*Abridgment*

# Safety Impact of the 65-mph Speed Limit: A Time Series Analysis

RONALD C. PFEFER, WILLIAM W. STENZEL, AND BYOUNG DOO LEE

An examination of the impact of the increase in the speed limit in 1987 to 65 mph on rural Interstate highways in Illinois was conducted. Autoregressive integrated moving average (ARIMA) time series intervention analyses using monthly speed data collected by the Illinois Department of Transportation for 15 rural Interstate highway segments were used to examine changes in (a) 85th-percentile speeds and speed variances for cars and large trucks (i.e., vehicles greater than 24 ft in length) and (b) car-truck speed differentials. ARIMA analyses were also used to examine the changes in accident frequency, accident rates, and proportion of car-truck accidents to all accidents. Consideration was given both to all accidents and to fatal and injury accidents only. Using May 1987 as the point of intervention (i.e., the increase in the speed limit), the ARIMA analyses are based on time series consisting of 52 preintervention months and 15 post-intervention months. Results were obtained for four individual highway segments and for all 15 segments collectively. An increase of 4.0 mph in the 85th-percentile speed for cars was detected at the 95 percent confidence level. No change was found in the 85th-percentile speed for trucks or in the speed variance for either cars and trucks. An increase of 2.8 mph in the car-truck speed differential was found at the 80 percent confidence level. Although the frequency of all accidents increased by 14 percent following the speed limit change, no statistically significant change in the frequency of fatal and injury accidents only was found. No change was detected in the rate for all accidents, but an increase of 18.5 percent was detected in the rate for fatal and injury accidents only. Significant reductions were found for both the rate of car-truck fatal and injury accidents and the proportion of car-truck fatal and injury accidents to all fatal and injury accidents.

On April 2, 1987, 13 years after passage of the National Maximum Speed Limit (NMSL), the law was changed to allow speeds up to 65 mph on rural Interstate facilities. The original objective of NMSL was to conserve fuel in response to the Arab oil embargo. With the establishment of the NMSL, the national annual highway fatality frequency fell by more than 9,100 persons. Many gave NMSL credit for this reduction, and safety emerged as the primary argument for its continuation once the oil embargo was no longer in effect.

The enactment of the NMSL, its implementation and monitoring, and its recent modification have occurred within an atmosphere of continuing controversy. Opponents of the law see the action as arbitrary and an imposition on a free society. Economic inefficiency and lost personal time as a result of slower travel are also cited as drawbacks to the law. The safety benefits are discounted as having been brought about by other factors, such as a decline in travel and improvements to vehicles and the roadway system.

However, the preponderance of opinion among policy makers is that the NMSL does save a significant number of lives each year. It is estimated that between 2,000 and 4,000 lives were saved in 1983 (*1*). The same source also estimated that between 2,500 and 4,500 fewer severe injuries occurred in 1983 as a result of the law. Another study (*2*) examined the potential safety impact of the 65-mph speed limit on rural Interstates using two methods for estimating the annual number of fatalities. One method is promoted by the National Safety Council (NSC), whereas the other was developed by the TRB Committee for the Study of Benefits and Costs of the 55-mph NMSL. Both methods predicted an increase in highway fatalities: 200 to 700 deaths per year using the NSC method, and 300 to 450 deaths per year using the TRB method.

The institution of the 65-mph speed limit on the rural Interstate system occurred as support for NMSL was eroding, as evidenced by a trend toward higher speeds in several states. In Illinois, for example, the 85th-percentile speed on freeways in 1987, just before the law change, was 65 mph [Illinois Department of Transportation (IDOT), unpublished]. Although the recommendation of the TRB committee was for general retention of the NMSL, the use of a higher speed limit on rural Interstates was left as an open issue.

Shortly after passage of the revised law, Congress directed IDOT to initiate a series of studies to investigate the impact of higher speed limits on rural Interstate highways. The activities and findings of a study (*3*) conducted to examine the impact of the 65-mph speed limit on rural Interstates in Illinois are described.

## METHODOLOGY

### Research Questions

The following research questions were considered:

1. Was there a significant change in speed?
2. Was there a concurrent change in crash experience?
3. Was there a relationship between the change in speed and the change in crash experience?
4. Were observed changes in speeds and accidents different for trucks and other vehicles?
5. Was there an increase in speed differentials between trucks and other vehicles?
6. Was there a concurrent change in accidents involving passenger cars and trucks?

R. C. Pfefer and W. W. Stenzel, Research and Development, Traffic Institute, Northwestern University, 405 Church St., Evanston, Ill. 60204. B. D. Lee, Department of Political Science, Northwestern University, 401 Scott Hall, Evanston, Ill. 60201. Current affiliation: Ma-po Gu Kong-Buk Bong 105-86, Seoul, Korea.

7. Was there a relationship between the change in speed differential and the change in car-truck crash experience?

## General Approach

The change to 65 mph in Illinois occurred in May 1987 on approximately 1,200 mi of rural Interstate highway. The speed limit for heavy trucks remained at 55 mph on all Interstate facilities. Traffic volume, speed, and crash data from rural interstate highways were provided by IDOT. The data were analyzed using site-specific and aggregate measures of speed and crash experience. Speed data were provided by IDOT, generated from 15 speed-monitoring sites on rural Interstate highways. Use of state reporting systems for speed and accidents allowed an examination of the impact of speed changes on accident severity. More than 90 percent of the accident reports on Interstate highways are submitted by the Illinois State Police, and the overall quality of the reports is considered to be excellent and consistent.

## Analytical Method

Changes in speed and accident experience were examined using time series intervention impact analysis on the basis of autoregressive integrated moving average (ARIMA) models (*4,5*). ARIMA modeling enables the analyst to mathematically represent complex time series patterns; intervention impact analysis is a specific application of ARIMA modeling that enables testing for the impact of an intervention after statistically controlling for historic patterns and other known interventions.

The time series quasi-experiment was first proposed by Campbell (*6*) as a way to examine the impact of interventions on social processes. Two requirements for the use of time series quasi-experiments are as follows:

1. The social process under investigation must be operationalized as a time series; and
2. There must be a discrete intervention that divides the time series into two distinct segments, one consisting of all preintervention observations and another consisting of all postintervention observations.

The proposed study of the Illinois speed limit change satisfies both requirements. The social process under investigation (i.e., driving behavior) was operationalized with monthly speed estimates and monthly crash data, and the intervention event (i.e., the speed limit change) was a discrete event that divided each time series into two parts.

Analysis of a time series quasi-experiment focuses on two issues:

1. Did the intervention have an impact on the time series?
2. If an impact occurred, what was the magnitude and form of the impact?

Both issues are examined statistically by comparing the pre- and postintervention segments of the time series.

## Data Collection

### *Speed Data*

The IDOT Traffic Operations Division collects speed data at 70 automated data collection sites throughout the state. Of these, 15 are on rural Interstate roads. The speed data are acquired from induction loop detectors buried in the pavement.

The basic data are received as frequency counts within twelve 5-mph speed categories and for two vehicle length classifications. The classification by vehicle length is possible because a pair of induction loops is placed at each site. Vehicles less than or equal to 24 ft in length are tabulated separately from those with lengths greater than 24 ft. This procedure provides an approximate separation of semitrailer trucks from other vehicles. The length defining the two categories was changed from 21 ft at the beginning of 1983. It was assumed that the speeds of vehicles longer than 24 ft were representative of semitrailer truck speeds and that those for shorter vehicles were representative of passenger vehicles (cars).

Speed-monitoring station data are stored on tape in 80-column records for each vehicle type for each hour of each day. A typical tabulation of the data is presented in Table 1. The IDOT Traffic Operations Division provided a monthly aggregation of speed frequencies by speed bin for the period January 1983–July 1988.

A summary of the data collection activities for each candidate site is presented in Table 2. This table includes information about the percent of days and number of months by year for which speed data were recorded. The summary tabulations provided by IDOT for the 15 rural Interstate monitoring stations indicated that there were some months at every site for which no speed data were recorded because of mechanical failure of the speed-monitoring devices.

The raw speed data were used to compute two aggregate measures: (a) 85th-percentile speed to represent the higher end of the speed distribution, and (b) speed variance as a surrogate measure of speed differentials.

Direct measurement of speed differentials between cars and trucks was not possible due to the lack of data for individual pairs of vehicles in a given lane. The mean speed differential of cars and trucks at each speed-monitoring site was selected as a measure of overall speed disparity. It was recognized that this measure is an average and includes vehicles in adjacent lanes as well as those in a vehicle-following situation. The mean speed differential for cars and trucks in a given traffic stream can be determined from the key statistics of their individual speed distributions (*3*).

The calculation of the speed statistics used standard formulas for classified data, with the middle value of each class interval representing the entire class. The exceptions to this rule were the classes at either end of the range. For the lowest interval (i.e., 1 to 30 mph), a value of 28 mph was used. For the highest interval (i.e., 81 mph and higher), a value of 83 mph was used.

TABLE 1 SPEED-MONITORING DATA BY HOUR FOR 1 DAY AT ONE LOCATION, CARS ONLY

Telac Data for Thursday - 12 November 1987

Station Number 1110 Telac Number 1
Station Type 2 Polling Group 1
Station Location INT90 MP 82.8: 0.5 MILE SOUTH OF NAGLE A

Eastbound Combined Speeds for Length 1 thru 24 feet for Lane 1 thru 3

| Speed (Mph) (LOWER UNIT FOR RANGE) / Time | 1 | 31 | 36 | 41 | 46 | 51 | 56 | 61 | 66 | 71 | 76 | 81 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01:00 | 0 | 0 | 0 | 4 | 33 | 150 | 389 | 307 | 253 | 136 | 42 | 18 | 1332 |
| 02:00 | 0 | 0 | 0 | 0 | 0 | 8 | 19 | 14 | 10 | 3 | 2 | 2 | 58 |
| 03:00 | 0 | 0 | 0 | 2 | 16 | 68 | 154 | 110 | 61 | 37 | 11 | 3 | 462 |
| 04:00 | 0 | 0 | 0 | 3 | 12 | 82 | 113 | 81 | 52 | 20 | 11 | 5 | 379 |
| 05:00 | 0 | 0 | 1 | 7 | 27 | 95 | 177 | 149 | 81 | 45 | 13 | 3 | 598 |
| 06:00 | 0 | 0 | 0 | 12 | 48 | 207 | 563 | 434 | 448 | 284 | 75 | 21 | 2092 |
| 07:00 | 623 | 794 | 1068 | 704 | 417 | 540 | 502 | 347 | 236 | 78 | 10 | 2 | 5321 |
| 08:00 | 3519 | 498 | 98 | 20 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4137 |
| 09:00 | 1951 | 577 | 752 | 537 | 187 | 36 | 7 | 0 | 0 | 0 | 0 | 2 | 4049 |
| 10:00 | 586 | 241 | 391 | 422 | 456 | 526 | 676 | 518 | 426 | 190 | 40 | 9 | 4481 |
| 11:00 | 0 | 0 | 0 | 9 | 55 | 376 | 859 | 854 | 923 | 594 | 124 | 29 | 3823 |
| 12:00 | 0 | 0 | 1 | 20 | 69 | 280 | 680 | 787 | 851 | 571 | 181 | 38 | 3478 |
| 13:00 | 0 | 0 | 0 | 3 | 42 | 255 | 576 | 777 | 773 | 621 | 187 | 42 | 3276 |
| 14:00 | 0 | 0 | 0 | 8 | 72 | 338 | 653 | 852 | 910 | 568 | 178 | 30 | 3609 |
| 15:00 | 0 | 0 | 1 | 9 | 101 | 361 | 805 | 930 | 1026 | 555 | 155 | 25 | 3968 |
| 16:00 | 374 | 88 | 103 | 165 | 348 | 684 | 994 | 891 | 806 | 244 | 31 | 9 | 4737 |
| 17:00 | 563 | 198 | 158 | 249 | 528 | 854 | 1037 | 711 | 339 | 60 | 9 | 2 | 4708 |
| 18:00 | 0 | 0 | 8 | 87 | 570 | 1134 | 1435 | 948 | 357 | 55 | 10 | 3 | 4607 |
| 19:00 | 0 | 0 | 0 | 21 | 302 | 923 | 1303 | 944 | 655 | 160 | 17 | 4 | 4329 |
| 20:00 | 0 | 0 | 0 | 1 | 83 | 460 | 909 | 850 | 737 | 322 | 57 | 9 | 3428 |
| 21:00 | 0 | 0 | 0 | 9 | 44 | 278 | 660 | 658 | 590 | 318 | 82 | 27 | 2666 |
| 22:00 | 0 | 0 | 0 | 13 | 87 | 277 | 678 | 605 | 610 | 355 | 83 | 24 | 2732 |
| 23:00 | 0 | 0 | 1 | 1 | 78 | 315 | 699 | 666 | 582 | 281 | 81 | 14 | 2718 |
| 24:00 | 0 | 1 | 0 | 7 | 54 | 208 | 499 | 475 | 445 | 243 | 62 | 21 | 2015 |
| 24 Hour Totals | 7616 | 2397 | 2582 | 2313 | 3630 | 8456 | 14387 | 12908 | 11171 | 5740 | 1461 | 342 | 73003 |

| | | | |
|---|---|---|---|
| Total Vehicles — 73003 | Total Vehicles over 55 Mph — 46009 | Percentage of Vehicles over 55 Mph — 63.0 |
| Average Speed — 54.7 | Total Vehicles over 60 Mph — 31622 | Percentage of Vehicles over 60 Mph — 43.3 |
| Median Speed — 54.3 | Total Vehicles over 65 Mph — 18714 | Percentage of Vehicles over 65 Mph — 25.6 |
| 85th %tile Speed — 64.5 | Total Vehicles over 70 Mph — 7543 | Percentage of Vehicles over 70 Mph — 10.3 |

The monthly values of the 85th-percentile speeds and speed variances for passenger cars and trucks are shown in Figures 1–4. Monthly estimates of the mean speed differential between passenger cars and trucks are shown in Figure 5.

### *Accident Data*

Accident data were provided by the IDOT Traffic Safety Division. Monthly summaries were provided for each site for January 1983–July 1988. The highway segment lengths associated with each monitoring station were selected on the basis of inspection of maps, personal knowledge of the areas, advice from IDOT representatives, physical data provided by the Office of Planning and Programming, and, in some cases, site visits.

Crash data included frequencies of fatal accidents, personal-injury accidents, and property-damage-only accidents. These data were tabulated separately for accidents involving semitrailer trucks and those not involving semitrailer trucks, as well as accidents involving passenger cars and semitrailer trucks moving in the same direction. The separation of accidents related to semitrailer trucks relates as closely as possible to the vehicle dichotomy resulting from the speed measurement data.

Monthly accident rates were calculated using estimates of vehicle-miles of travel (VMT) provided by IDOT for all roadway sections with the higher speed limit.

Biannual average daily traffic (ADT) estimates for car traffic volume for each segment were aggregated and adjusted using seasonality factors provided by IDOT to yield traffic volumes expressed in millions of VMT for each month for the period January 1983–July 1988.

Monthly VMT values for nontrucks were derived by subtracting the estimated daily VMT values for trucks from the daily VMT values for all vehicles and multiplying the difference by a seasonal factor and the number of days in the month. Monthly VMT values for trucks were obtained by multiplying the estimated daily VMT by the number of days in the month.

Two monthly frequencies of accidents, supplied by IDOT, were used to calculate accident rates:

1. All accidents, and
2. Only accidents involving a car and a truck moving in the same direction.

These frequencies were divided by the monthly VMT figures to obtain time series for accident rates on 65-mph rural Interstate segments.

TABLE 2 SUMMARY OF DATA COLLECTION ACTIVITIES FOR 15 RURAL INTERSTATE SPEED-MONITORING SITES

| STATION NUMBER | LOCATION INTERSTATE NUMBER | MILE POST | NO. MILES | DIRECTION FROM | CROSSING FACILITY |
|---|---|---|---|---|---|
| 181 | 55 | 248 | 0.5 | N | US 6 |
| 303 | 80 | 85.1 | 4.3 | W | IL 29 |
| 305 | 55 | 231.5 | 0.5 | N | BRACEVILLE RD |
| 377 | 57 | 273.1 | 0.9 | S | BUCKLEY OVERHD |
| 479 | 74 | 75.8 | 1.3 | E | BRIMFIELD OVERHD |
| 576 | 74 | 178 | 0.9 | W | I-57 |
| 577 | 72 | 66.4 | 0.8 | E | WHITEHEALTH RD. |
| 676 | 55 | 78.1 | 1.8 | S | DIVERNON OVERHD |
| 677 | 72 | 15.2 | 4 | W | ILLIOPOLIS OVERHD |
| 703 | 70 | 89.8 | 2 | W | I-57 |
| 707 | 57 | 168 | 4.9 | N | I-70 |
| 775 | 64 | 68.5 | 0.7 | W | WOODLAWN RD. |
| 802 | 55 | 23.1 | 0.7 | N | IL 43 |
| 975 | 57 | 29.3 | 0.3 | S | US 45 |
| 976 | 24 | 36.3 | 0.7 | N | US45 |

PERCENT REPORTING DAYS AND NUMBER OF MONTHS FROM SPEED MONITORING STATION

| STATION | 1983 | | 1984 | | 1985 | | 1986 | | 1987 | | 1988 | | OVERALL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUMBER | % DAYS | NO. MONTHS | % DAYS | NO. MONTHS | % DAYS | NO. MONTHS | % DAYS | NO. MONTHS | % DAYS | NO. MONTHS | % DAYS | NO. MONTHS | PERCENT |
| 181 | 14.8% | 3 | 29.0% | 6 | 0.0% | 0 | 38.6% | 5 | 63.8% | 8 | 16.7% | 2 | 832.1% |
| 303 | 39.2% | 7 | 47.7% | 9 | 0.0% | 0 | 48.2% | 6 | 83.0% | 10 | 0.0% | 0 | 812.6% |
| 305 | 60.8% | 9 | 63.8% | 9 | 0.0% | 0 | 18.4% | 3 | 68.5% | 9 | 41.4% | 5 | 791.4% |
| 377 | 71.8% | 12 | 35.9% | 6 | 30.7% | 4 | 99.7% | 12 | 76.7% | 10 | 0.0% | 0 | 769.9% |
| 479 | 55.9% | 12 | 39.5% | 6 | 85.5% | 12 | 81.9% | 11 | 69.0% | 11 | 58.1% | 7 | 736.4% |
| 576 | 90.1% | 12 | 64.4% | 9 | 93.4% | 12 | 99.7% | 12 | 99.7% | 12 | 58.1% | 7 | 692.7% |
| 577 | 93.2% | 12 | 46.8% | 8 | 80.5% | 11 | 51.2% | 9 | 50.1% | 7 | 0.0% | 0 | 635.0% |
| 676 | 84.1% | 12 | 53.2% | 7 | 94.0% | 12 | 99.7% | 12 | 95.6% | 12 | 58.1% | 7 | 609.1% |
| 677 | 88.5% | 12 | 55.3% | 7 | 94.0% | 12 | 96.4% | 12 | 100.0% | 12 | 57.0% | 7 | 553.2% |
| 703 | 83.8% | 12 | 35.1% | 5 | 29.6% | 6 | 49.9% | 7 | 94.0% | 5 | 12.6% | 2 | 496.1% |
| 707 | 65.5% | 10 | 63.3% | 9 | 95.3% | 12 | 32.1% | 4 | 84.7% | 11 | 58.1% | 7 | 479.0% |
| 775 | 77.0% | 12 | 58.1% | 9 | 78.1% | 12 | 34.8% | 5 | 0.0% | 0 | 26.3% | 5 | 433.0% |
| 802 | 81.9% | 12 | 69.3% | 9 | 0.0% | 0 | 37.3% | 6 | 74.5% | 10 | 57.5% | 7 | 412.4% |
| 975 | 49.0% | 12 | 0.0% | 0 | 90.1% | 12 | 95.1% | 12 | 93.2% | 12 | 9.0% | 2 | 379.5% |
| 976 | 92.6% | 12 | 62.5% | 9 | 69.6% | 11 | 99.7% | 12 | 75.1% | 9 | 25.8% | 4 | 344.6% |

The accident frequency and accident rate series for passenger cars only are shown in Figures 6–9. The accident frequency and accident rate series for car-truck accidents are shown in Figures 10–13. Figures 14 and 15 show the fraction of car-truck accidents as a proportion of all accidents, which eliminates the need for an exposure base. Only frequencies are required for the calculation, yet it maintains a relationship to exposure by assuming that the changes in VMT will occur at the same relative rate for both cars and trucks.

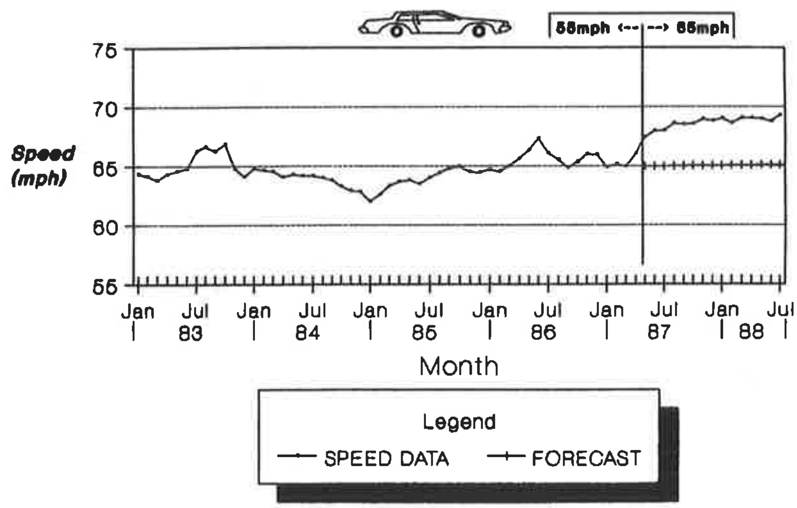



**FIGURE 1 85th-percentile speed by month: passenger cars, all sites.**

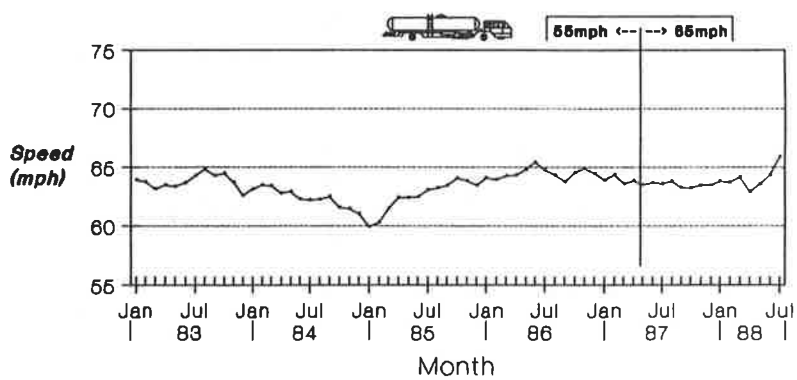



**FIGURE 2 85th-percentile speed by month: trucks, all sites.**

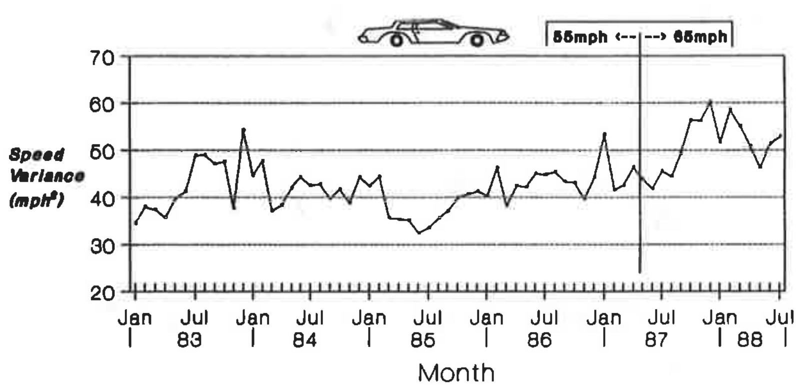



**FIGURE 3 Speed variance by month: passenger cars, all sites.**

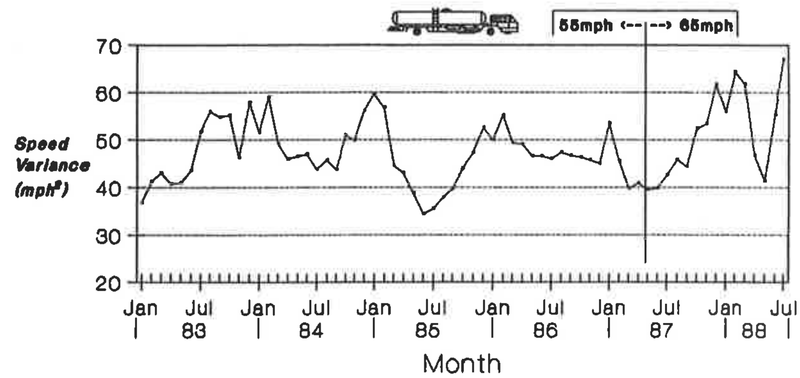



**FIGURE 4 Speed variance by month: trucks, all sites.**

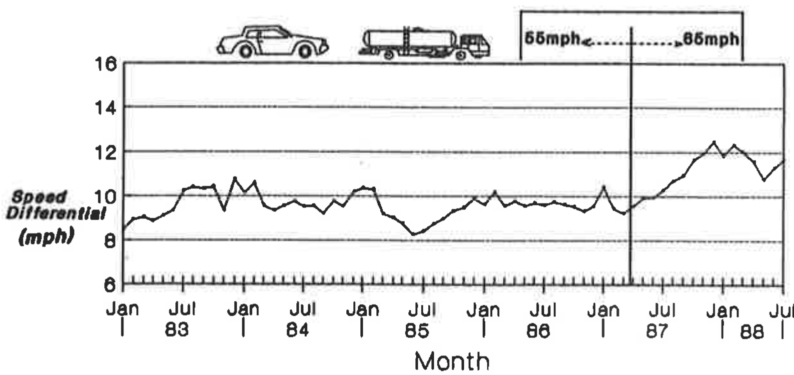



**FIGURE 5 Car-truck speed differential by month: all sites.**

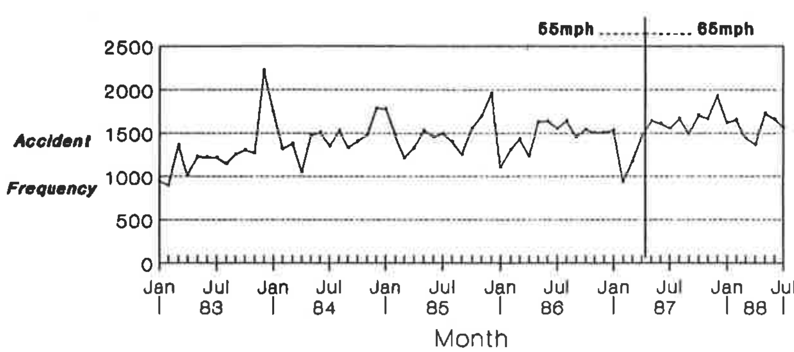



**FIGURE 6 Accident frequency by month: all reported accidents, passenger cars, all sites.**

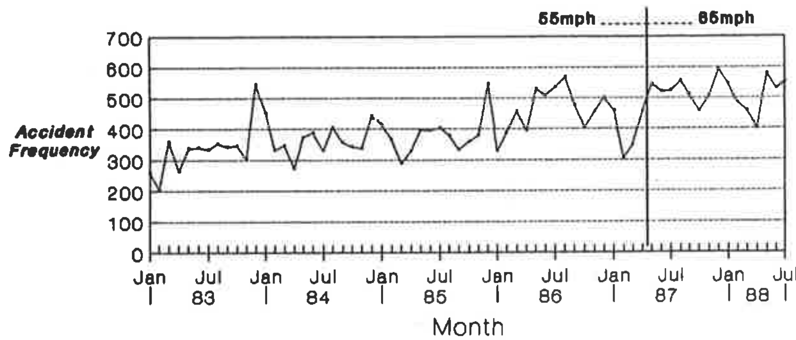
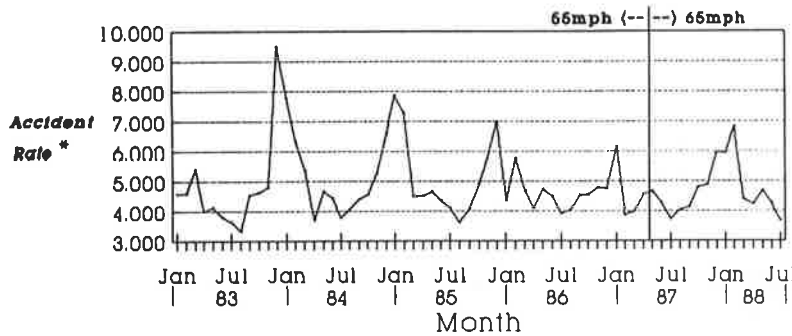
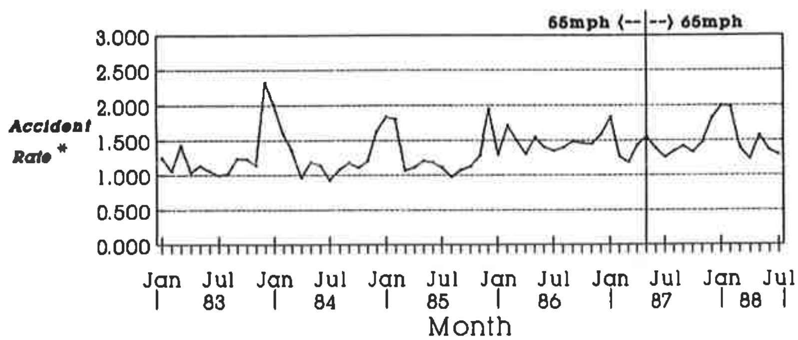



**FIGURE 7** Accident frequency by month: fatal and injury accidents, passenger cars, all sites.




*
Accidents Per Month
Per Million VMT

**FIGURE 8** Accident rate by month: all reported accidents, passenger cars, all sites.




*
Accidents Per Month
Per Million VMT

**FIGURE 9** Accident rate by month: fatal and injury accidents, passenger cars, all sites.

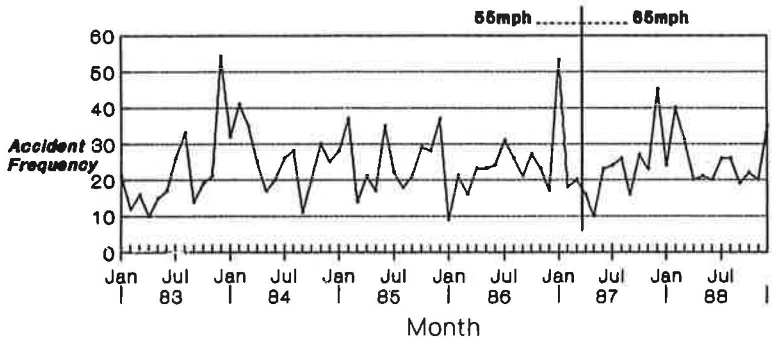



**FIGURE 10** Car-truck accident frequency by month: all reported accidents, all sites.

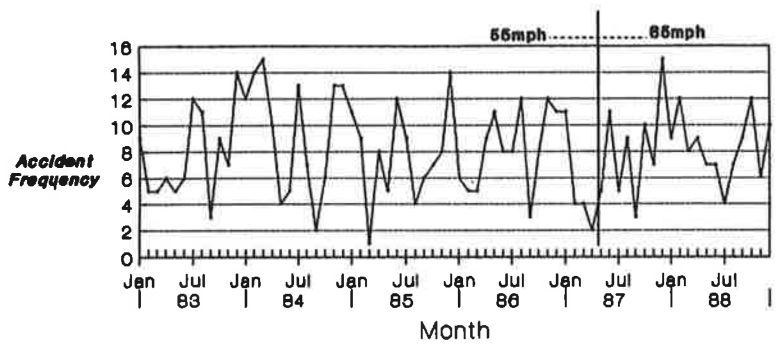



**FIGURE 11** Car-truck accident frequency by month: fatal and injury accidents, all sites.

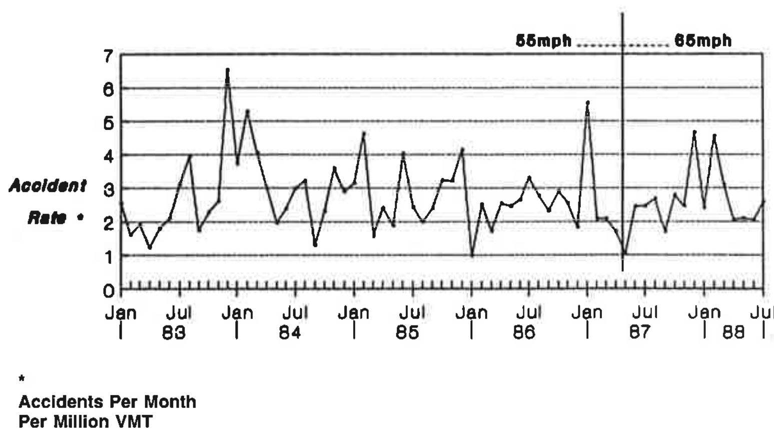



**FIGURE 12** Car-truck accident rate by month: all reported accidents, all sites.

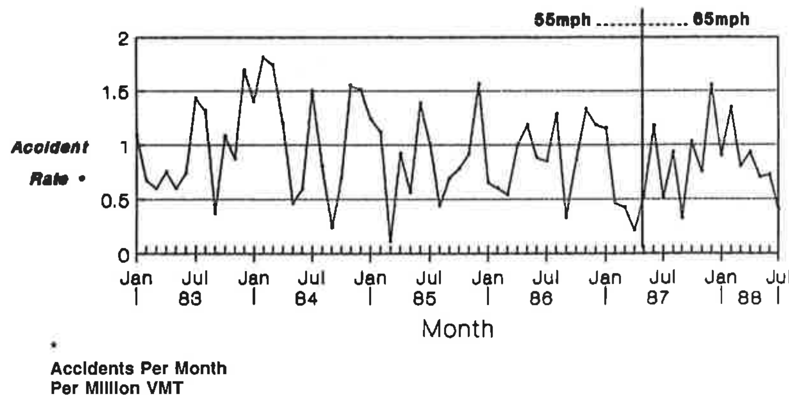



**FIGURE 13** Car-truck accident rate by month: fatal and injury accidents, all sites.

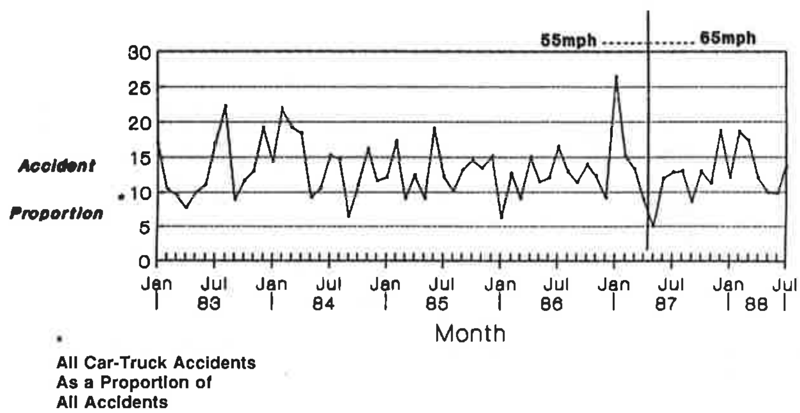



**FIGURE 14** Car-truck accident proportion by month: all reported accidents, all sites.

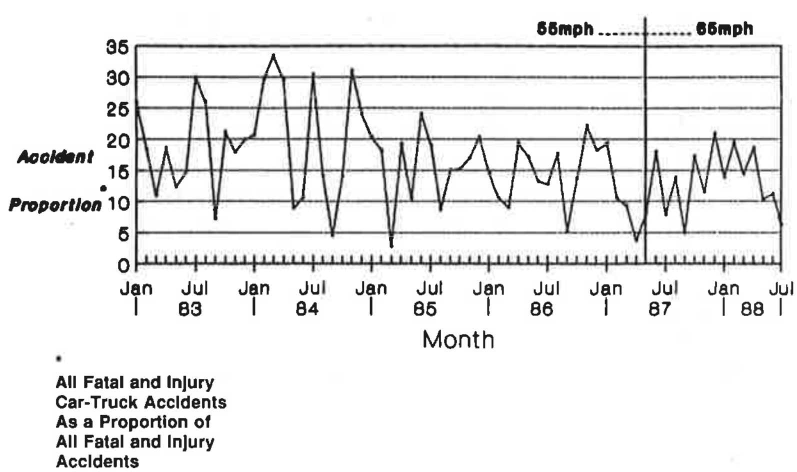



**FIGURE 15** Car-truck accident proportion by month: fatal and injury accidents, all sites.

## FINDINGS

### Changes in Vehicular Speed

The change in the speed limit for rural Interstate facilities in Illinois occurred in May 1987. Treating the monthly observations of each measure as time series, ARIMA intervention analyses were performed to test for the presence, magnitude, and nature of changes, if any, in the speed data after the law change. The ARIMA analysis identified a statistically significant increase in the 85th-percentile speed for cars (see Table 3). The analysis also indicated that the form of the change was gradual and permanent, which suggests that the impact on the 85th-percentile speed occurred gradually after the law change. The ARIMA analysis also predicted that the ultimate increase in speed was 4.0 mph. No impact was detected on the speed variance of passenger cars. No permanent change in truck speeds was detected, measured either by 85th-percentile speed or by speed variance.

The speed differential between cars and trucks was also examined. The results suggested that a gradual, permanent increase occurred in the car-truck speed differential after the change in the law. The conclusion, however, is only supported at the 20 percent level of significance. The asymptotic value for the change was estimated at 2.8 mph.

### Changes in Accidents

The accident rate time series covered the same 67-month period that was used for the analyses of the speed data (i.e., January 1983–July 1988). In addition to frequency and rate,

TABLE 3 IMPACT OF SPEED LIMIT CHANGE ON 85TH-PERCENTILE SPEED AND SPEED VARIANCE AT 15 SPEED-MONITORING SITES, CARS AND TRUCKS

| | Speed Measures | |
|---|---|---|
| Vehicle Type | 85th Percentile Speed (MPH) | Speed Variance ($MPH^2$) |
| Cars | delta MPH = +4.0[a] (GP, .05)[b] | No Impact |
| Trucks | No Impact | No Impact |

[a] The delta value indicates the estimated asymptotic change in the 85th percentile speed.

[b] (GP, .05) indicates that a "gradual permanent" post-intervention model was identified at the .05 significance level. The reported significance level represented the least significant level among all relevant parameters in the ARIMA model used for this case.

a third accident measure for car-truck accidents was used: the proportion of car-truck accidents to all accidents.

The results of the ARIMA analysis of the accident measures, presented in Tables 4 and 5, were inconclusive. A statistically significant increase of 14.2 percent was found in the frequency of all accidents for the 65-mph rural Interstate sites. There was not, however, a corresponding increase in the frequency of fatal and injury accidents. The analyses did indicate an impact (at a low level of significance) on fatal and injury accident rates. A permanent increase in the fatal and injury

TABLE 4 IMPACT OF SPEED LIMIT CHANGE ON ACCIDENT MEASURES FOR PASSENGER CAR ACCIDENTS ONLY, ALL SITES

| | Accident Severity | |
|---|---|---|
| Accident Measure | All Accidents | Fatal and Injury Accidents Only |
| Accident Frequency (Accidents per Month) | Freq. Change = +14.2%[a] (AP, .05)[b] | No Impact |
| Accident Rate (Accidents per month) per Million VMT | No impact | Rate Change=18.5% (AP, .20)[a] |

a The Freq. or Rate Change value for an "abrupt permanent" post-intervention model (AP) indicates the estimated permanent percent change in the accident frequency or accident rate that occurred at the time of the intervention.

b (XX, .xx) indicates the form and significance level of the post-intervention model; i.e.,

XX = AP (abrupt permanent), or .xx = .05, or
= GP (gradual permanent), or = .10, or
= AT (abrupt temporary). = .20.

Reported significance levels for each case represent the least significant level among all relevant model parameters for that case.

TABLE 5 IMPACT OF SPEED LIMIT CHANGE ON ACCIDENT MEASURES FOR CAR-TRUCK ACCIDENTS ONLY, ALL SITES

| | Accident Severity | |
|---|---|---|
| Accident Measure | All Accidents | Fatal and Injury Accidents Only |
| Accident Frequency (Accidents per Month) | No Impact | No Impact |
| Accident Rate (Accidents per Month per Million VMT) | No Impact | Rate Change = -27.3%[a] (AP, .05)[a] |
| Accident Proportion[b] (Car-Truck Accidents as a % of All Accidents | No Impact | Prop. Change = -74.8%[c] (AT, .10) |

a The Freq. or Rate Change value for an "abrupt permanent" post-intervention model (AP) indicates the estimated permanent percent change in the accident frequency or accident rate that occurred at the time of the intervention.

b Two proportions were examined. For all accidents, the proportion equaled all car-truck accidents divided by all accidents. For fatal and injury accidents only, the proportion equaled all fatal and injury car-truck accidents divided by all fatal and injury accidents.

c The Prop. Change value for an "abrupt temporary" post-intervention model (AT) indicates the estimated temporary percent change in the proportion of car-truck fatal and injury accidents among all fatal and injury accidents that occurred at the time of the intervention.

accident rate of about 18.5 percent was calculated (significant at the 20 percent level).

The time series analyses of car-truck accidents are presented in Table 5. Both the accident rate and the accident proportion measures, for fatal and injury accidents only, exhibited significant reductions in car-truck accidents associated with the law change.

## CONCLUSIONS

On the basis of the analyses of speed data, there is evidence that an increase of 4 mph occurred in 85th-percentile speeds of passenger vehicles along rural Interstate highways in Illinois after the change to the 65-mph speed limit. There is not sufficient evidence, however, to indicate that any change occurred in truck speeds. There is also no strong evidence that either the speed variance or the car-truck speed differential changed.

The safety impact associated with the speed increase is not clear. Although there is strong evidence that the overall accident frequency increased more than 14 percent on these same facilities after the law change, it does not seem to have affected the injury and fatal accident experience. Furthermore, when traffic volume variations are taken into account, there is no strong evidence that there was an effect on accidents associated with the law change. Finally, there is no strong evidence that the car-truck accident experience was affected by the law change. In fact, the incidence of car-truck accidents decreased after the change.

The experience gained from this research suggests specific methodological issues for further study:

1. Sensitivity analysis of the study results on the particular month used (i.e., the increase in the speed limit);
2. Elimination of non-speed-related accidents; and
3. A study of long-term trends by extending the data collection period after the law change.

Most of the work being conducted today is global in its orientation. However, the variations from nationally aggregate study results found within this study, and initial indications that similar variations have been identified in other states, suggest the need for more analyses that are based on disaggregate data to allow the development of valid models for the preimplementation examination of proposed policies. Areas of research for further consideration include the following:

1. Comparison of speed and crash experience associated with the law change in states having similar roadway, environment, enforcement, and legal conditions;
2. Analysis of variations in the speed and crash experience

with respect to design attributes of the roadways, terrain, traffic mix, weather, and enforcement practices; and

3. A study of specific issues related to speed differential using headway and other data measured from pairs of vehicles, by type of vehicle.

## ACKNOWLEDGMENTS

This paper is based in part on a project conducted by The Traffic Institute, Northwestern University, under an NHTSA grant. The authors acknowledge the support and assistance of Susan Partyka of NHTSA and David Skinner of the Transportation Systems Center. IDOT was helpful and cooperative in identifying and providing the data on which the analyses were based. The authors extend their thanks and gratitude to the many individuals at IDOT who were involved.

## REFERENCES

1. *Special Report 204: 55: A Decade of Experience*. TRB, National Research Council, Washington, D.C., 1984.
2. A. F. Hoskin. Consequences of Raising the Speed Limit. *Journal of Safety Research*, Vol. 17, No. 4, Winter 1986, pp. 179–182.
3. R. Pfefer and W. Stenzel. *The Safety Impact of the 65 mph Speed Limit—A Time Series Analysis*. NHTSA, U.S. Department of Transportation, 1989.
4. G. E. P. Box and G. M. Jenkins. *Time Series Analysis: Forecasting and Control*. Holden-Day, San Francisco, Calif., 1976.
5. R. McCleary and R. A. Hay. *Applied Time Series Analysis for the Social Sciences*. Sage Publications, Inc., Beverly Hills, Calif., 1980.
6. D. T. Campbell. From Description to Experimentation: Interpreting Trends as Quasi-Experiments. In *Problems of Measuring Change* (C. W. Harris, ed.), University of Wisconsin Press, Madison, 1963.

*Publication of this paper sponsored by Committee on Traffic Law Enforcement.*