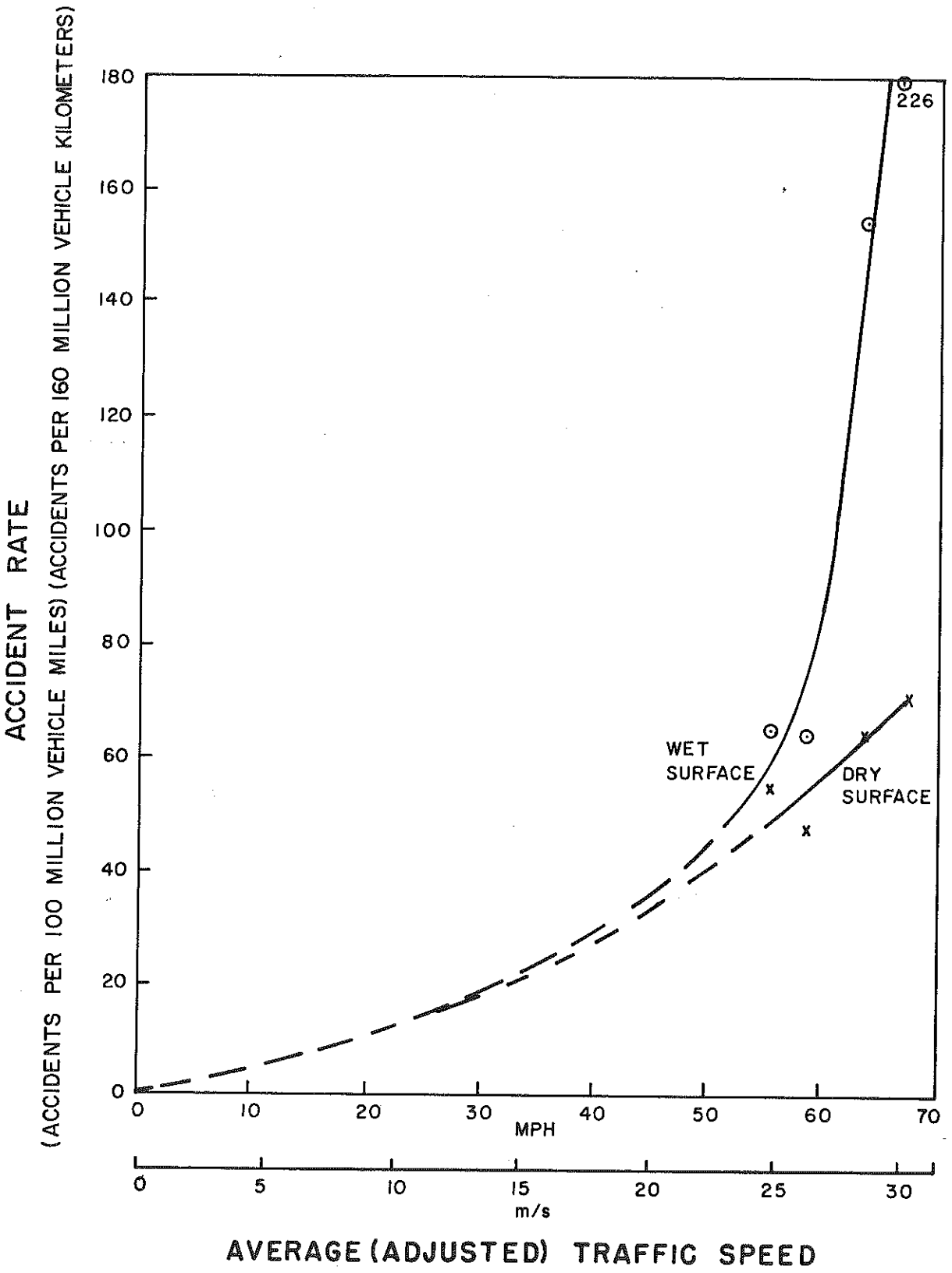

Figure S-2. **Relationship Between Average Traffic Speed (Adjusted between Automobiles and Trucks) and Accident Rate (Interstate Highways).**

TABLE S-1

SUMMARY OF ACCIDENT DATA FOR VARIOUS HIGHWAY TYPES

		ACCIDENTS			FATALITIES			INJURIES			
TYPE OF HIGHWAY	PERIOD[a]	NUMBER	RATE[b]	RATE DECREASE (percent)	NUMBER	RATE[b]	RATE DECREASE (percent)	NUMBER	RATE[b]	RATE DECREASE (percent)	SEVERITY INDEX
Two-Lane	1973	13283	266		446	8.9		8593	172		2.76
	1974	11160	230	13.5	290	6.0	32.6	6653	137	20.3	2.63
Four-Lane Divided	1973	592	162		10	2.7		353	96		2.48
(No Access Control)	1974	480	131	19.1	11	3.0	11.1[d]	289	79	17.7	2.41
Interstate	1973	1080	88		26	2.1		678	55		2.50
	1974	845	73	17.0	27	2.3	9.5[d]	499	43	21.8	2.58
Parkway	1973	216	69		11	3.5		150	48		3.17
	1974	192	62	10.1	2	0.6	82.9	98	32	33.3	2.53
Total System[c]	1973	15411	220		512	7.3		9940	142		2.72
	1974	12847	190	13.6	333	4.9	32.9	7660	113	20.4	2.65

[a]1973 – Dec 1972 through Jun 1973
1974 Dec 1973 through Jun 1974

[b]Number per 100 million vehicle miles (161 million vehicle kilometers)

[c]Also includes three-lane and four-lane, undivided (no access control) highways

[d]Increase

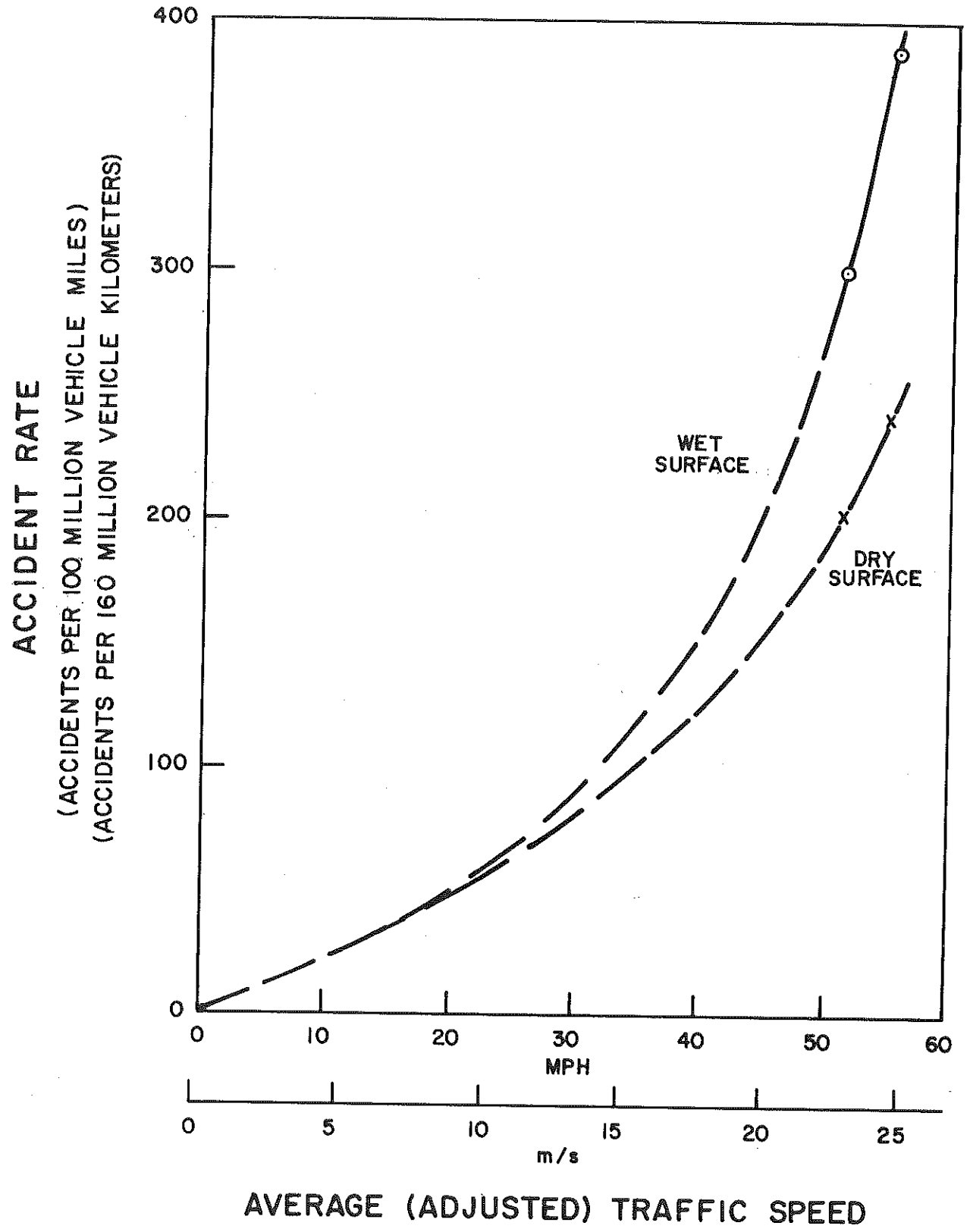

Figure S-3. Relationship between Average Traffic Speed (Adjusted between Automobiles and Trucks) and Accident Rate (Two-Lane Highways).

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF TRANSPORTATION
FRANKFORT, KENTUCKY 40601
BUREAU OF HIGHWAYS

BILLY PAXTON
SECRETARY

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GOVERNOR

H-3-32

October 30, 1974

MEMORANDUM TO: J. R. Harbison
State Highway Engineer
Chairman, Research Committee

SUBJECT: **Research Report No. 404; "Effects of the Energy Crisis on Traffic in Kentucky (Rural Highways);" KYP-72-32; HPR-PI-1(10), Part III.**

The recent shortage of gasoline and the conservation measures which ensued provided a grand experiment and opportunity to study the effects of speed and traffic volume in relationship to accidents. No other, known constraint on traffic has been found to be as effective toward accident abatement as reductions in speed limits. Although there are no assurances from the study reported at this time that the effectiveness will persist, or that a valid basis for comparison will be found after a significant lapse of time, continuation of the 55-mph speed limit seems highly advisable.

The transition and readjustment period may not be over; traffic volumes have recovered considerably. Weekend travel was affected most by the crisis. It is hoped that accident rates will remain low.

Whereas 70- and 60-mph speed limits were lowered, the 50-mph roads (nighttime) were allowed to increase to 55 mph. This effect has not been evaluated.

Respectfully submitted,

Jas. H. Havens
Director of Research

JHH:gd
Attachment
cc's: Research Committee

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16. Abstract

The Arab oil embargo in mid-October 1973 curtailed availability of gasoline. Fuel conservation measures resulted in reduced travel and decreased traffic speeds. On March 1, 1974, posted speed was set at 55 mph on rural highways in Kentucky. Traffic volumes, speeds, and accidents for the rural highway during the period known as the "energy crisis" and its after effects were compared to the corresponding period a year earlier.

Traffic volumes began to decline in December 1973 but began to rise again in March 1974. Total travel in the seven months through June 1974 decreased by 3.5 percent; traffic increased by 5 percent in 1973. Accident rates during this period decreased by 13.6 percent; and the largest decreases were associated with the highways experiencing the greatest reductions in travel speed. The relationship between traffic speed and accident rate showed a great decrease in accident rate as traffic speeds decreased. Differences between wet-surface and dry-surface accident rates were especially significant and were more so for interstate than for two-lane highways. Improved wet-pavement skid resistance at the lower speeds obviously contributed to a reduction in accident rates. Continuation of the 55-mph speed limit on all rural highways would seem advisable.

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EFFECTS OF THE ENERGY CRISIS ON TRAFFIC IN KENTUCKY (Rural Highways)

KYP-72-32, HPR-PL-1(10), Part III

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October 1974

INTRODUCTION

The "energy crisis" became a reality to motorists during the latter months of 1973. Theretofore, the public ignored warnings of fossil fuel shortages. Events, however, demonstrated the seriousness of the problem. Gasoline availability became critical. Voluntary (later mandatory) adherence to lower speed limits reduced traffic speed. Traffic volumes decreased. Public's rush to purchase smaller cars exhausted inventories. Driving habits and lifestyles changed. Speculation concerning effects upon accident experience abounded in the press and in the professional community. Clearly significant and perhaps lasting changes in highway transporation were being shaped.

The gasoline shortage became critical soon after the Arab oil embargo began. The Arab oil-producing nations began withholding oil from the United States in mid-October 1973. The President delivered an important energy message to the nation November 7, 1973. He discussed the criticalness of the situation and requested voluntary energy conservation measures such as reducing travel and lowering travel speeds. Gasoline allocation to service stations was initiated. With December 1973, came "gasless Sundays". Most service stations were closed from 9 p.m. Saturday until Monday morning. The truckers' strike in February 1974 intensified the awareness of the gasoline shortage. On March 1, 1974, Kentucky's speed limits were reduced to 55 mph (24.6 m/s). The oil embargo ended in mid-March. Gasoline again became plentiful but at a much higher price.

This report presents data and analysis of traffic volumes, speeds, and accidents on rural highways in Kentucky as affected by the energy crisis.

PROCEDURE

Accident and traffic volume data were collected for each month between November 1971 and June 1974. The accident data were obtained from computer tapes containing all state police reported accidents for rural areas. Therefore, only rural accidents (including cities with less than 2500 population) were considered.

The report deals with the total rural system as well as the various highway types comprising the total system. The highway system was divided into the following highway types:

(1) two-lane,
(2) three-lane,
(3) four-lane, undivided,
(4) four-lane, divided (no access control),
(5) interstate, and
(6) parkway (toll road).

Volume data for each month was obtained from the automatic traffic recording (ATR) stations located throughout the state. Volumes were converted into vehicle miles of travel for each type of highway. The total vehicle miles of travel for 1972 *(1)* was used as the base or reference. Data from the ATR stations were summarized by month. The percentage of the total traffic counted in 1972 was calculated for each month. The total vehicle miles of travel on a particular highway type from 1972 was then multiplied by the adjustment factor for each month to obtain the monthly volumes. These volumes were also adjusted for new highway openings. There were 29 ATR stations on two-lane highways but none on three-lane highways. The factors obtained for the two-lane highways were used for three-lane highways. There was only one usable ATR station for rural, four-lane highways. The factors obtained from this station were used for both four-lane divided and undivided highways. Five ATR stations were located on rural interstate highways. The monthly factors for parkways were obtained from monthly counts of total traffic on the toll road system made available by the Kentucky Toll Road Authority. Annual growth factors from 1971 to 1972, from 1972 to 1973, and from 1973 to 1974 were then calculated for each month and used to find the monthly traffic volumes in 1971, 1973, and 1974. Volumes from the ATR stations were used in the analysis of traffic volumes. Inasmuch as sections of new highways were added during the study period, vehicle miles (kilometers) of travel used for rate calculations reflect changing lengths of roads. The total vehicle miles (kilometers) of travel for a given type of roadway, therefore, may not be directly comparable from one year to the next.

From the accident and volume data, monthly accident rates (accidents per 100 million vehicle miles) (accidents per 160 million vehicle kilometers) were calculated for each highway type.

Severity of the accidents was studied. The number of fatalities and injuries for each month were obtained. The monthly severity index *(2)* was calculated.

Traffic speed data were obtained at two interstate (I 65 in Hardin County and I 75 in Scott County) locations, five four-lane highway locations, and one two-lane highway site before and after initiation of the 55-mph (24.6-m/s) speed limit. The average speeds and speed distributions were determined as well as the 10-mph (4.6-m/s) pace and the percentage of vehicles in the 10-mph (4.6-m/s) pace. The pace is the increment of speed including the greatest number of vehicles.

Safety belt usage was also determined. The percentage of vehicle occupants involved in accidents who were using safety belts was obtained as well as the number of occupants riding in vehicles not equipped with safety belts.

RESULTS

The findings presented here pertain to the total rural highway system (approximately 23,000 miles (3700 kilometers) of roads) and its major components in Kentucky. Detailed accident and volume data may be found in the APPENDIX. Monthly data of 1 year were compared to the data of the corresponding month in the preceding year. This method best illustrated changes occurring during otherwise comparable periods of time. Three-lane and four-lane undivided highways, however, will not be discussed here because of their limited mileage.

Traffic Volume

An evident effect of the energy crisis has been the reduction in traffic volume. Monthly volumes for the total rural system are compared in Figure 1. December 1973 was the first month in which volume dropped below the corresponding month of the previous year. In the past, volumes increased by about five percent annually as exhibited by the months preceding December 1973. The decrease in traffic volume beyond December 1973 continued through June 1974 -- reaching a maximum in March 1974. In April and May 1974, the decrease in traffic volumes lessened, giving indications that 1974 monthly volumes may soon surpass 1973 volumes. But in June 1974, there was a slightly larger decrease in traffic. For a seven month period (December 1973 through June 1974), the total vehicle miles (kilometers) driven decreased by 3.5 percent compared to the same period a year earlier. The decrease was surely significant in light of a five percent increase experienced heretofore.

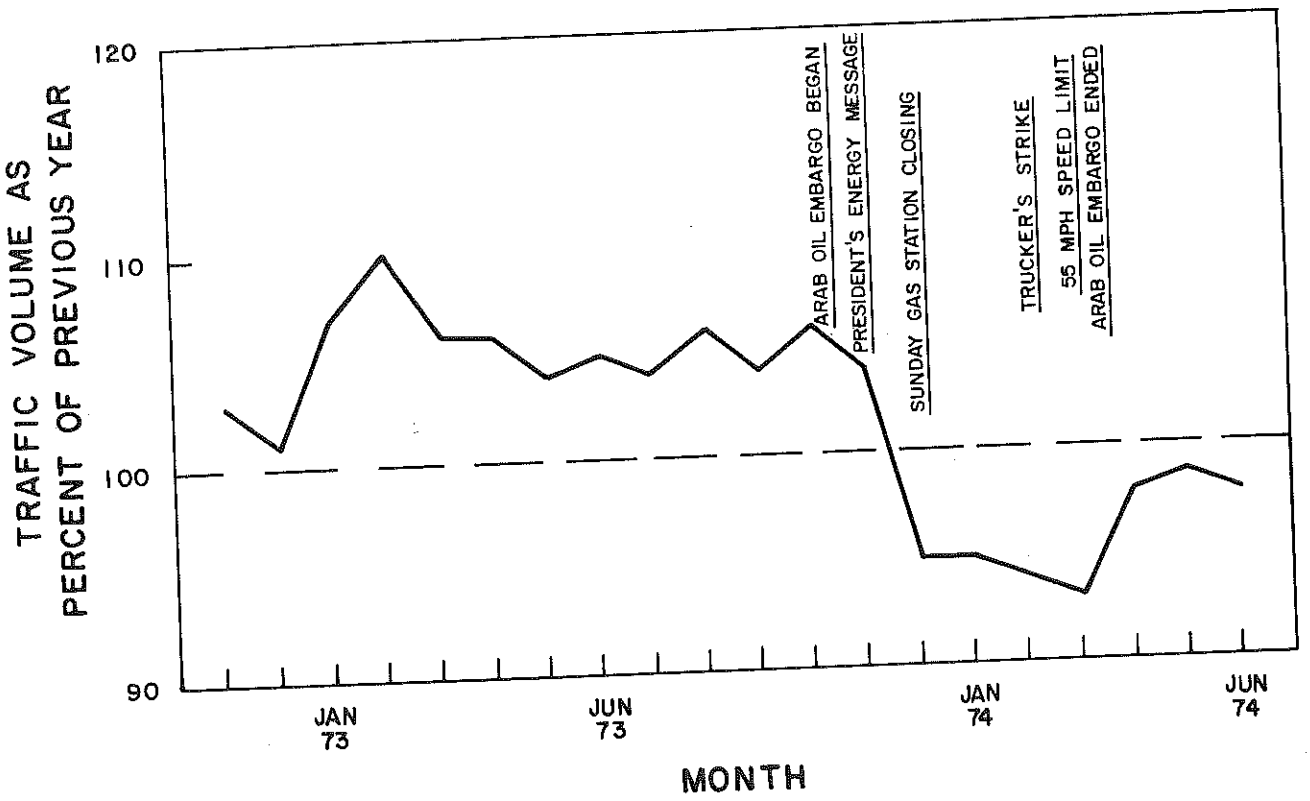


Figure 1. Comparison of Monthly Volumes to Corresponding Month in Preceding Year (Total Rural Highway System).

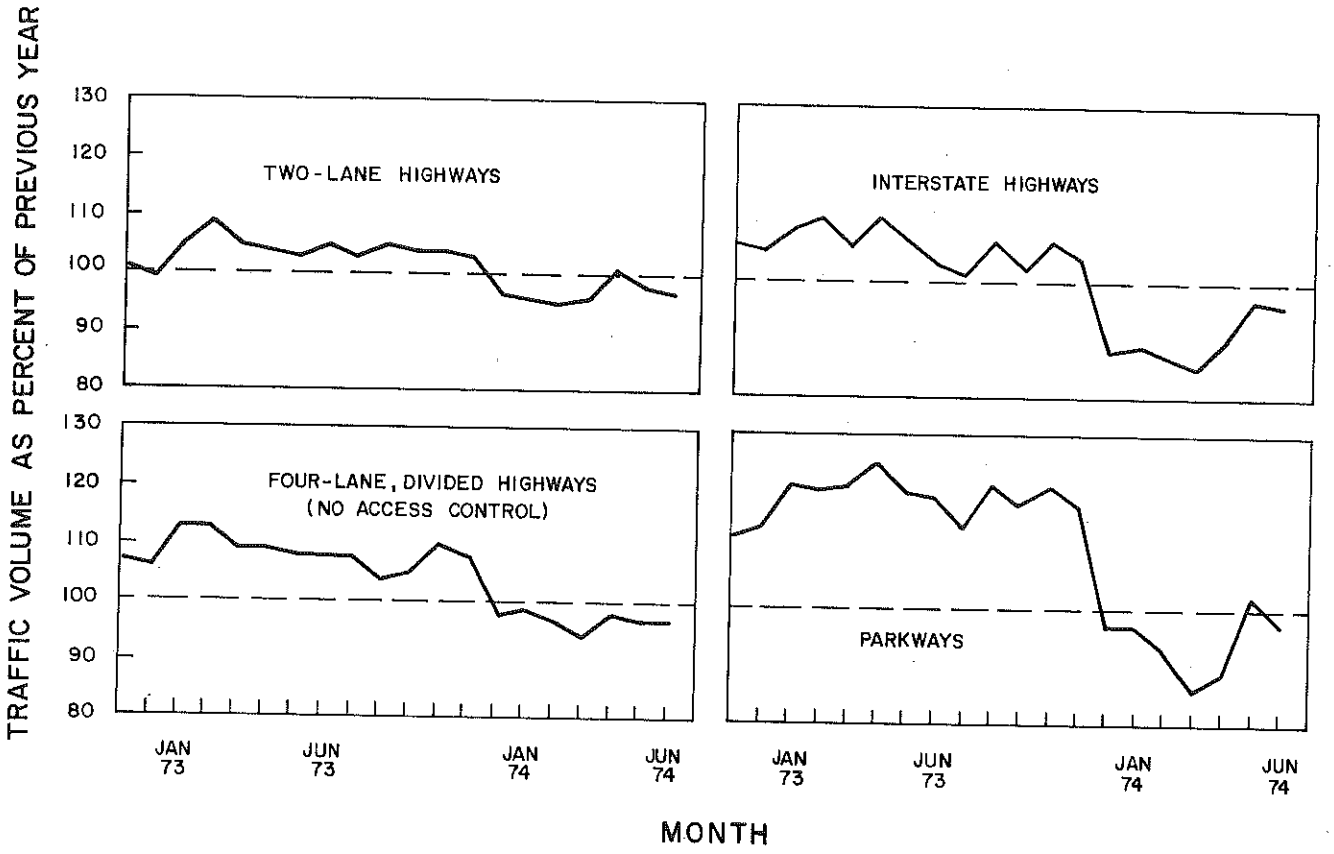


Figure 2. **Comparison of Monthly Volumes to Corresponding Month in Preceding Year (Various Highway Types).**

Major events surrounding the energy crisis are also shown in Figure 1. The traffic volumes began dropping shortly after the start of the oil embargo in October 1973 and continued to drop until the end of the oil embargo in March 1974. Traffic volume increased from May to June 1974, but not by as large a percentage as in the past. The decline in volumes in June 1974, compared to June 1973, may reflect the concern for higher gasoline prices and economic uncertainties in general.

Trends in volume changes for the various highway types were similar (Figure 2). In all cases, December 1973 was the first month which showed a large decrease compared with the preceeding year. The maximum reductions occurred in February and March 1974. Interstate highways and parkways showed the largest reduction in volume. This would be expected because minimizing long distance travel by the public would be considered foremost. The increase in parkway volume in 1973 was partially due to the opening of a new parkway in December 1972. The volume on the parkway, however, was minimal compared to the whole highway system. Two-lane and four-lane divided (no access control) highways had a smaller decrease in volume due to the local traffic on these types of highways.

Speed

Imposition of the 55-mph (25-m/s) speed limit placed a definite constraint on traffic speed. Even before then, conservation efforts by the highway user resulted in reduced travel speeds. Figure 3 shows the average automobile and truck speeds on interstate highways. In June 1973, the average speed was 68.4 mph (30.6 m/s) for cars and 62.6 mph (28.0 m/s) for trucks. Some speed reduction occurred by November and again in February for all vehicles. In March 1974, after the speed limit was changed, speeds reduced by 12.5 mph (5.6 m/s) for cars and 8.8 mph (3.9 m/s) for trucks compared with June 1973. Both car and truck speeds increased in May compared to March. Car speeds in July were comparable to speeds in May, but truck speeds continued to rise. By July, automobiles were being operated 9.6 mph (4.3 m/s) slower than last year, and trucks had slowed by 3.5 mph (1.6 m/s). However, trucks, for the first time, were traveling slightly faster than automobiles on interstate routes.

An important aspect of traffic speed is uniformity. An index to uniformity is the 10-mph (4.5-m/s) pace which indicates the 10-mph (4.5-m/s) speed range in which the greatest percentage of vehicles operate. Data in Table 1 show that the percentage of vehicles on interstate routes in the pace increased as traffic speed diminished. This increased percentage means that the average variance in speeds between vehicles has decreased. This may contribute to a reduction in accidents *(3)*.

Average driving speeds and 10-mph (4.5-m/s) paces for four-lane divided (no access control) and two-lane highways are summarized in Table 2, which includes data for before and after the speed limit reduction. The changes in speeds on both types of highways were similar. Average truck speeds decreased by about 1.5 mph (0.7 m/s), and average automobile speeds decreased by more than 3.5 mph (1.6 m/s). No significant change in percentages of vehicles in the pace was evident on the four-lane divided (no access control) highways. On two-lane roads, the percentage of vehicles in the pace increased.

Speed distribution curves for automobiles and trucks are presented in Figure 4 through Figure 7. Before the concern for gas conservation materialized (June 1973) 40 percent of the automobiles on the interstate roads traveled above the 70-mph (31.3-m/s) posted speed. A year later (July 1974), 79 percent exceeded the posted speed of 55 mph (24.6 m/s). These percentages drop to 16 percent (June 1973) and 26 percent (July 1974) when a 5-mph (2.2-m/s) tolerance above posted speed was considered. On two-lane roads, the previous 60-mph (26.9-m/s) posted speed (daytime) was exceeded by 19 percent of automobiles; the percentage remained the same after the speed was changed to 55 mph (24.6 m/s).

Before the reduction of posted speed from 70 mph (31.3 m/s) to 55 mph (24.6 m/s) on interstate roads, six percent of the trucks exceeded the speed limit and one percent exceeded 75 mph (33.6 m/s) (June 1973). After the reduction, 78 percent exceeded the speed limit and 26 percent surpassed 60 mph (26.9 m/s) (July 1974) -- these percentages after the speed reduction are identical to those for automobiles. On two-lane highways, the truck speed limit was raised from 50 mph (22.4 m/s) to 55 mph (24.6 m/s). The increased speed limit has reduced the 32 percent of trucks traveling above 50 mph (22.4 m/s) (before) to virtually zero at 55 mph (24.6 m/s). The speed data, however, represents a single location and, therefore, may not be entirely representative of all two-lane, state maintained roads.

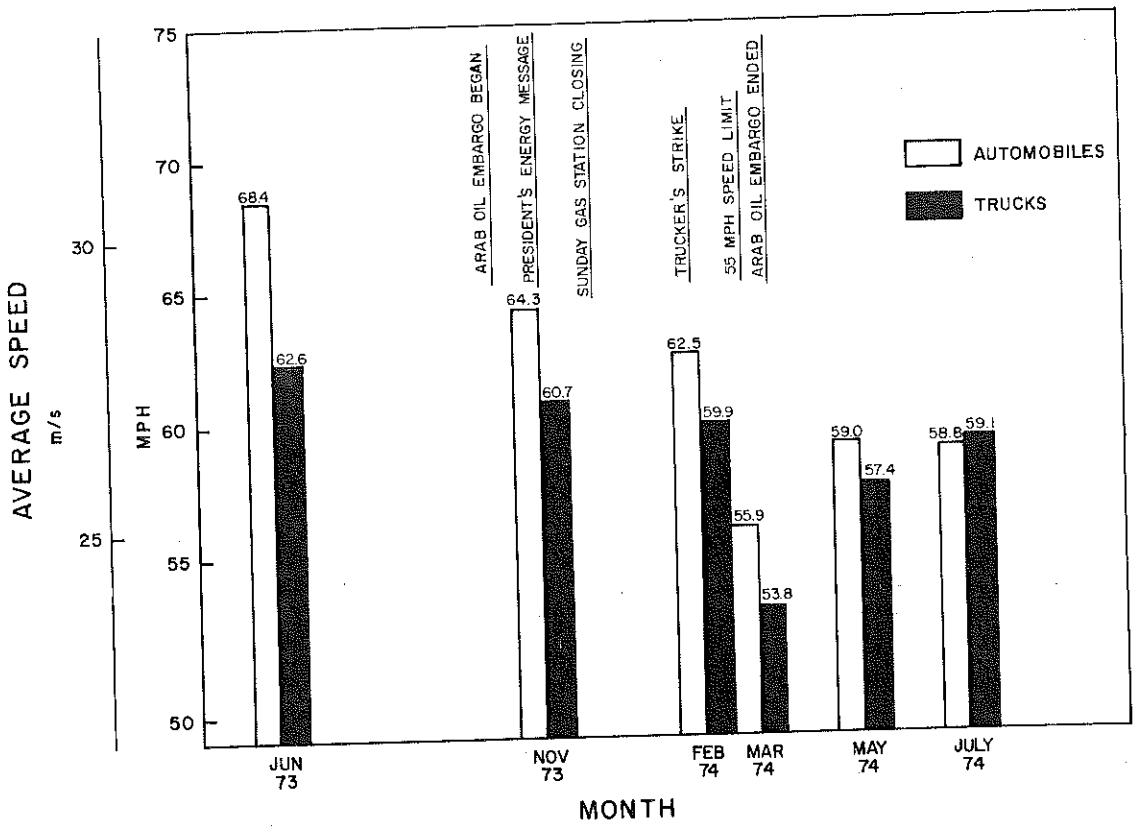


Figure 3. Interstate Speed Trends during the Energy Crisis

TABLE 1

10-mph (4.5-m/s) PACE FOR INTERSTATE HIGHWAYS (COMBINED HARDIN AND SCOTT COUNTY LOCATIONS)

	AUTOMOBILES			TRUCKS		
		RANGE			RANGE	
MONTH	(percent)	(mph)	(m/s)	(percent)	(mph)	(m/s)
Jun 1973	50	64 - 73	28.6 - 32.6	68	59 - 68	26.4 - 30.4
Nov 1973	64	61 - 70	27.3 - 31.3	70	57 - 66	25.5 - 29.5
Feb 1974	64	51 - 66	22.8 - 29.5	66	55 - 64	24.6 - 28.6
Mar 1974	79	51 - 60	22.8 - 26.8	76	49 - 58	21.0 - 25.9
May 1974	74	55 - 64	24.6 - 28.6	79	53 - 62	23.7 - 27.7
Jul 1974	82	53 - 62	23.7 - 27.7	79	53 - 62	23.7 - 27.7

TABLE 2

AVERAGE DRIVING SPEEDS AND 10-mph (4.5-m/s) PACE BEFORE AND AFTER THE SPEED LIMIT REDUCTION

TYPE OF HIGHWAY	AVERAGE SPEED						10-mph (4.5-m/s) PACE					
	BEFORE (1972)		AFTER (Aug 1974)		CHANGE		BEFORE (1972)			AFTER (Aug 1974)		
								RANGE			RANGE	
	(mph)	(m/s)	(mph)	(m/s)	(mph)	(m/s)	(percent)	(mph)	(m/s)	(percent)	(mph)	(m/s)
						AUTOMOBILES						
Four-Lane Divided[a] (No Access Control)	57.2	25.6	53.7	24.0	-3.5	-1.6	66.5	53 - 62	23.7 - 27.7	64.6	49 - 58	21.9 - 25.9
Two-Lane[b]	56.0	25.0	52.0	23.2	-4.0	-1.8	61.0	53 - 62	23.7 - 27.7	70.0	45 - 54	20.1 - 24.1
						TRUCKS						
Four-Lane Divided[a] (No Access Control)	53.2	23.8	50.9	22.8	-1.3	-0.6	68.9	47 - 56	21.0 - 25.0	61.9	47 - 56	21.0 - 25.0
Two-Lane[b]	47.7	21.3	46.2	20.7	-1.5	-0.7	55.0	47 - 56	21.0 - 25.0	63.0	43 - 52	19.2 - 23.2

[a]Five locations

[b]One location

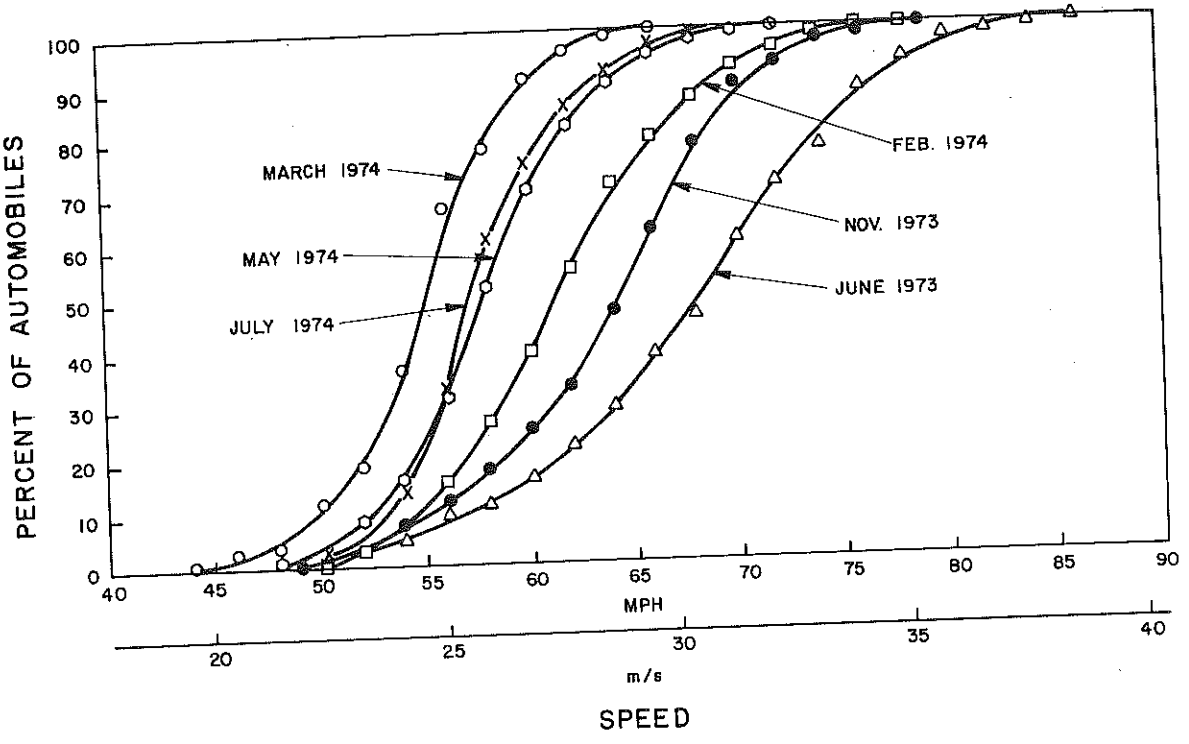
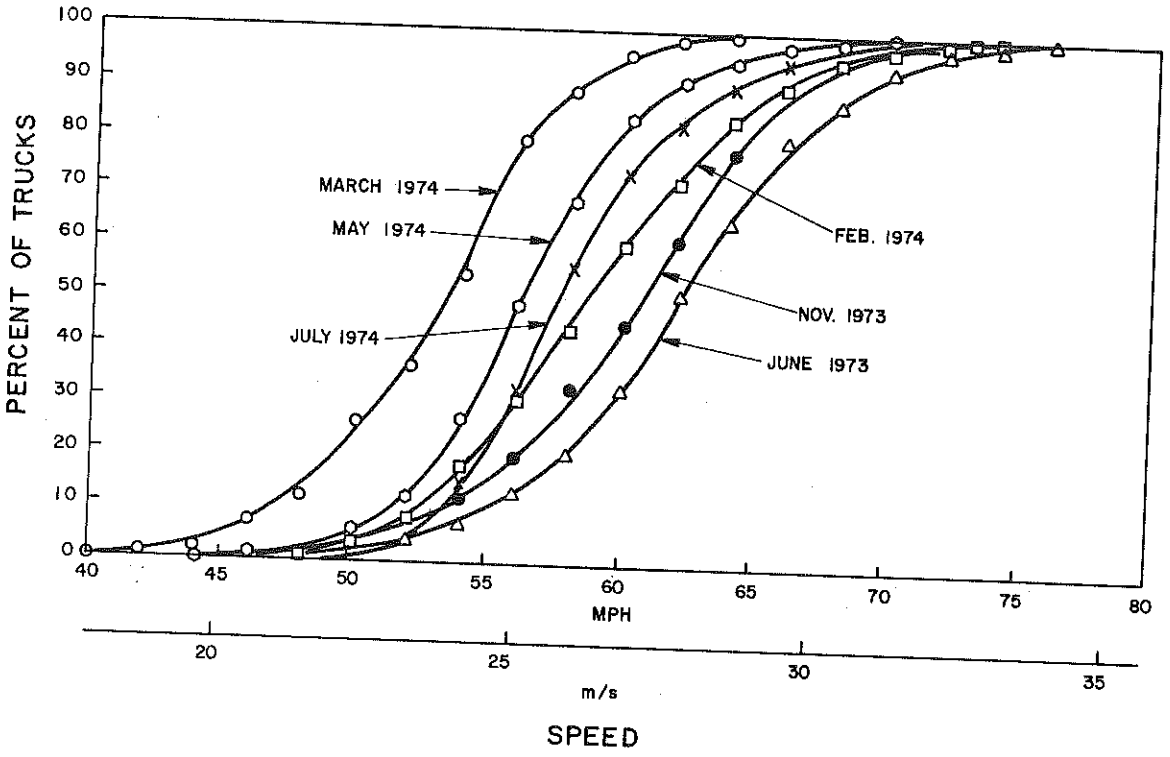


Figure 4. Automobile Speed Distribution Curves (Interstate Highways).

Figure 5. Truck Speed Distribution Curves (Interstate Highways).



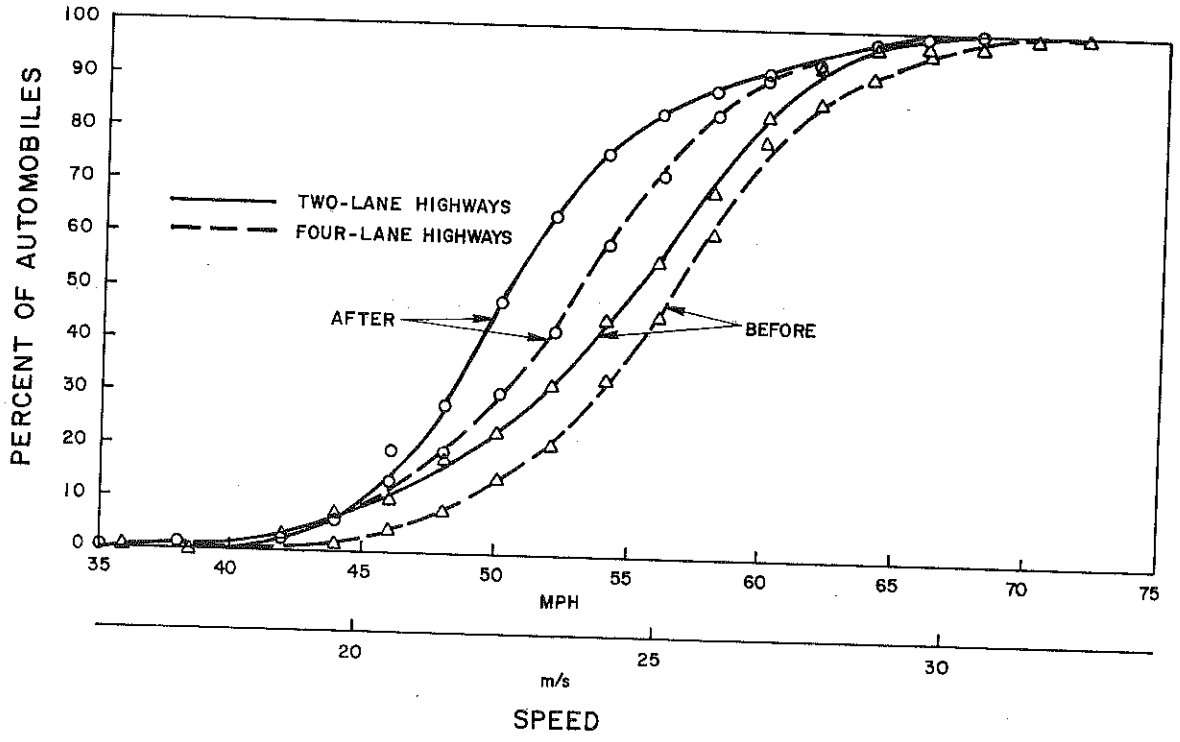


Figure 6. Automobile Speed Distribution Curves (Two-Lane and Four-Lane (No Access Control) Highways).

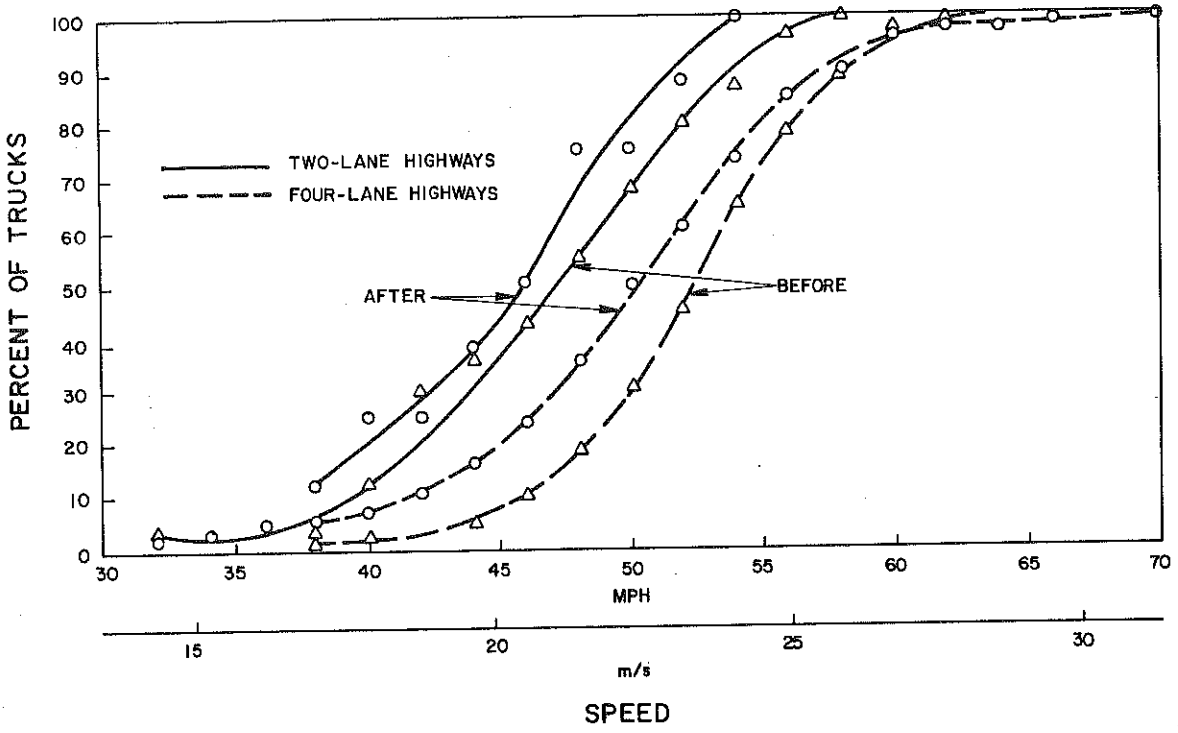


Figure 7. Truck Speed Distribution Curves (Two-Lane and Four-Lane (No Access Control) Highways).

Accidents

The effect of the energy crisis on the number of accidents on the entire rural system is shown in Figure 8. Similar to traffic volumes, December 1973 was the first month which exhibited decreased accidents compared to the year before. Except for January 1974, the number of accidents in each month of 1974 was considerably less than for the corresponding month in 1973. During the months preceding December 1973, accidents had increased by an average of more than 10 percent over the year before. The largest decrease in accidents occurred in March and April 1974. There were also decreases in volume during these months, and it should be noted that these low accident months followed the lowering of the speed limit on March 1, 1974.

All four major highway types experienced a decrease in accidents for almost every month in 1974 (Figure 9). March and April 1974 showed the largest decreases. Interstate and four-lane divided (no access control) highways had the most dramatic drop in accidents. The number of accidents on parkways has fluctuated widely, but the largest decrease occurred in March 1974. On two-lane highways, the monthly percentage in the number of accidents first dropped below the previous year in December 1973. This decrease continued through June 1974 -- reaching a minimum of 75 percent in March and April. On four-lane divided (no access control) highways, the number of accidents remained below the previous year since August 1973, except for January and June of 1974. Monthly accident rates on the total rural system first showed a significant decrease from the year before in March 1974, although there were indications of the accident rate lowering prior to then (Figure 10). In November and December 1973, the accident rate dipped slightly below the same periods in 1972. In January 1974, there was an increase, but the rate again decreased in February. After the speed limit reduction on March 1, 1974, the accident rate reduced sharply compared to the year before. The reduced accident rate has continued through June 1974 -- reaching a minimum during April. The accident rate for the period between December 1973 and June 1974 was 190 accidents per 100 million vehicles miles (160 million vehicle kilometers) but was 220 during the same period a year earlier. Between 1970 and 1972, the rate was 204 *(1)*.

The monthly variation in accident rates for the various highway types is given in Figure 11. Except for two-lane highways, there was a large variation in the monthly accident rates. March and April 1974 showed the largest decrease in accident rates for all highway types. The reduction in accident rates was greater for interstate than for two-lane highways. This might be related to the fact that speeds decreased more on interstate than on two-lane highways.

Pavement surface conditions (dry, wet, snow, or ice) should be considered whenever accident occurrences are compared. Weather conditions for the months of December 1973 through June 1974 were, therefore, compared to the corresponding month in the preceding year. Large differences were found for January and April. There was a 63-percent increase in the hours of inclement weather in January 1974 and a 52-percent decrease in April 1974. These differences in weather may partially account for the increased accident rate in January 1974 and the decreased accident rate in April 1974. A 14-percent decrease in inclement weather in March 1974 may slightly affect the accident rate although not to the extent that the rate decreased. During the remaining months, variations were five percent or less.

Figure 8. Comparison of Number of Monthly Accidents to Corresponding Month in Preceding Year (Total Rural Highway System).

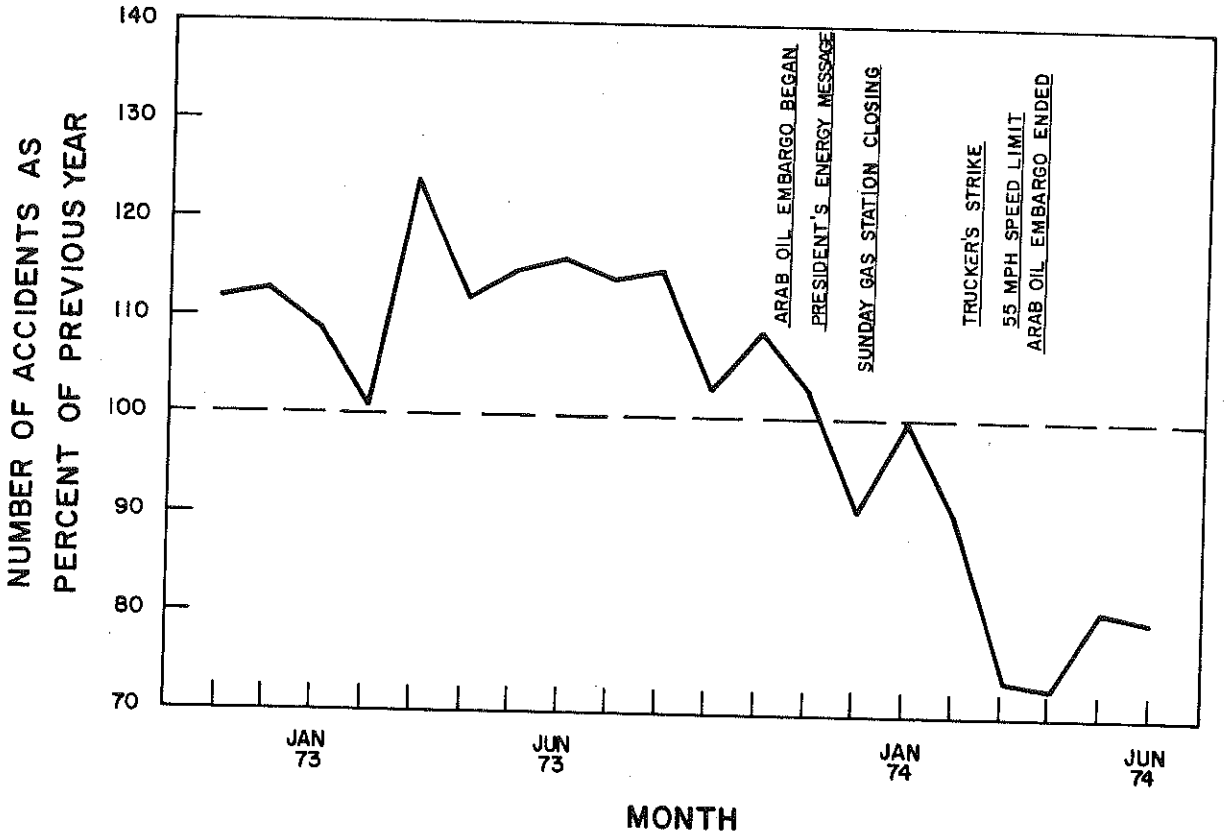
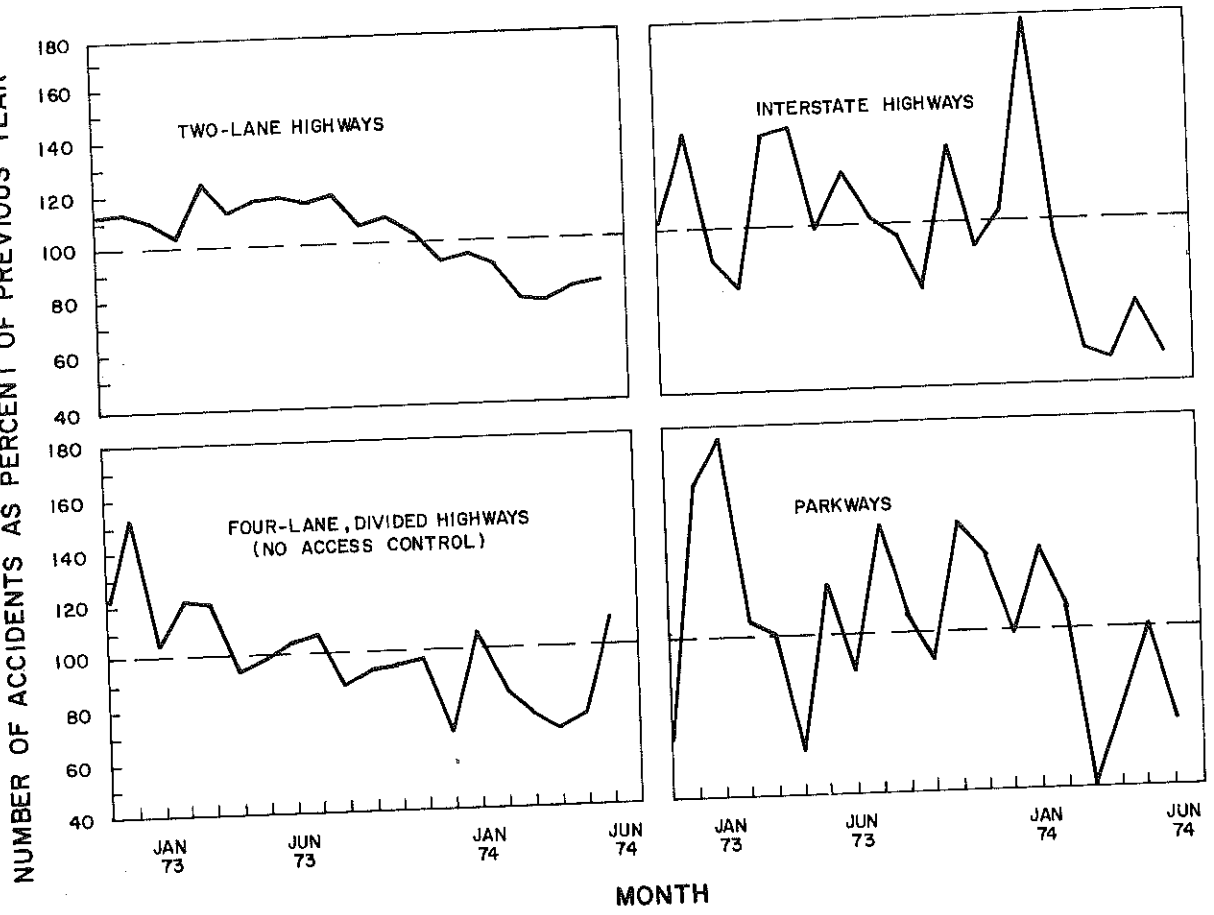


Figure 9. Comparison of Number of Monthly Accidents to Corresponding Month in Preceding Year (Various Highway Types).



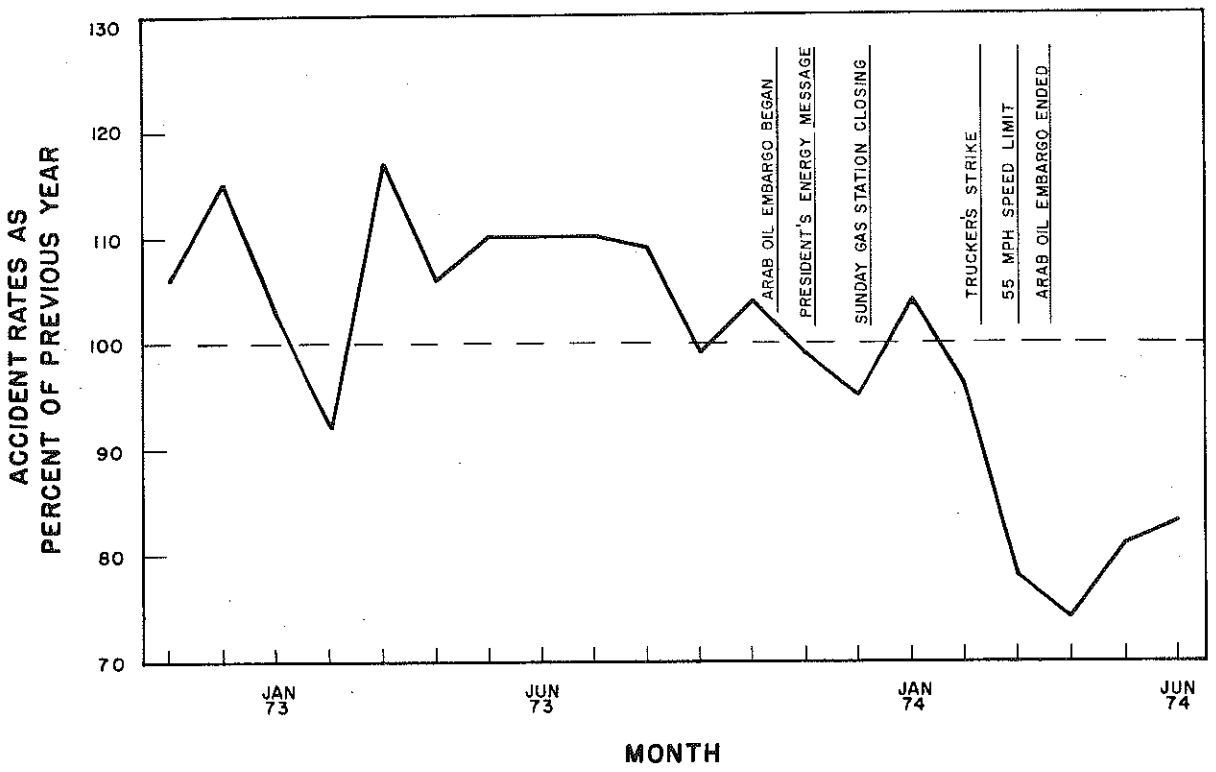
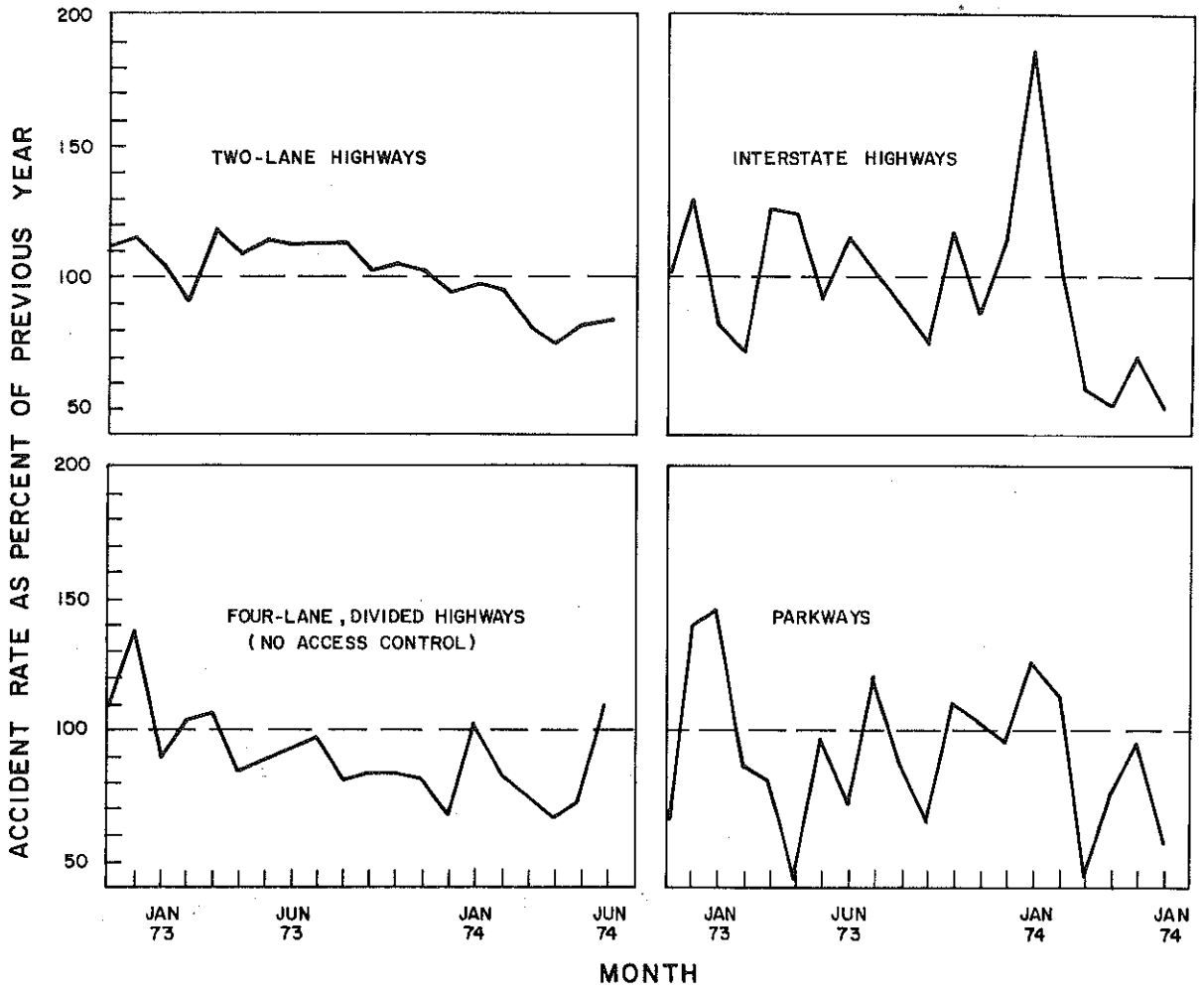


Figure 10. **Comparsion of Monthly Accident Rates to Corresponding Month in Preceding Year (Total Rural Highway System).**

Figure 11. Comparison of Monthly Accident Rates to Corresponding Month in Preceding Year (Various Highway Types).



Fatalities

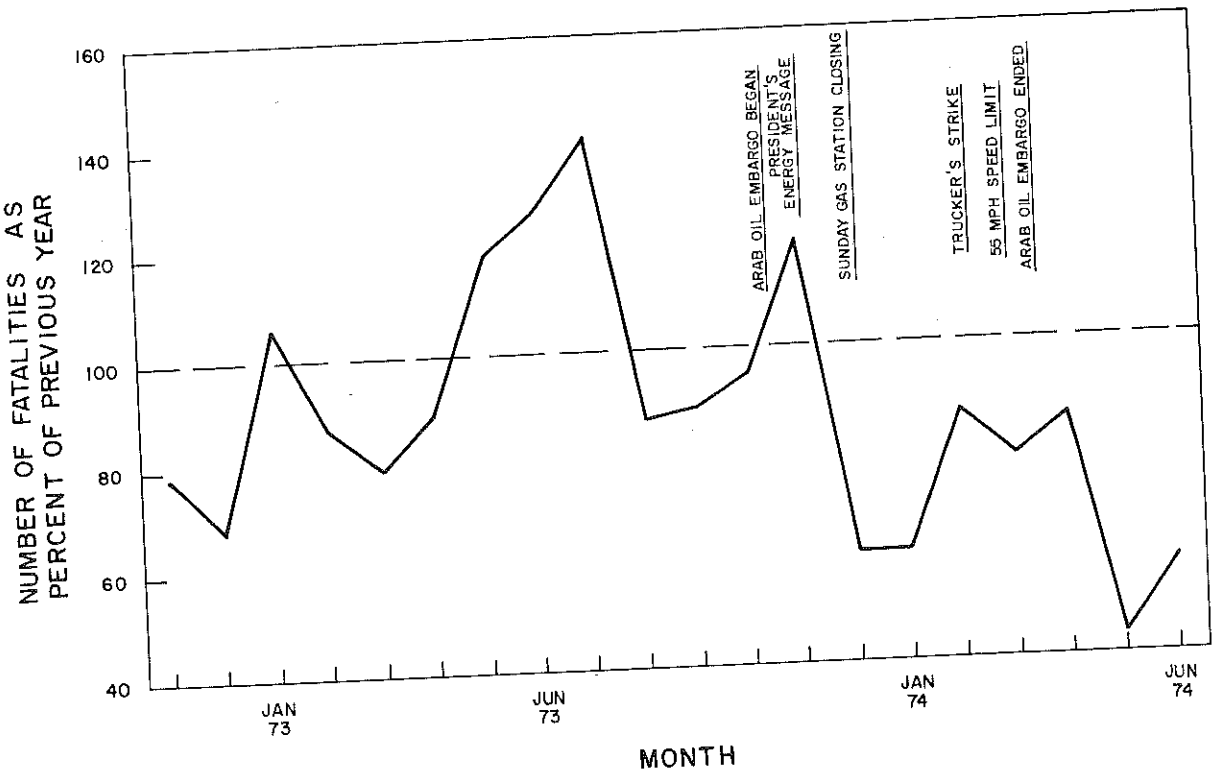
The monthly variation in fatalities has fluctuated considerably as shown in Figure 12. The number of fatalities has remained below the preceding year from December 1973 through June 1974. The total number of fatalities from December 1973 (when the energy crisis seemed to have an impact) through June 1974 were compared to the same time periods two years earlier (Figure 13). The number of fatalities dropped from 512 (1973) to 333 (1974), or a reduction of 35 percent. At the same time, vehicle miles (kilometers) driven dropped by only 3.5 percent.

Figure 14 presents the number of fatalities for several highway types. The average change in fatalities was a 35.0-percent decrease for two-lane highways, a 81.9-percent decrease for parkways, a 10.8-percent increase for four-lane divided highways, and a 3.8-percent increase for interstates. Changes in fatalities on the multi-lane facilities may not be statistically significant because of the limited number of fatalities recorded. Fatalities for two-lane highways were reduced considerably while the average speed decreased by 3.5 mph (1.6 m/s) (automobiles).

A very wide fluctuation in fatality rate was also observed for the total rural system during the study period (Figure 15). As with fatalities, the fatality rate has remained below the preceding year rate (December through June). The lowest fatality rate occurred in May 1974. The fatality rate for the period December 1973 through June 1974 was 4.9 fatalities per 100 million vehicle miles (160 million vehicle kilometers) and 7.3 fatalities per 100 million vehicle miles (160 million vehicle kilometers) for the same period a year earlier. The drop in fatality rate, therefore, was considerable (32.9 percent).

The fatality rate on two-lane highways decreased by 32.6 percent. As stated before, changes on other highways may not be statistically valid comparisons. If additional, clarifying information such as roadway conditions at the time of the accident were available, explanation of the differences may be evident.

Figure 12. Comparison of Monthly Fatalities to Corresponding Month in Preceding Year (Total Rural Highway System).



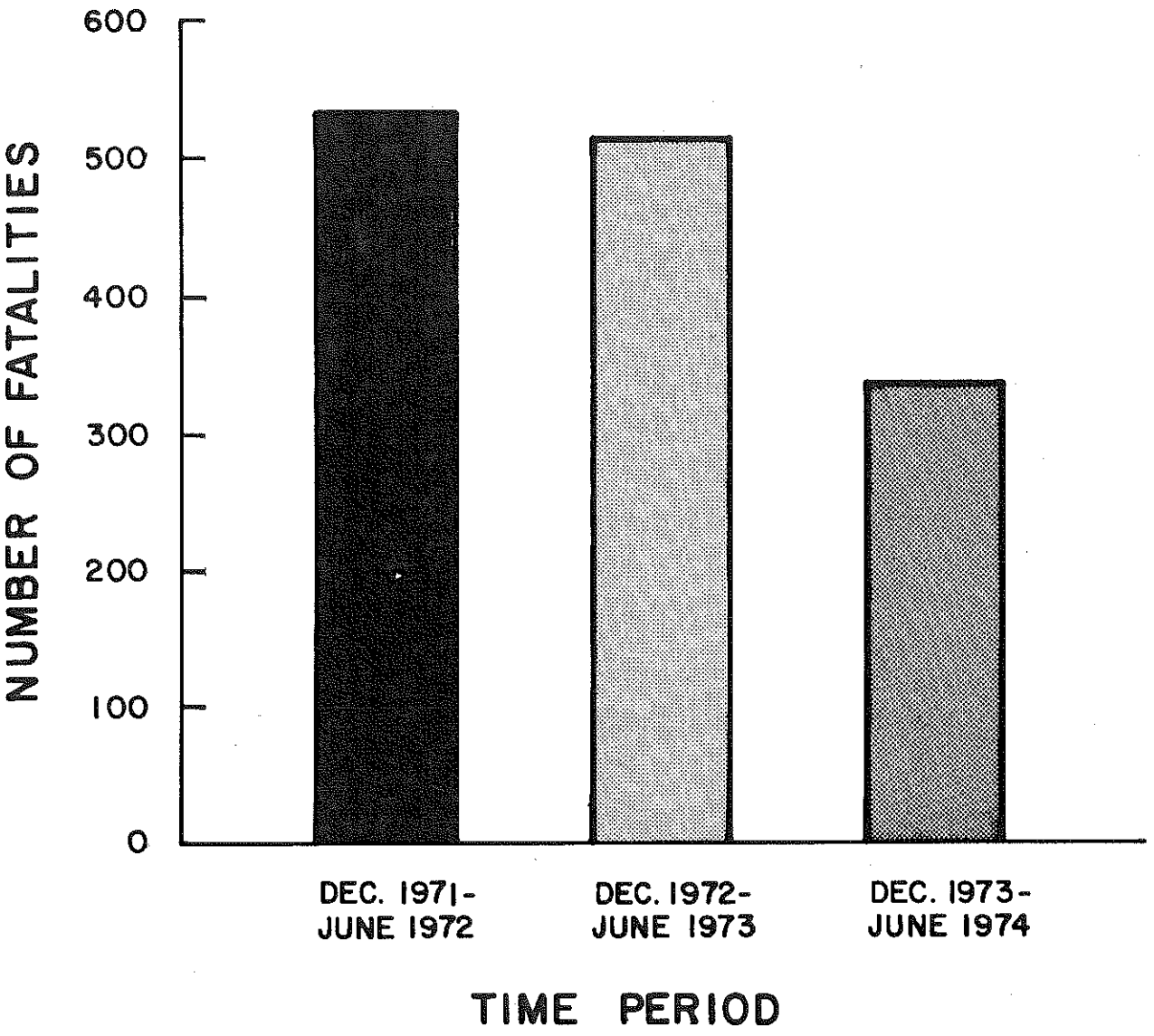


Figure 13. Comparison of Fatalities for Several 7-Month Periods (Total Rural Highway System).

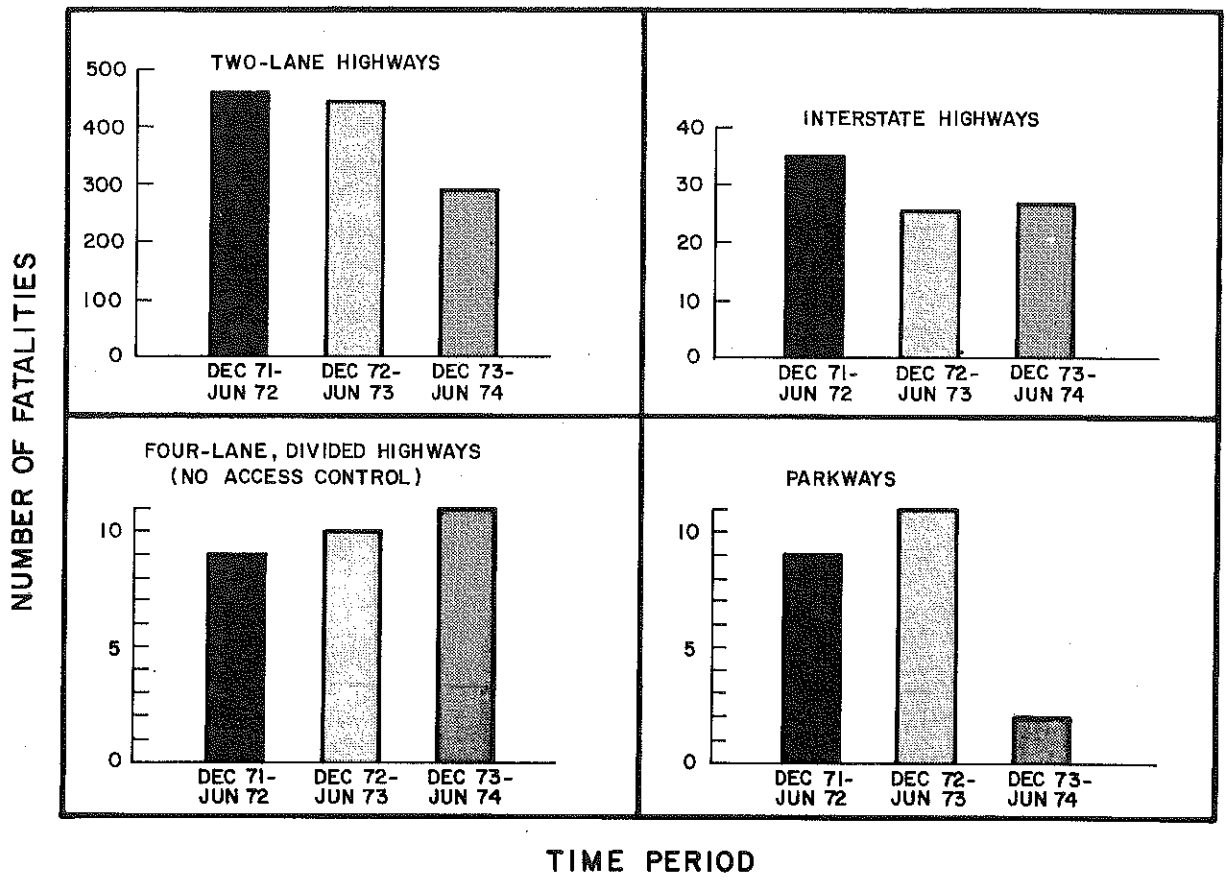


Figure 14. **Comparison of Fatalities for Several 7-Month Periods (Various Highway Types).**

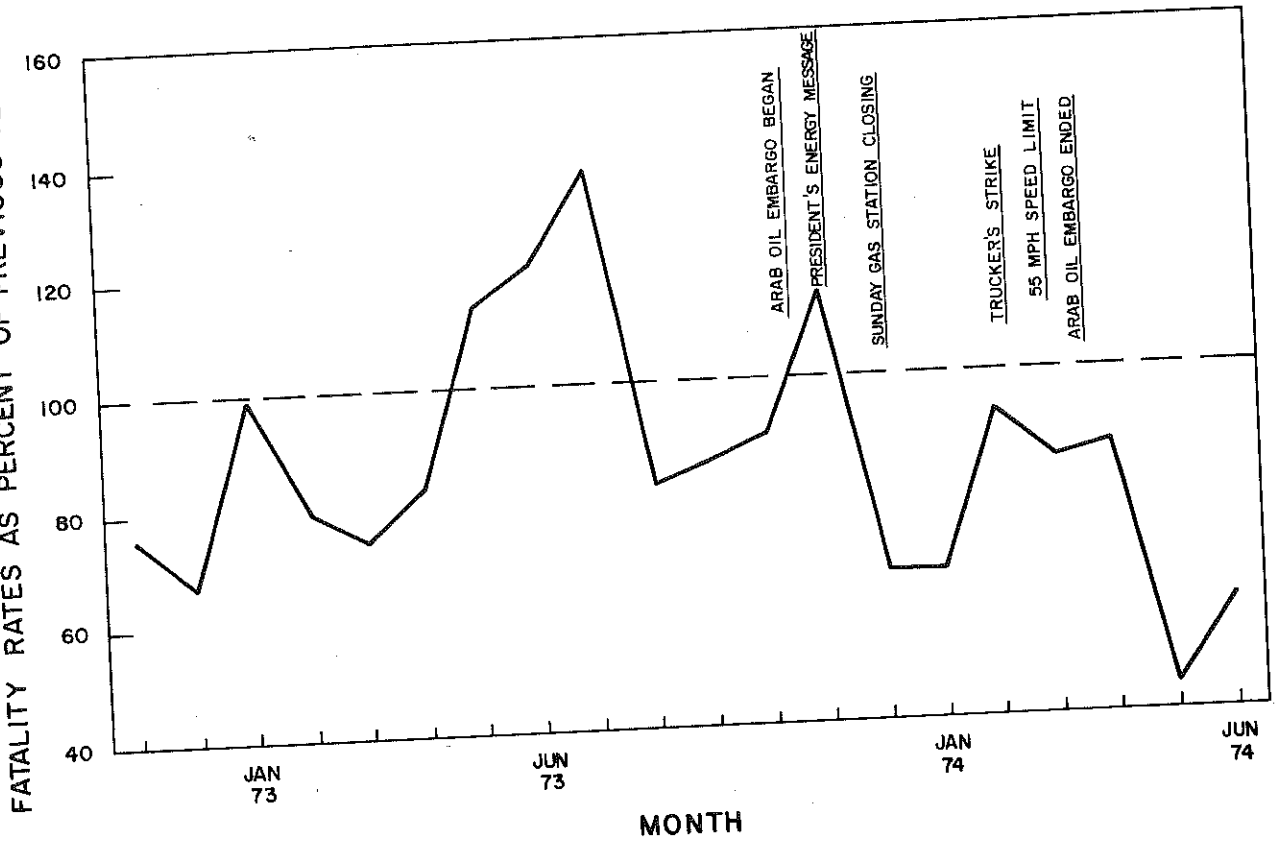


Figure 15. Comparison of Monthly Fatality Rates to Corresponding Month in Preceding Year (Total Rural Highway System).

Injuries

The change in injuries for the total rural system is shown in Figure 16. There was a pronounced change in the number of injuries since December 1973. In the months preceding December 1973, the number of injuries increased on an average of more than 10 percent from the previous year. In April 1974, the injuries reached a minimum of only 67 percent compared to April 1973.

The reduction in injuries for the various highway types is shown in Figure 17. All highway types had a reduced number of injuries in 1974; the greatest decreases occurred in March, April, and May. Interstates and parkways had the largest decrease -- to below 50 percent in March and April 1974. The number of injuries on two-lane highways first dropped below the previous year in December 1973 and has remained below the previous year through June 1974. For four-lane divided (no access control) highways, the number of injuries has fluctuated widely. The reductions in April and May 1974 could not be considered dramatic.

The change in the injury rate for the total rural system (Figure 18) since the beginning of the energy crisis was very similar to the change in the number of injuries. With the exception of January 1974, every month since November 1973 has been below the corresponding month in the preceding year. The large drop in the injury rate occurred in March 1974 and has continued through June 1974.

The variation in injury rates by highway type is given in Figure 19. For interstate, parkway, and four-lane divided (no access control) highways, injury rates have fluctuated above and below the previous year rates since the first months of 1973, but the injury rate did decrease in 1974. The injury rate on two-lane highways first dropped below the previous year in December 1973 and reduced to 68 percent in April 1974.

Severity Index

The severity index (SI) attempts to place a value on the average severity of accidents. The severity index increases as the damage and injuries increase. The weighting factors used in the formula *(2)* were calculated by considering the cost of each type of accident or injury and the number of accidents or injuries. Fatal accidents and A-injury accidents were grouped together; although fatalities are much more costly, they are also rarer. Accidents classified as B-injury or C-injury were also grouped together.

No definite trends could be discerned in the monthly severity index for the total rural system when compared to the corresponding month in the preceding year (Figure 20). However, from November 1973 through June 1974, the severity index had decreased to 2.65 compared to 2.72 a year earlier.

Accident severity has decreased slightly each year since 1970 *(1)*. This decrease may be attributable to safer vehicles, safety belt usage, safety improvements to the highway system, etc. The severity index for each highway type has decreased since the beginning of the energy crisis in December 1973 except for interstate highways.

Safety Belt Usage

Accident severity has decreased slightly over the past few years. One reason may be the safety features incorporated in newer vehicles. Beginning with the 1974 model year, automobiles could not be started until the occupants' safety belts were fastened. This feature could significantly increase the percentage of vehicle occupants who were wearing safety belts. A past study *(1)* showed that persons not wearing safety belts had approximately twice the probability of being injured and four times the probability of being killed compared to persons who do wear safety belts. There has been a slight increase in the percentage of motorists involved in accidents who were wearing safety belts. This percentage has changed from an average of 6.0 percent for 1970 through 1972 to 6.7 percent in 1973 and 6.6 percent for January through June of 1974. It is interesting to note that this percentage is much lower than the 20 to 25 percent of all occupants of cars on the road today who are wearing safety belts *(4)*. This may also suggest that wearing a safety belt may decrease the probability of being involved in an accident; it could also mean that drivers who use seat belts are more cautious and attentive. Another possible reason for reduced accident severity is that the percentage of older cars not equipped with safety belts, or other safety features, is constantly being reduced. The percentage of vehicle occupants in a car not equipped with safety belts has dropped from an average of 44.2 percent for 1970 through 1972, to 35.0 percent in 1973, and to 32.1 percent for January through June of 1974.

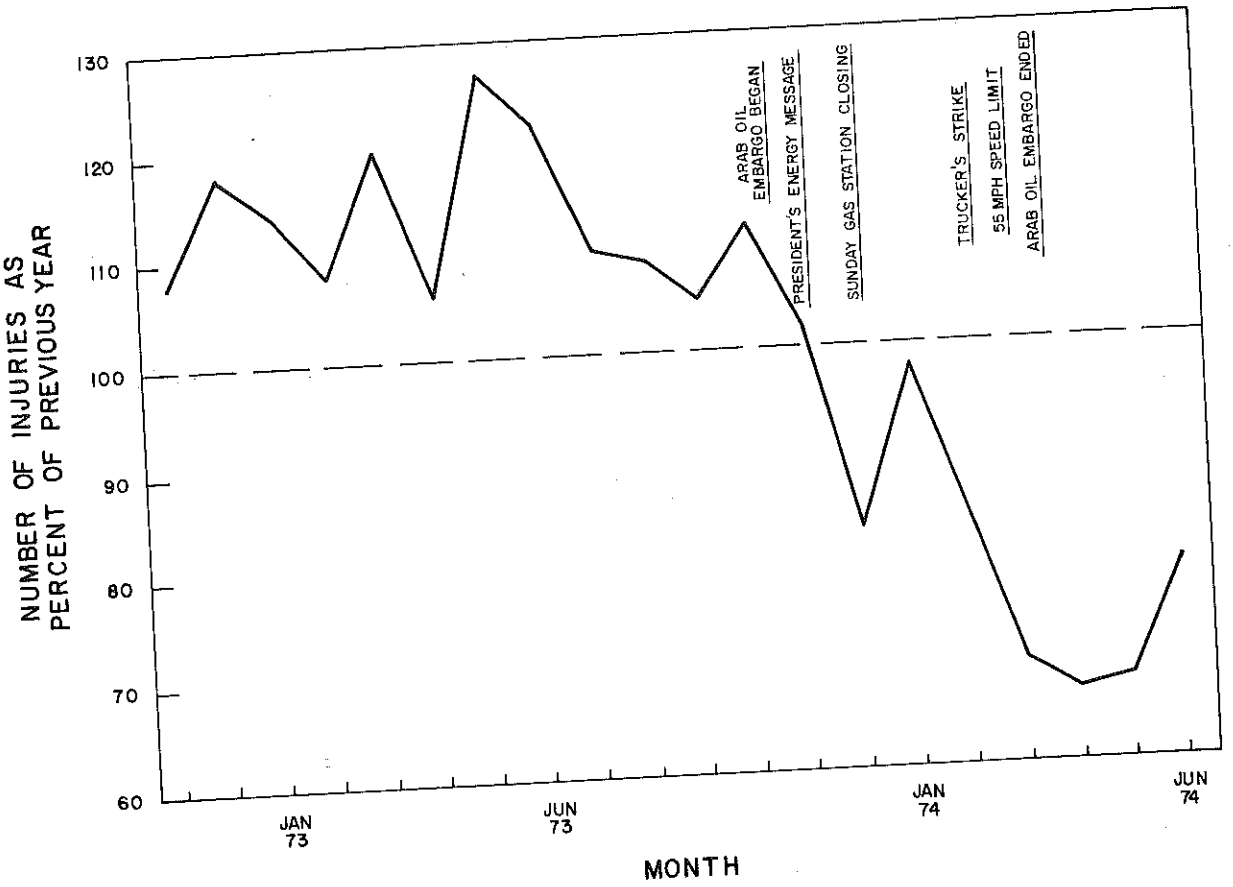
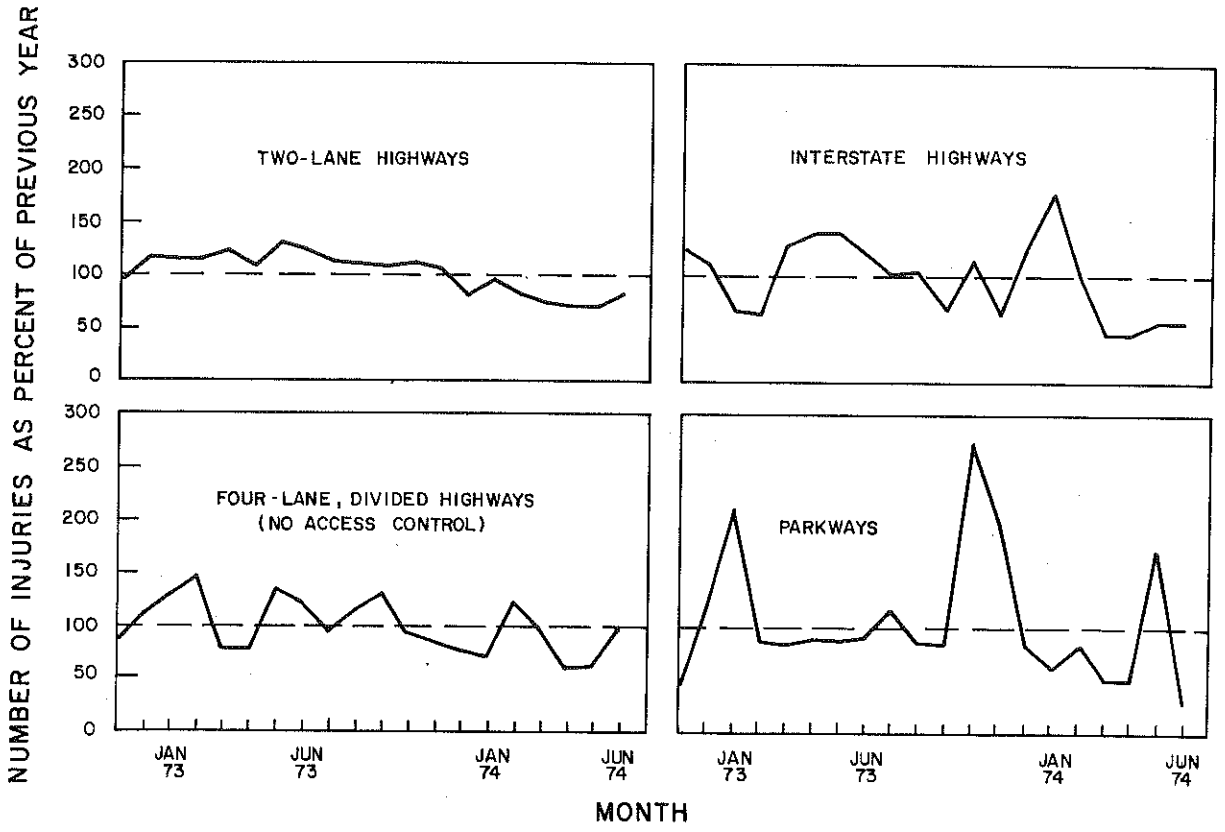


Figure 16. **Comparison of Number of Injuries to Corresponding Month in Preceding Year (Total Rural Highway System).**

Figure 17. Comparison of Number of Injuries to Corresponding Month in Preceding Year (Various Highway Types).



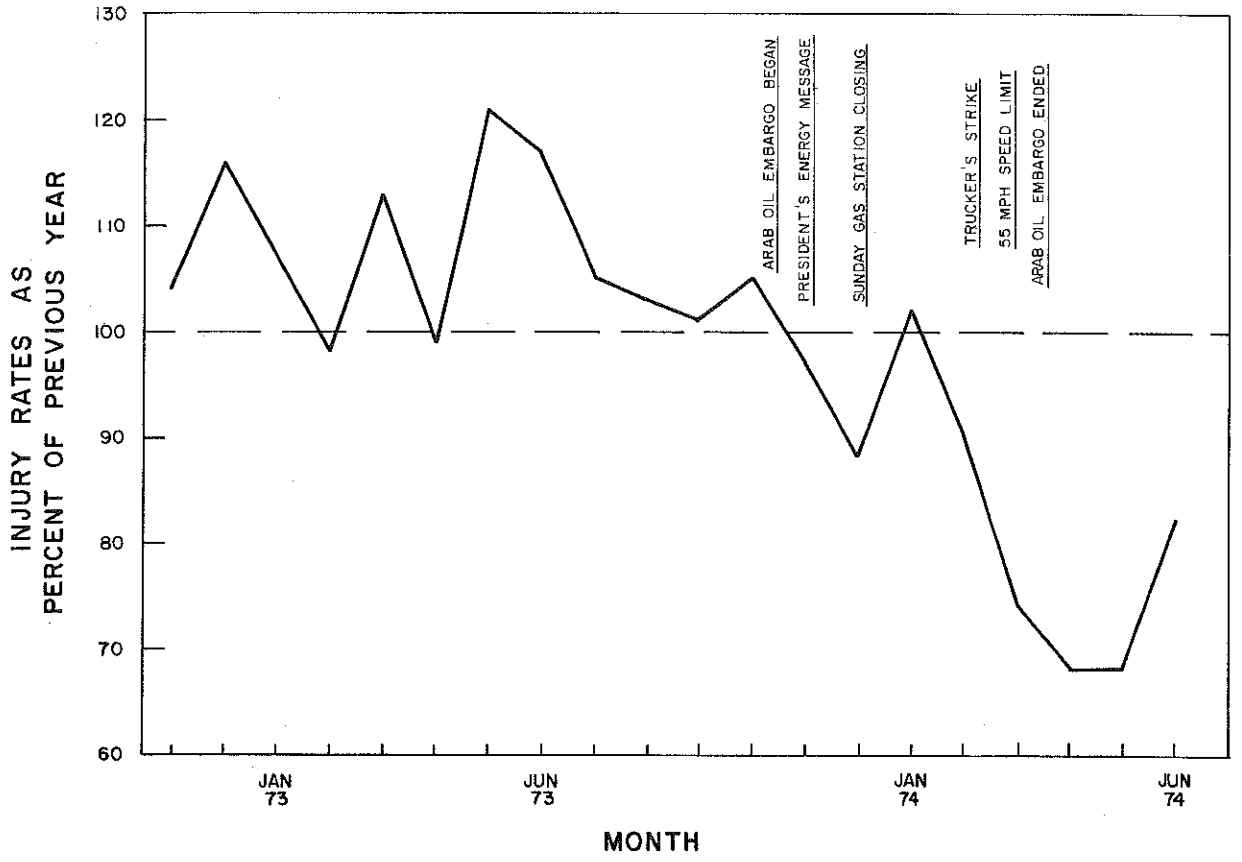


Figure 18. **Comparison of Monthly Injury Rates to Corresponding Month in Preceding Year (Total Rural Highway System).**

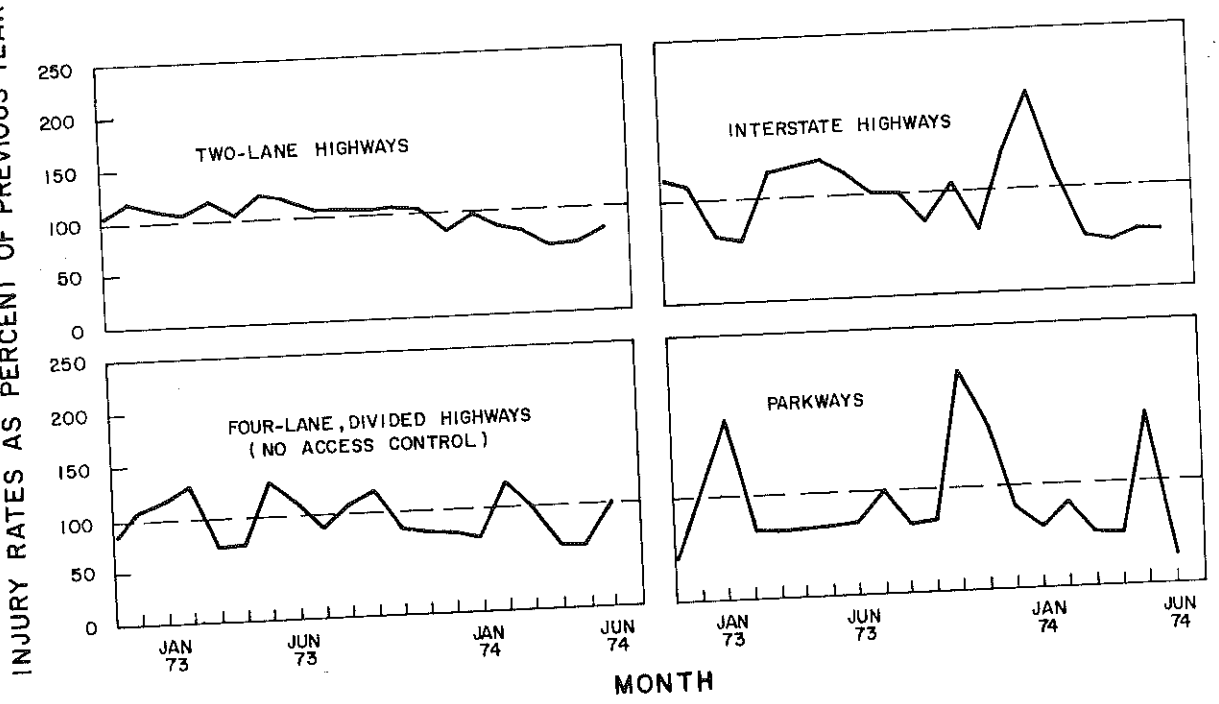


Figure 19. **Comparison of Monthly Injury Rates to Corresponding Month in Preceding Year (Various Highway Types).**

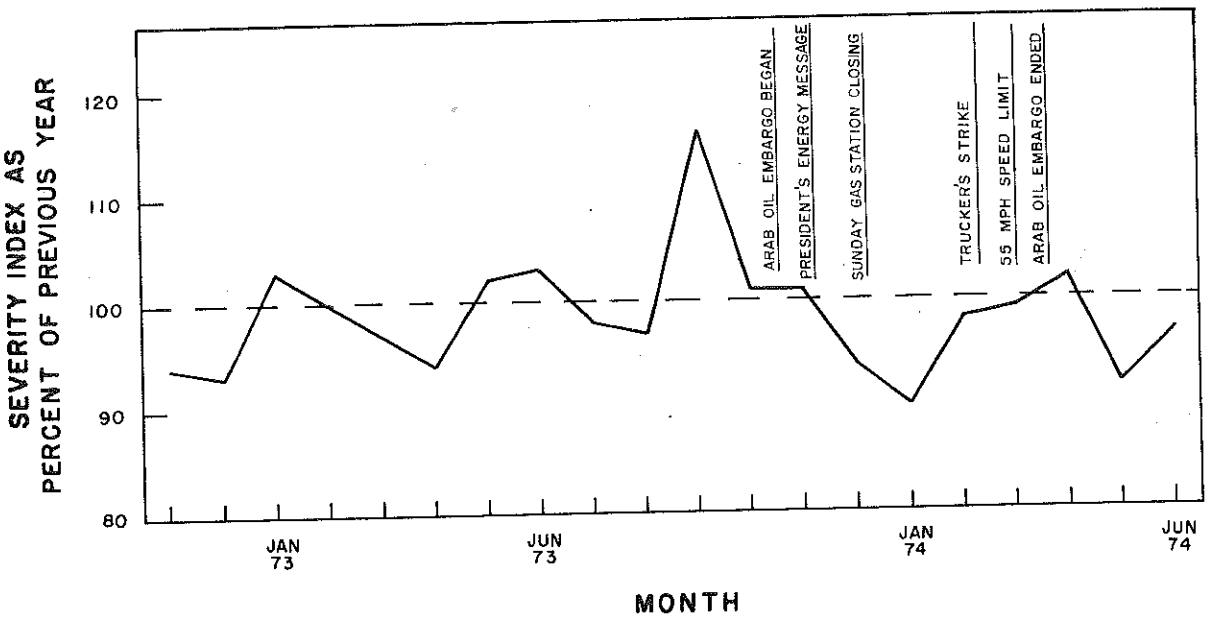


Figure 20. **Comparison of Monthly Severity Index to Corresponding Month in Preceding Year (Total Rural Highway System).**

Surface Conditions

Accident rates have been recognized as being higher on wet pavements than on dry pavements. Furthermore, research has shown that accident rates tend to increase as wet skid resistance diminishes *(5)*. Table 3 shows accident rates for dry, wet, and snow or ice surface conditions for two periods of time (1973 and 1974). Accident rates were calculated from adjusted vehicle miles (kilometers) of travel under each surface condition using precipitation data for the Lexington area (Table 4). The assumption was made that Lexington weather data applied statewide and that traffic volumes did not differ between dry, wet, and ice or snow surface conditions. The latter assumption in particular is not entirely true. Some reduction in travel probably occurs in wet weather, and travel would certainly diminish during snow or ice conditions. The accident rates in contrast to those cited in Table 3, therefore, would be lower for dry surfaces, somewhat higher for wet surfaces, and substantially higher for ice or snow surfaces.

Under dry conditions, the greatest accident rate decrease occurred on interstates (19.2 percent) and parkways (22.2 percent). As shown earlier, the speed decreases were much larger on these highway types. It is important to note the very substantial decrease in wet-weather accident rates on interstates (45.3 percent) and parkways (54.1 percent). The reductions were far in excess of the corresponding decreases during dry conditions. Obviously, improved skid resistance at the lower travel speeds provided an added margin of safety and, therefore, contributed to a reduction in accidents. A similar decrease was found for four-lane divided (no access control) highways -- 33.7 percent when wet and 11.8 percent when dry.

The wet-weather accident decrease (10.3 percent) on two-lane highways was somewhat similar to dry-surface conditions (13.4 percent). It must be pointed out, however, that even a modest error in the precipitation data used in one of the periods could substantially influence the results.

During snow- or ice-surface conditions, some decreases in accident rates are evident on all highways as a result of lower posted speeds. The decreases, however, were below those shown for dry and wet conditions; the decrease on four-lane divided (no access control) highways was significantly greater. No data were available to compare travel speeds under these conditions. It may be reasonable to assume, however, that traffic normally responds to severely hazardous driving conditions and reduces speeds accordingly. Changes in posted speeds, therefore, may not affect driving speeds to the same extent as during favorable weather. Again, assumed applicability of weather data may introduce errors.

DISCUSSION

It was shown that fatalities, accidents, and injuries, as well as fatality rates, accident rates and injury rates decreased since the beginning of the energy crisis. The question remains whether these decreases resulted from changes in traffic volumes, speeds, etc. or as a result of any combination of contributing factors. As shown in Figure 21, the decrease in volume, which began in December 1973, corresponds to a reduced accident rate; but volume reductions lessened in April and May while the accident rate reached its lowest percentage in April. The dramatic decrease in accident rate occurred in March 1974 while the reduction in volume remained the same. The large accident rate decrease, therefore, corresponded with the lowering of the speed limit to 55 mph (24.6 m/s) on March 1, 1974. Total travel during the last seven months has decreased by 3.5 percent while the accident rate decreased by 13.6 percent compared to the same period a year earlier.

The relationship between traffic speed and accident rate for interstate highways is shown in Figure 22 and for two-lane highways in Figure 23. Very limited (but precious) data points were available in preparing the plots. The data points, of course, are subject to errors due to uncertainties as to traffic speeds and volumes associated with various weather conditions. The plots do, however, bring to attention a disproportionate increase in accident rates as speed increases. The differences between wet-surface and dry-surface accident rates are especially significant and more so for interstate highways (previously posted speed - 70 mph (31.3 m/s)) than for two-lane highways (previously daytime posted speed - 60 mph (26.9 m/s). Improved wet-pavement skid resistance at the lower speeds obviously contributed to a reduction in accident rates. Reduced speed, therefore, has a greater effect upon accident rates during wet-surface than during dry-surface conditions.

A summary of accident experience for various highways is presented in Table 5. Fatality and injury rates decreased more than accident rates. The most dramatic impact, of course, must be the 179 lives saved between December 1973 and June 1974 when compared to the same period a year earlier. Whereas traffic volume and other contributing factors may account for some of the decrease in accident rates since the beginning of the energy crises, lower travel speeds certainly stand out as the single most important reason why accident, fatality and injury rates have decreased.

TABLE 3

SUMMARY OF ACCIDENT DATA FOR VARIOUS PAVEMENT SURFACE CONDITIONS

		ALL ACCIDENTS			DRY-SURFACE ACCIDENTS			WET-SURFACE ACCIDENTS			SNOW OR ICE ACCIDENTS		
TYPE OF HIGHWAY	PERIOD[a]	NUMBER	RATE[b]	RATE DECREASE (percent)	NUMBER	RATE[b]	RATE DECREASE (percent)	NUMBER	RATE[b]	RATE DECREASE (percent)	NUMBER	RATE[b]	RATE DECREASE (percent)
Two-Lane	1973	13232	265	13.4	9034	330	13.3	3606	403	10.2	602	334	10.5
	1974	11104	229		7641	199		2506	362		957	299	
Four-Lane Divided (No Access Control)	1973	590	161	21.4	354	123	11.8	192	293	33.7	44	333	40.5
	1974	465	127		315	109		102	194		48	198	
Interstate	1973	1079	88	16.3	595	62	19.2	319	145	45.3	165	372	7.9
	1974	842	73		452	50		130	79		260	343	
Parkway	1973	216	69	19.9	127	52	22.2	58	104	54.1	31	277	9.2
	1974	171	56		99	41		21	48		51	251	
Total System (for above types)	1973	15117	219	13.8	10100	186	13.4	4175	338	14.3	842	339	11.7
	1974	12582	189		8507	161		2759	289		1316	299	

[a]1973 -- Dec 1972 through Jun 1973
1974 -- Dec 1973 through Jun 1974

[b]Accidents per 100 million vehicle miles (161 million vehicle kilometers)

TABLE 4

PRECIPITATION DATA

	SURFACE CONDITION[a]		
PERIOD	DRY	WET[b]	ICE OR SNOW
Dec 1972 through Jun 1973	78.5	17.9	3.6
Dec 1973 through Jun 1974	79.1	14.3	6.6

[a]Percent of time in the Lexington area

[b]Trace or more of rainfall

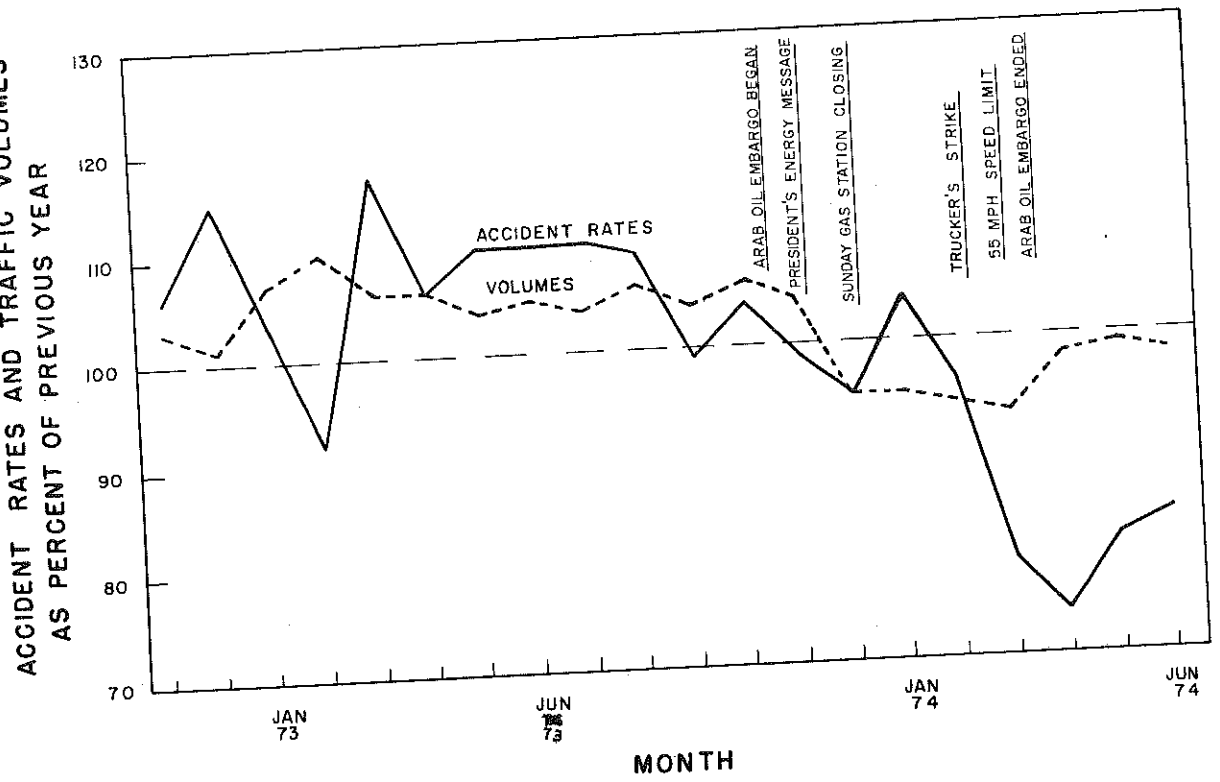


Figure 21. **Comparison of Monthly Accident Rates and Volumes to Corresponding Month in Preceding Year (Total Rural Highway System).**

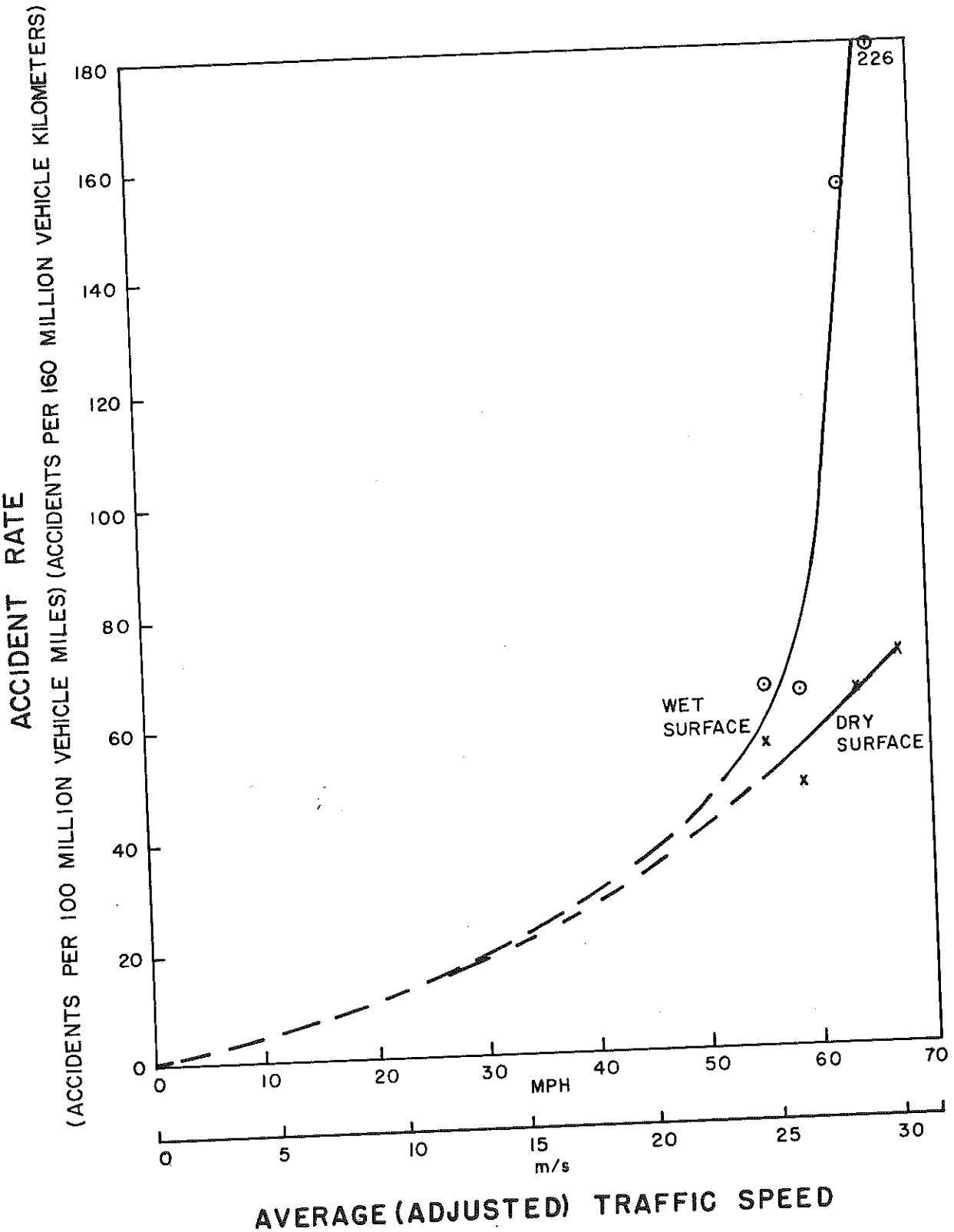


Figure 22. Relationship between Average Traffic Speed (Adjusted between Automobiles and Trucks) and Accident Rate (Interstate Highways).

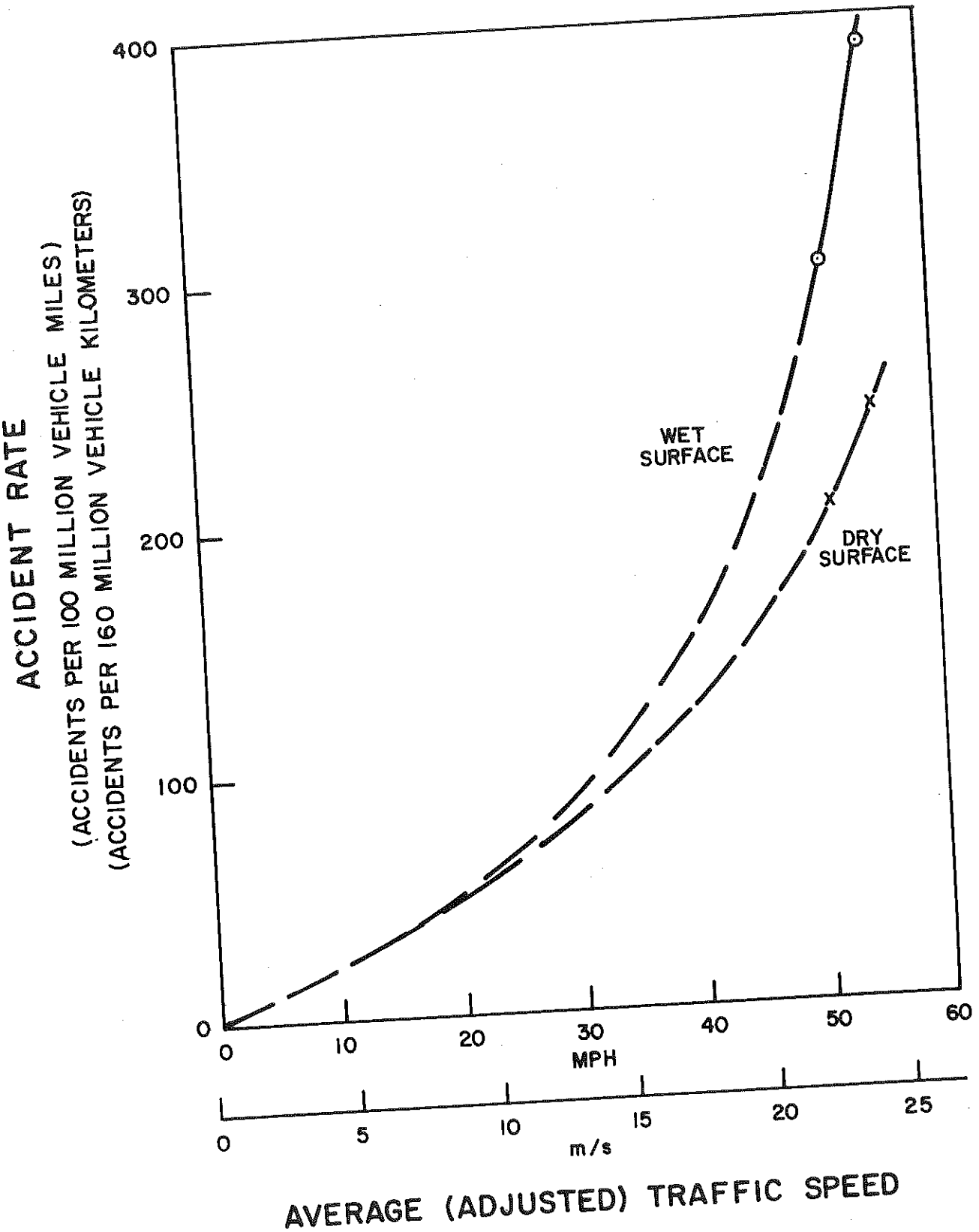


Figure 23. Relationship between Average Traffic Speed (Adjusted between Automobiles and Trucks) and Accident Rate (Two-Lane Highways).

TABLE 5

SUMMARY OF ACCIDENT DATA FOR VARIOUS HIGHWAY TYPES

TYPE OF HIGHWAY	PERIOD[a]	ACCIDENTS NUMBER	ACCIDENTS RATE[b]	ACCIDENTS RATE DECREASE (percent)	FATALITIES NUMBER	FATALITIES RATE[b]	FATALITIES RATE DECREASE (percent)	INJURIES NUMBER	INJURIES RATE[b]	INJURIES RATE DECREASE (percent)	SEVERITY INDEX
Two-Lane	1973	13283	266	13.5	446	8.9	32.6	8593	172	20.3	2.76
	1974	11160	230		290	6.0		6653	137		2.63
Four-Lane Divided (No Access Control)	1973	592	162	19.1	10	2.7	11.1[d]	353	96	17.7	2.48
	1974	480	131		11	3.0		289	79		2.41
Interstate	1973	1080	88	17.0	26	2.1	9.5[d]	678	55	21.8	2.50
	1974	845	73		27	2.3		499	43		2.58
Parkway	1973	216	69	10.1	11	3.5	82.9	150	48	33.3	3.17
	1974	192	62		2	0.6		98	32		2.53
Total System[c]	1973	15411	220	13.6	512	7.3	32.9	9940	142	20.4	2.72
	1974	12847	190		333	4.9		7660	113		2.65

[a]1973 -- Dec 1972 through Jun 1973
1974 Dec 1973 through Jun 1974

[b]Number per 100 million vehicle miles (161 million vehicle kilometers)

[c]Also includes three-lane and four-lane, undivided (no access control) highways

[d]Increase

CONCLUSION

Decreases in accident rates associated with reducing the speed limit to 55 mph (24.6 m/s) (from previous 70 mph (31.3 m/s) on interstates and parkways and 60 mph (26.9 m/s) on two-lane roads) have been dramatic. To safeguard the public from undue hazards associated with higher-speed driving, continuation of maximum speed limit at 55 mph (24.6 m/s) on all rural highways seems advisable.

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2. Agent, K. R., *Evaluation of the High-Accident Location Spot-Improvement Program in Kentucky*, Division of Research, Kentucky Department of Transporation, February 1973.

3. **A Policy on Geometric Design of Rural Highways**, American Association of State Highway Officials, 1965.

4. *Choosing a Small Car: The Safety Question*, **Consumer Reports**, April 1974.

5. Rizenbergs, R. L., Burchett, J. L., and Napier, C. T., *Accidents on Rural Interstate and Parkway Roads and Their Relationship to Pavement Friction*, Division of Research, Kentucky Department of Transportation, October 1973.

APPENDIX

DETAILED ACCIDENT AND TRAFFIC VOLUME DATA

TABLE A1. DATA FOR TWO LANE HIGHWAYS (21836 MILES)

MONTH	VOLUME (MVM)	ACCIDENT TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITY FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY SEVERITY RATE (INJ/100 MVM)	INJURY SEVERITY INDEX
NOV.1971	699	1688	252	74	11.1	1087	163	2.92
DEC.1971	658	1748	266	72	10.9	1037	158	2.73
JAN.1972	576	1489	259	62	10.8	777	135	2.58
FEB.1972	583	1386	238	46	7.9	780	134	2.66
MAR.1972	673	1473	219	73	10.8	948	141	2.84
APR.1972	722	1700	235	64	8.9	1204	167	2.92
MAY 1972	780	1923	247	73	9.4	1296	166	2.83
JUNE1972	814	1907	234	70	8.6	1221	150	2.78
JULY1972	856	2023	236	71	8.3	1386	162	2.94
AUG.1972	831	1876	226	72	8.7	1351	163	2.91
SEP.1972	755	1982	263	89	11.8	1359	180	2.94
OCT.1972	726	2016	278	82	11.3	1293	178	2.76
NOV.1972	676	1883	279	53	7.8	1161	172	2.68
DEC.1972	653	1970	302	52	8.0	1226	188	2.67
JAN.1973	604	1641	272	62	10.3	895	148	2.64
FEB.1973	634	1432	226	41	6.5	892	141	2.67
MAR.1973	705	1829	259	49	7.0	1165	165	2.75
APR.1973	749	1915	256	59	7.9	1286	172	2.76
MAY 1973	801	2254	281	92	11.5	1641	205	2.93
JUNE1973	853	2242	263	91	10.7	1488	174	2.84
JULY1973	887	2338	264	81	9.1	1546	174	2.87
AUG.1973	870	2224	256	65	7.5	1491	171	2.83
SEP.1973	782	2101	269	89	11.4	1470	188	2.95
OCT.1973	750	2196	293	78	10.4	1445	193	2.77
NOV.1973	691	1981	287	73	10.6	1231	178	2.72
DEC.1973	627	1806	288	31	4.9	997	159	2.47
JAN.1974	574	1541	268	36	6.3	852	148	2.42
FEB.1974	597	1289	216	34	5.7	731	122	2.55
MAR.1974	671	1410	210	44	6.6	846	126	2.69
APR.1974	751	1446	193	56	7.5	888	118	2.83
MAY 1974	795	1832	230	39	4.9	1127	142	2.67
JUNE1974	830	1836	221	50	6.0	1212	146	2.77

TABLE A2. DATA FOR INTERSTATE HIGHWAYS (472 MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	157	153	97	3	1.9	89	57	2.54
DEC.1971	159	115	72	6	3.8	71	45	2.56
JAN.1972	131	136	104	4	3.1	85	65	2.67
FEB.1972	135	141	104	6	4.4	99	73	2.75
MAR.1972	167	134	80	3	1.8	85	51	2.58
APR.1972	180	132	73	6	3.3	80	44	2.69
MAY 1972	173	147	85	7	4.0	89	51	2.88
JUNE1972	203	158	78	3	1.5	110	54	2.64
JULY1972	231	207	90	4	1.7	173	75	2.76
AUG.1972	225	170	76	8	3.6	104	46	2.40
SEP.1972	184	157	85	9	4.9	127	69	2.93
OCT.1972	178	124	70	4	2.2	105	59	2.82
NOV.1972	167	154	92	7	4.2	111	66	2.74
DEC.1972	167	156	93	1	0.6	80	48	2.29
JAN.1973	142	119	84	3	2.1	57	40	2.32
FEB.1973	150	109	73	1	0.7	62	41	2.37
MAR.1973	177	179	101	9	5.1	110	62	2.67
APR.1973	200	182	91	4	2.0	111	56	2.51
MAY 1973	186	146	78	4	2.2	125	67	2.59
JUNE1973	210	189	90	4	1.9	133	63	2.64
JULY1973	234	213	91	18	7.7	173	74	2.82
AUG.1973	241	163	68	8	3.3	108	45	2.60
SEP.1973	188	120	64	1	0.5	86	46	2.67
OCT.1973	194	160	82	4	2.1	120	62	2.87
NOV.1973	178	140	79	3	1.7	72	40	2.65
DEC.1973	151	163	108	4	2.6	100	66	2.44
JAN.1974	133	209	157	7	5.3	101	76	2.35
FEB.1974	135	104	77	3	2.2	62	46	2.85
MAR.1974	156	91	58	1	0.6	48	31	2.79
APR.1974	185	86	46	0	0	49	26	2.29
MAY 1974	186	100	54	5	2.7	69	37	2.90
JUNE1974	204	92	45	7	3.4	70	34	2.74

TABLE A3. DATA FOR FOUR LANE, DIVIDED (NO ACCESS CONTROL) HIGHWAYS(195 MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	45.6	76	167	1	2.2	57	125	2.68
DEC.1971	46.2	83	180	0	0	55	119	2.76
JAN.1972	39.7	70	176	0	0	27	68	1.76
FEB.1972	40.9	59	144	0	0	21	51	2.25
MAR.1972	46.9	71	151	1	2.1	55	117	2.68
APR.1972	49.9	91	182	2	4.0	66	132	2.73
MAY 1972	52.9	92	174	1	1.9	52	98	2.67
JUNE1972	55.3	72	130	5	9.0	53	96	2.96
JULY1972	56.5	96	170	0	0	64	113	2.53
AUG.1972	58.3	111	190	3	5.1	66	113	2.55
SEP.1972	52.9	88	166	3	5.7	47	89	2.65
OCT.1972	50.5	111	220	2	4.0	64	127	2.39
NOV.1972	48.7	86	177	3	6.2	48	99	2.48
DEC.1972	48.7	120	246	1	2.1	61	125	2.02
JAN.1973	45.5	72	158	2	4.4	35	77	2.42
FEB.1973	46.8	70	150	1	2.1	31	66	2.54
MAR.1973	51.7	84	162	1	1.9	42	81	2.29
APR.1973	55.0	84	153	1	1.8	51	93	2.48
MAY 1973	57.8	89	154	2	3.5	69	119	2.82
JUNE1973	60.4	73	121	2	3.3	64	106	3.08
JULY1973	62.8	104	166	3	4.8	60	96	2.37
AUG.1973	62.8	97	154	0	0	76	121	2.34
SEP.1973	57.7	81	140	3	5.2	61	106	2.90
OCT.1973	57.7	103	185	1	1.8	59	106	2.74
NOV.1973	53.0	77	145	0	0	41	77	2.29
DEC.1973	48.7	82	168	0	0	47	97	2.18
JAN.1974	46.6	76	163	0	0	25	54	1.76
FEB.1974	47.0	58	123	4	8.5	38	81	2.69
MAR.1974	50.7	62	122	3	5.9	41	81	3.14
APR.1974	55.9	57	102	2	3.6	33	59	2.55
MAY 1974	58.1	65	112	0	0	42	72	1.92
JUNE1974	59.9	80	134	2	3.3	63	105	2.78

TABLE A4. DATA FOR PARKWAYS (565 MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	34.5	42	122	1	2.9	25	72	2.46
DEC.1971	36.1	26	72	2	5.5	14	39	2.62
JAN.1972	29.8	20	67	1	3.4	14	47	3.25
FEB.1972	28.9	20	69	0	0	12	42	3.32
MAR.1972	37.2	30	81	0	0	32	86	3.05
APR.1972	39.6	42	106	2	5.1	28	71	2.61
MAY 1972	40.5	28	69	1	2.5	20	49	4.14
JUNE1972	45.1	37	82	3	6.7	32	71	3.35
JULY1972	51.6	30	58	1	1.9	28	54	3.24
AUG.1972	50.2	30	60	2	4.0	29	58	3.93
SEP.1972	40.5	28	69	3	7.4	17	42	3.18
OCT.1972	39.1	20	51	0	0	10	26	2.35
NOV.1972	38.6	25	65	1	2.6	12	31	2.96
DEC.1972	41.0	41	100	1	2.4	16	39	1.84
JAN.1973	35.7	35	98	2	5.6	29	81	3.70
FEB.1973	35.4	21	59	0	0	10	28	2.69
MAR.1973	45.8	30	66	2	4.4	26	57	3.90
APR.1973	50.1	24	48	2	4.0	24	48	4.21
MAY 1973	49.4	33	67	1	2.0	17	34	2.27
JUNE1973	54.4	32	59	3	5.5	28	51	4.05
JULY1973	59.7	42	70	5	8.4	32	54	3.48
AUG.1973	61.6	32	52	1	1.6	24	39	3.27
SEP.1973	48.5	25	52	0	0	14	29	3.10
OCT.1973	49.6	28	56	3	6.0	27	54	3.41
NOV.1973	47.8	32	67	2	4.2	23	48	3.17
DEC.1973	42.3	40	95	0	0	13	31	2.01
JAN.1974	37.3	46	123	0	0	17	46	1.78
FEB.1974	34.5	23	67	0	0	8	23	2.80
MAR.1974	41.3	12	29	1	2.4	12	29	4.38
APR.1974	46.3	17	37	0	0	11	24	2.68
MAY 1974	51.8	33	64	0	0	29	56	3.48
JUNE1974	54.4	21	39	1	1.8	8	15	2.70

TABLE A5. DATA FOR THREE LANE HIGHWAYS (34 MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	3.87	7	181	0	0	2	52	1.71
DEC.1971	3.81	8	210	1	26.2	8	210	3.56
JAN.1972	3.33	5	150	0	0	3	90	2.00
FEB.1972	3.37	8	237	0	0	9	267	2.38
MAR.1972	3.89	9	231	1	25.7	3	77	3.17
APR.1972	4.17	10	240	1	23.9	14	336	4.30
MAY 1972	4.50	3	67	0	0	4	89	6.67
JUNE1972	4.70	9	191	0	0	3	64	2.89
JULY1972	4.94	14	283	0	0	8	162	2.14
AUG.1972	4.80	6	125	0	0	3	62	3.83
SEP.1972	4.36	7	161	1	22.9	8	183	5.71
OCT.1972	4.19	12	286	2	47.7	11	263	2.83
NOV.1972	3.91	17	435	0	0	17	435	3.12
DEC.1972	3.77	14	371	0	0	6	159	2.57
JAN.1973	3.51	11	314	0	0	9	256	2.91
FEB.1973	3.67	6	163	0	0	2	54	2.83
MAR.1973	4.08	9	221	0	0	8	196	4.00
APR.1973	4.34	10	230	0	0	4	92	2.35
MAY 1973	4.64	7	151	2	43.1	10	216	2.64
JUNE1973	4.94	7	142	2	40.5	7	142	4.14
JULY1973	5.14	10	195	0	0	8	156	2.35
AUG.1973	5.04	6	119	0	0	1	20	1.42
SEP.1973	4.53	7	155	2	44.2	10	221	3.64
OCT.1973	4.36	4	92	0	0	7	161	5.00
NOV.1973	4.03	8	199	0	0	8	199	3.31
DEC.1973	3.66	6	164	0	0	2	55	1.83
JAN.1974	3.36	8	208	0	0	14	417	3.75
FEB.1974	3.49	7	201	0	0	3	86	1.71
MAR.1974	3.93	4	102	0	0	4	102	2.88
APR.1974	4.38	7	160	0	0	4	91	2.93
MAY 1974	4.64	4	86	0	0	6	129	3.50
JUNE1974	4.84	5	103	0	0	4	83	2.50

TABLE A6. DATA FOR FOUR LANE, UNDIVIDED, HIGHWAYS (35MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	7.99	32	401	5	62.6	10	125	2.72
DEC.1971	8.09	27	334	3	37.1	15	185	3.04
JAN.1972	6.96	17	244	1	14.4	8	115	1.94
FEB.1972	7.17	27	376	2	27.9	14	195	2.50
MAR.1972	8.23	26	316	3	36.5	19	231	3.21
APR.1972	8.75	16	183	1	11.4	11	126	3.81
MAY 1972	9.28	24	259	3	32.3	19	205	2.44
JUNE1972	9.70	25	258	2	20.6	1	10	1.78
JULY1972	9.91	23	232	0	0	20	202	3.09
AUG.1972	10.2	29	284	2	19.6	22	216	2.60
SEP.1972	9.28	32	345	1	10.8	25	269	2.84
OCT.1972	8.86	26	293	1	11.3	14	158	2.60
NOV.1972	8.54	32	375	2	23.4	19	222	3.25
DEC.1972	8.54	27	316	2	23.4	24	281	3.24
JAN.1973	7.87	24	305	2	25.4	15	191	2.90
FEB.1973	8.11	24	296	4	49.3	12	148	3.08
MAR.1973	8.97	27	301	3	33.4	15	167	2.94
APR.1973	9.54	24	252	1	10.5	13	136	3.08
MAY 1973	10.0	25	250	0	0	22	220	2.82
JUNE1973	10.5	25	238	3	28.6	19	181	4.02
JULY1973	10.7	21	196	1	9.3	21	196	3.29
AUG.1973	10.6	25	236	2	18.9	9	85	2.56
SEP.1973	9.75	33	338	0	0	14	144	1.97
OCT.1973	9.75	36	369	0	0	15	154	1.96
NOV.1973	9.23	31	336	1	10.8	14	152	2.19
DEC.1973	8.37	19	227	0	0	18	215	2.95
JAN.1974	7.79	16	205	1	12.8	9	116	2.84
FEB.1974	7.86	11	140	0	0	9	115	2.45
MAR.1974	8.43	8	95	1	11.9	2	24	4.19
APR.1974	9.35	17	182	0	0	11	118	1.59
MAY 1974	9.72	27	278	0	0	13	134	2.85
JUNE1974	9.96	31	311	1	10.0	22	221	2.68

TABLE A7. DATA FOR THE TOTAL RURAL SYSTEM (23137 MILES)

MONTH	VOLUME (MVM)	TOTAL ACCIDENTS	ACCIDENT RATE (ACC/100MVM)	FATALITIES	FATALITY RATE (FAT/100 MVM)	INJURIES	INJURY RATE (INJ/100 MVM)	SEVERITY INDEX
NOV.1971	910	1998	220	84	9.2	1270	140	2.86
DEC.1971	911	2007	220	84	9.2	1200	132	2.73
JAN.1972	787	1737	221	68	8.6	914	116	2.56
FEB.1972	798	1641	206	54	6.8	935	117	2.66
MAR.1972	936	1743	186	81	8.7	1142	122	2.83
APR.1972	1004	1991	198	76	7.6	1403	140	2.90
MAY 1972	1060	2217	209	85	8.0	1480	140	2.84
JUNE1972	1132	2208	195	83	7.3	1420	125	2.78
JULY1972	1210	2393	198	76	6.3	1679	139	2.91
AUG.1972	1180	2222	188	87	7.4	1575	133	2.87
SEP.1972	1046	2294	219	106	10.1	1583	151	2.52
OCT.1972	1007	2309	229	91	9.0	1497	149	2.74
NOV.1972	943	2197	233	66	7.0	1368	145	2.69
DEC.1972	922	2328	252	57	6.2	1413	153	2.60
JAN.1973	839	1902	227	71	8.5	1040	124	2.63
FEB.1973	878	1662	189	47	5.4	1009	115	2.65
MAR.1973	993	2158	217	64	6.4	1366	138	2.75
APR.1973	1068	2239	210	67	6.3	1489	139	2.74
MAY 1973	1109	2554	230	101	9.1	1884	170	2.90
JUNE1973	1193	2568	215	105	8.8	1739	146	2.86
JULY1973	1259	2728	217	108	8.6	1840	146	2.85
AUG.1973	1251	2547	204	76	6.1	1709	137	2.80
SEP.1973	1090	2367	217	95	8.7	1655	152	2.92
OCT.1973	1063	2527	238	86	8.1	1673	157	2.78
NOV.1973	983	2269	231	79	8.0	1389	141	2.71
DEC.1973	881	2116	240	35	4.0	1177	134	2.45
JAN.1974	802	1896	236	44	5.5	1018	127	2.38
FEB.1974	824	1492	181	41	5.0	851	103	2.58
MAR.1974	931	1587	170	50	5.4	953	102	2.73
APR.1974	1052	1630	155	58	5.5	996	95	2.78
MAY 1974	1105	2061	187	44	4.0	1286	116	2.68
JUNE1974	1163	2065	178	61	5.2	1379	119	2.76