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TRUCK ACCIDENT TRENDS IN MICHIGAN, 1978-84

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16. Abstract

After a four-year period of decline, traffic accidents involving large trucks in Michigan have increased in both 1983 and 1984. The University of Michigan Transportation Research Institute (UMTRI) carried out an analysis of existing computerized traffic accident data from the State of Michigan, the NHTSA Fatal Accident Reporting System (FARS), the Bureau of Motor Carrier Safety (BMCS), and the UMTRI Trucks Involved in Fatal Accidents (TIFA) files to identify trends in the involvement of large trucks in traffic accidents in Michigan, and to examine the accident experience of trucks with longer trailers. Trends in large truck accident involvement were developed for Michigan, Indiana, Ohio, and the United States, excluding Alaska and Hawaii, for the years 1978 through 1984.

In general, this is a period that shows a sharp decrease in the involvement of trucks in traffic accidents in 1980, and then increases in 1983 and 1984. The findings of this study show that the trends in the involvement of large trucks in accidents in Michigan are generally below the national accident trends over this period, and are consistent with the accident trends in Indiana and Ohio. The number of trucks involved in accidents in Michigan in 1984 is still below the 1978 figure. Tractor combinations involved in non-fatal accidents have shown the greatest growth in the past two years (1983-1984). Examination of the safety impact of longer trailers resulted in a recommendation for adequate rear underride protection in order to mitigate the potential hazard posed by the substantial rear overhang of the proposed trailers to the occupants of passenger cars that may collide with the rear of these trailers.

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TRUCK ACCIDENT TRENDS

SUMMARY FINDINGS AND RECOMMENDATIONS

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With the support of the Michigan Department of Transportation, the University of Michigan Transportation Research Institute (UMTRI) has carried out an analysis of computerized accident data from the State of Michigan, the NHTSA Fatal Accident Reporting System (FARS), the Bureau of Motor Carrier Safety (BMCS), and the UMTRI Trucks Involved in Fatal Accidents (TIFA) files to identify trends in the involvement of large trucks in traffic accidents in Michigan, and to examine the accident experience of trucks with longer trailers. Trends in large-truck accident involvement were developed for Michigan, Indiana, Ohio, and the United States, excluding Alaska and Hawaii, for the years 1978 through 1984.

SUMMARY FINDINGS

In general, this is a period that shows a sharp decrease in the involvement of trucks in traffic accidents in 1980, and then increases in 1983 and 1984. These trends are generally expected to follow the economic trends over this period. However, because reliable exposure information is not available, this study is limited to comparison of trends in the accident data. The findings of this study show that the trends in the involvement of large trucks in accidents in Michigan are generally below the national accident trends over this period, and are consistent with the accident trends in Indiana and Ohio. The number of trucks involved in accidents in Michigan in 1984 is still below the 1978 figure. Tractor combinations involved in non-fatal accidents have shown the greatest growth in the past two years (1983–1984). Examination of the safety impact of longer trailers resulted in a recommendation for adequate rear underride protection in order to mitigate the potential hazard posed by the substantial rear overhang of the proposed trailers to the occupants of passenger cars that may collide with the rear of these trailers.

Fatal Accidents. The overall trend in the involvement of combination vehicles in fatal accidents in Michigan for the years 1978 through 1984 is below the national trend for this period. Based on the NHTSA FARS data, the number of combination vehicles involved in fatal accidents nationally reached its lowest level in this period in 1982, declining to 83 percent of the 1978 level. Nationally, the number of combination vehicles involved in fatal accidents has increased since then to 92 percent of the 1978 level in 1984. In Michigan, the number of combination vehicles involved in fatal accidents dropped to less than half of the 1978 level by 1982, and has only recovered to 60 percent of the 1978 level in 1984. The trend in Michigan is comparable with the trends in Indiana and Ohio. Comparison of the UMTRI files on Trucks Involved in Fatal Accidents (TIFA) with the State of Michigan data indicates that the number of large single-unit trucks may be over-estimated by about 25 percent in the State of Michigan data.

BMCS-Reported Injury Accidents Involving Tractor-Semitrailer Combinations. The overall trend in the involvement of tractor-semitrailers in BMCS-reported injury accidents in Michigan for the years 1978 through 1984 is below the national trend for this period. The trend in Michigan is comparable to the trends observed in Indiana and Ohio. The national trend is lowest in 1983 at 81 percent of the 1978 level, and recovers to 89 percent in 1984. The Michigan trend drops to 55 percent in 1982, and recovers to 69 percent in 1984. However, a comparison of the data in the State of Michigan files and the UMTRI TIFA files with the BMCS data indicates that the under-reporting of accidents to BMCS by interstate carriers is increasing substantially.

Trucks with Double Trailers or Gross Combination Weights Greater Than 80,000 Pounds. Combination vehicles with two trailers or weighing more than 80,000 pounds are only a small proportion of the fatal and BMCS-reported injury-accident involvements, and do not contribute significantly to the observed trends.

State of Michigan Data. All levels of accident severity (property damage, injury, and fatal) are included in the State of Michigan data, and each was examined separately for both straight trucks and tractor combinations. The trends in fatal and injury accidents were compared with the trends observed in the FARS, BMCS, and TIFA data described above. In the State of Michigan data, accidents involving straight trucks follow about the same trend at all levels of accident severity. The straight truck trend is comparable to the lower trends observed in the other data sources, such as the BMCS-reported injury accidents involving tractor-semitrailer combinations. In the State of Michigan data, straight truck accident involvements drop to about 60 percent of the 1978 levels in 1982, and recover to 70 percent of this level in 1984. The apparent over-counting of this type of truck identified above does not seem to influence the overall trend.

The State of Michigan data on tractor-semitrailers show two different trends. Fatal accidents involving tractor-semitrailers follow the lower trend described above. However, the injury and property damage accidents involving tractor-semitrailers in the State of Michigan data follow a higher trend than that observed in the BMCS-reported injury accidents in Michigan. The Michigan data show a trend that decreases to about 70 percent of the 1978 level in 1981, and then recovers to more than 90 percent of the 1978 level in 1984. Hence, tractor-semitrailers operated by carriers that do not report to BMCS involved in non-fatal accidents have shown the most growth in the past two years (1983–1984).

Comparison of BMCS and Michigan Data. Comparison of the State of Michigan data and the BMCS data on injury accidents involving tractor-semitrailers shows a 25 percent drop from 1981 to 1982 in the ratio of BMCS-reported cases to cases in the State of Michigan data. In the UMTRI TIFA data, the proportion of interstate carriers for Michigan involvements has increased steadily from 57.6 percent in 1980 to 71.1 percent in 1983. This trend is consistent with the deregulation of the trucking industry over this period of time. The increase in interstate carriers and the decline in accidents reported to BMCS in Michigan indicates that the under-reporting of accidents to BMCS by interstate carriers is increasing substantially.

Trailer Length. The recommended axle placement[1] for a 53-foot trailer leaves the cargo body extending 5.5 feet behind the rear axle. Prior research has established the

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[1]R.D. Ervin and T.D. Gillespie, *Safety and Operational Impacts of 53-Foot Truck Trailers in Michigan.* Report No. UMTRI-86-13. Ann Arbor: The University of Michigan Transportation Research Institute, March 1986.

hazard presented by the relatively high frame of the trailer cargo body when struck from the rear by a passenger car. The hood of the passenger car passes, relatively unimpeded, under the trailer body, and the rear of the trailer body impacts the windshield and penetrates the passenger compartment. This type of collision is described as an "underride," and is associated with the exposed rear overhang of the trailer body. Most semitrailers up to 48 feet in length are operated with the rear axle near the back of the trailer, thus providing a fairly effective "underride" guard. Since the necessary axle placement for the proposed 53-foot trailers leaves 5.5 feet of the cargo body extending behind the rear wheels, a potential hazard is created for the occupants of passenger cars that may collide with the rear of these trailers.

SUMMARY RECOMMENDATIONS

Initiate a Michigan Truck Accident Study. While the UMTRI TIFA file provides relatively accurate and comprehensive data on large trucks involved in fatal accidents in Michigan, comparable data on non-fatal accidents is not available except for the BMCS data. This study indicates that under-reporting of accidents to BMCS is a growing problem. Furthermore, the carriers not reporting to BMCS show the largest growth in 1983 and 1984. Without more comprehensive information on these accidents, further analysis cannot be pursued. A work plan is being prepared for the Michigan Office of Highway Safety Planning entitled "Michigan Large-Truck Accident and Exposure Study." The objective of this work plan is to develop a comprehensive project to address current large-truck safety issues. If accidents involving trucks with longer trailers were identified on the police accident report, all of these could be included in the supplemental follow-up.

Speed Up 1984 TIFA Survey Work for Michigan. The TIFA survey work is currently in progress for fatal accidents occurring in 1984. The Michigan cases could be given priority for completion so that more accurate fatal accident counts for Michigan in 1984 would be available in about one month. While not part of the current work, this task could be added.

Trailer Underride. Since the recommended axle placement for the proposed 53-foot trailers results in a substantial rear overhang, it is recommended that adequate rear underride protection be required in order to mitigate the potential hazard to the occupants of passenger cars that may strike the rear of these trailers. Underride cannot be studied in the existing accident data. Underride is not identified, nor is the rear overhang of the trailer or the presence and type of rear underride guard. We further recommend initiation of a supplemental follow-up of accidents where longer trailers are struck in the rear to monitor the effectiveness of rear underride protection.

OBJECTIVES

After declining for the last four years, traffic accidents involving large trucks in Michigan have increased in both 1983 and 1984. This pattern is generally comparable to the trend in economic conditions in the state over this period. However, deregulation and the Surface Transportation Assistance Act of 1982 have also produced changes in the trucking industry. Since reliable information on miles traveled is not available, this study is limited to comparison of trends in the accident data. With the support of the Michigan Department of Transportation, the University of Michigan Transportation Research Institute (UMTRI) carried out an analysis of existing computerized traffic accident data from the State of Michigan, the NHTSA Fatal Accident Reporting System (FARS), the Bureau of Motor Carrier Safety (BMCS), and the UMTRI Trucks Involved in Fatal Accidents (TIFA) files to identify trends in the involvement of large trucks in traffic accidents in Michigan, Indiana, Ohio, and the United States, excluding Alaska and Hawaii, over the period 1978 through 1984. The objectives of this project were:

1. Identify trends in the involvement of large trucks in ***fatal*** accidents in Michigan, and compare this result with the trends in Indiana, Ohio, and the U.S. total. Analyze the available data for accident factors associated with these trends.

2. Identify trends in the involvement of large trucks in ***injury*** accidents in Michigan, and compare this result with the trends in Indiana, Ohio, and the U.S. total. Analyze the available data for accident factors associated with these trends.

3. Analyze existing data on fatal and injury accidents involving tractors with a single semitrailer for accidents factors associated with ***trailer length*** .

APPROACH

For this study, large trucks are those with gross vehicle weight ratings greater than 10,000 pounds. All pickup trucks are to be excluded. Trucks are categorized as single-unit or combination vehicles depending on whether or not a trailer is pulled, or as straight trucks or tractors based on the power unit. A straight truck is defined as a truck with a cargo body mounted on the power unit, while a tractor has no cargo body on the power unit, and a fifth wheel instead. A brief description of the data files used follows.

The NHTSA Fatal Accident Reporting System (FARS) is the primary source of information on all fatal traffic accidents occurring in the United States. FARS Analysts in each state transcribe information from the police report, the vehicle registration record, and the driver's license record into a common format for the FARS file. For large trucks, the descriptive information is limited to a distinction between straight trucks and tractors, and the number of trailers. Follow-up surveys conducted by UMTRI show that this information is incorrect for 10–15 percent of the trucks. However, the FARS data can provide counts of the large trucks involved in fatal accidents over the entire period, 1978–1984. The UMTRI TIFA program was not begun until 1980, and the 1984 TIFA file will

not be completed until later this year since it is initiated only after receipt of the FARS and BMCS data.

Motor carriers engaged in interstate commerce are required to file a report with the Bureau of Motor Carrier Safety on any accident resulting in injury or property damage of $2,000 or more. These reports are edited, keyed, and stored on magnetic tape by BMCS. UMTRI obtains the tape each year and carries out additional processing of the data to make it more suitable to our analytical needs. The MCS-50T accident report form that the carriers must fill out provides a comprehensive description of the truck, including number of axles, trailer body style, cargo type and weight, gross combination weight, and overall length. UMTRI adds information on the cab style to this file for the fatal accidents.

The TIFA, Trucks Involved in Fatal Accidents, file is the product of an UMTRI program that combines data from FARS, BMCS, and telephone interviews after checking the data for accuracy and consistency. This file has information on all trucks with gross vehicle weight ratings greater than 10,000 pounds involved in fatal accidents in the United States, except Alaska and Hawaii. Currently, these files are complete for 1980 through 1983. The survey work for the 1984 cases is in progress. The data elements of this file are those of both the FARS and the BMCS data. When a BMCS report has been filed for the involved truck, this information is combined with the FARS data. Otherwise, telephone interviews are conducted to obtain the data elements on the BMCS report. In this way, comprehensive information is provided on every large truck involved in a fatal accident in the United States. Copies of the police reports for each of these accidents are also obtained from each state. The opportunity to compare information from several sources on an accident eliminates many errors in the individual sources.

UMTRI obtains computerized accident data from the State of Michigan quarterly. These files are made available for analysis on the UMTRI Automated Data Access and Analysis System (ADAAS). All tabulations identified with the State of Michigan accident data in this report were prepared from the UMTRI files, as opposed to files actually maintained by the State of Michigan.

FINDINGS

Findings are presented in this section under headings corresponding to the three objectives listed.

FATAL ACCIDENT INVOLVEMENT TRENDS

Data on large trucks involved in fatal accidents were available in three files: Michigan, FARS, and TIFA. Large trucks were categorized as single-unit or combination vehicles in each of these files. The Michigan counts are compared in Figure 1 and Table 1. Agreement among the three sources is best for combination vehicles, and worst for the single-unit trucks. The counts in the FARS file for the single-unit trucks are about one-half of the figures from the Michigan file, with the TIFA data falling in between these two, but tending to be closer to the FARS counts. In the survey work for the TIFA file, we often find errors in the classification of trucks on the police accident reports. The count of single-unit trucks in the Michigan data may be inflated by light trucks incorrectly coded as large trucks. The apparent inclusion of these vehicles also inflates the counts for all trucks involved in fatal accidents in the Michigan file as compared to the other two data sources.

UMTRI is currently preparing a work plan for the Michigan Office of Highway Planning for a study of Large-Truck Accidents and Exposure in Michigan. A telephone follow-up of police-reported truck accidents in Michigan to clarify the type and configuration of truck is included in the draft work plan.

The FARS data were used to compare the trend in the involvement of combination trucks in fatal accidents in Michigan with the trends in Indiana, Ohio, and the national total. Only combination vehicles, which account for about 70 percent of all large trucks involved in fatal accidents (TIFA file), were used for this comparison as a consequence of the uncertainty in the single-unit counts. These findings are shown in Figure 2 and Table 2. The percentages shown in Figure 2 were calculated by using the 1978 counts as a baseline for each state. The trend lines for Michigan, Indiana, and Ohio all fall below the national trend except for Indiana and Ohio in 1979. The trend for Michigan is below the Indiana trend for every year in the period, and is below the Ohio trend for every year except 1984. In general, the trend in combination vehicle involvement in fatal accidents in Michigan compares favorably with the national trend and the trends in Indiana and Ohio.

Several factors were examined for variations that might be associated with the observed trends in the overall counts. No significant variations were found for large trucks involved in fatal accidents in Michigan. Among the factors examined were the proportion of large trucks with two trailers, and the proportion with a gross combination weight at the time of the accident greater than 80,000 pounds. The proportion of large trucks with two trailers involved in fatal accidents in Michigan was about 3 percent in 1982 and 1983. This proportion is down from about 8 percent in 1980 and 1981. The proportion of large trucks weighing more than 80,000 pounds when involved in a fatal accident in Michigan was about 10 percent in 1983. This proportion is up from about 6 percent in 1982, and about the same as in 1980. This increase accounts for 7 of the 26 additional large-truck involvements in fatal accidents in Michigan in 1983 as compared to 1982. Hence, combination vehicles with two trailers or weighing more than 80,000 pounds are not a major factor in the involvement of large trucks in fatal accidents in Michigan, or the trend in these involvements.

INJURY ACCIDENT INVOLVEMENT TRENDS

The BMCS data were used initially to determine trends in the involvement of combination vehicles in injury accidents. There are not sufficient numbers of single-unit trucks in the BMCS file for analysis. Examination of the property-damage-only accidents showed a steadily increasing trend over this period, unlike any of the other accident trends observed. This suggests that inflation of the dollar over this period may have produced a decreasing reporting threshold. In part for this reason, the BMCS has increased the reporting threshold for property-damage-only accidents to $4200 as of January 1, 1986. Consequently, trends in BMCS-reported property-damage-only accidents are not presented.

The trend in the involvement of tractors with single trailers in BMCS-reported injury accidents in Michigan is compared with the national trend and the trends in Indiana and Ohio in Figure 3 and Table 3. The percentages shown in Figure 3 were calculated using the 1978 counts as a baseline for each trend line. The trends in the involvement of tractors with single trailers in BMCS-reported injury accidents for Michigan, Indiana, and Ohio all fall below the national trend. In general, the trends for the three states are comparable, with Michigan being the lowest in 1984.

The trend in the involvement of tractors with single trailers in BMCS-reported injury accidents in Michigan was compared with the trend in the Michigan data on all

tractors with single trailers involved in 'A' and 'B' level injury accidents. The 'C' level injuries were not included because the BMCS reporting threshold requires treatment away from the scene of the accident. This comparison is shown in Figure 4 and Table 4. An important finding is that these two trends differ substantially. The BMCS-reported injury accidents in Michigan follow a trend similar to the fatal accidents, with a substantial decline continuing until 1982 and a partial increase to a level in 1984 of about 70 percent of the 1978 level. However, the trend for all tractors with single trailers involved in 'A' and 'B' level injury accidents in the State of Michigan files is much shallower with an increase in 1984 to more than 90 percent of the 1978 level. The trend for accidents not reported to the BMCS, shown on Figure 4, was obtained by subtracting the number of BMCS-reported involvements from the total given by the State of Michigan data. The implication of this result is that the greatest increase in tractor-semitrailer involvement in injury accidents in Michigan is among those carriers that do not report to BMCS.

Many factors were examined in the BMCS data on tractors with single trailers involved in injury accidents for associations with the overall trends from year to year. As with the fatal accidents, no changes of appreciable magnitude were found. Figures 5 and 6 show distributions of cargo type for the 48 states and for Michigan, respectively. The decrease in general freight tends to follow the trend for all accidents in the national data, while categories somewhat unique to Michigan, such as metal and motor vehicles, seem to reflect the economic conditions in the state over this period. However, these changes are not very large. The proportion of doubles and tractor-semitrailers over 80,000 pounds at the time of the accident was also examined in the BMCS-reported injury accidents in Michigan. The proportion of doubles in these data is constant at about 4 percent, as is the proportion of tractor-semitrailers weighing over 80,000 pounds at about the same value, 4 percent. Hence, neither of these factors plays a significant role in the trends in the BMCS-reported injury accidents involving tractor-semitrailers in Michigan.

In an effort to pursue the discrepancy in the trends in injury accidents in the Michigan and the BMCS data, the State of Michigan data were tabulated by most severe injury in the accident separately for straight trucks and tractor combinations. These results are shown in Figures 7 and 8, and Tables 5 and 6. In the State of Michigan data, accidents involving straight trucks follow about the same trend at all levels of accident severity. The straight truck trend is comparable to the lower trends observed in the other data sources, such as the BMCS-reported injury accidents involving tractor-semitrailer combinations. In the State of Michigan data, straight-truck accident involvements drop to about 60 percent of the 1978 levels in 1982, and recover to 70 percent of this level in 1984. The trend in straight-truck accidents shown in Figure 7 is particularly significant, because the straight trucks account for an increasing proportion of all large-truck accidents at the lower accident-severity levels. This is illustrated using the 1984 State of Michigan data in Figure 9. Although the comparison of fatal accident data sources shown in Figure 1 suggests that the number of straight trucks involved in accidents is somewhat over-estimated in the State of Michigan data, this possible error does not seem to be influencing the overall trends.

The State of Michigan data on tractors show two different trends. Fatal accidents involving tractor-semitrailers follow the lower trend shown in Figure 1. However, the injury and property damage accidents involving tractor-semitrailers in the State of Michigan data follow a higher trend than that observed in the BMCS-reported injury accidents in Michigan. The Michigan data shows a trend that decreases to about 70 percent of the 1978 level in 1981, and then recovers to more than 90 percent of the 1978 level in 1984. Using the data presented in Figure 4 and Table 4, trend lines were calculated separately for injury accidents involving tractor-semitrailers in Michigan that were reported to the BMCS, and those that were not. These two trends are shown in

Figure 10, along with the trend for all the tractor-semitrailers. The trend line for the BMCS-reported cases is based on the BMCS file, while the trend for all tractor-semitrailers involved in injury accidents is based on the State of Michigan data. The trend line for the involvements not reported to the BMCS is the difference between these two. The results shown in Figure 10 are striking. Prior to 1982, the BMCS-reported tractor-semitrailer involvements in injury accidents were steady at about 57 percent of the 'A' and 'B' level injury accidents in the Michigan file for this vehicle type. Starting in 1982, this proportion has dropped to about 43 percent. This trend is opposite to that for the proportion of interstate carriers. Based on the UMTRI TIFA data, the proportion of large trucks involved in fatal accidents in Michigan operated by interstate carriers has increased steadily, from 57.6 percent in 1980 to 71.1 percent in 1983. This trend is also reflected in the national figures from the TIFA file, and is consistent with the deregulation of the trucking industry over this period. The increase in interstate carriers and the decline in accidents reported to BMCS in Michigan indicates that the under-reporting of accidents to BMCS by interstate carriers is increasing substantially.

TRAILER LENGTH

Trailer length is not recorded in any existing accident data except the UMTRI TIFA files. Even in the TIFA file, about one-third of the records are taken from BMCS reports, and include only overall length. It was originally hoped that trailer length could be inferred from overall length by taking cab style and trailer body style into account, but this approach turned out to be unreliable. Information on over 6,000 semitrailers in a four-year TIFA file (1980–1983) was examined. Only 27 of these (0.4 percent) were longer than fifty feet. Of these 27, 2 were vans, 14 were flatbeds, 1 was a tank, and the remaining 10 were "other" body styles such as the pole trailers used in logging. In addition, there were 24 fifty-foot trailers, 10 forty-nine-foot trailers, and 50 forty-eight-foot trailers. A complete distribution of the lengths of these 6,367 trailers is shown in Figure 11. Many factors were examined for association with trailers longer than 45 feet, such as collision type, jackknife, rollover, cargo type and weight, carrier type, road class, and vehicle maneuver. The distribution of these factors was not appreciably different for the longer trailers as compared to 40–45 foot trailers. Hence, existing accident data are not sufficient to project the accident experience of trucks with longer trailers in Michigan.

Ervin[2] has examined the safety and operational impacts of 53-foot trailers, and recommends a maximum wheelbase of 40.5 feet. This requirement results in a rear overhang of 5.5 feet for these trailers. Prior research has established the hazard presented by the relatively high frame of the trailer cargo body when struck from the rear by a passenger car. The hood of the passenger car passes, relatively unimpeded, under the trailer body, and the rear of the trailer body impacts the windshield and penetrates the passenger compartment. This type of collision is described as an "underride," and is associated with the exposed rear overhang of the trailer body. Most semitrailers up to 48 feet in length are operated with the rear axle near the back of the trailer, thus providing a fairly effective "underride" guard. Since the necessary axle placement for the 53-foot trailers leaves 5.5 feet of the cargo body extending behind the rear wheels, it is necessary to equip these trailers with a "rear underride guard" to mitigate the potential hazard to the occupants of passenger cars that may collide with the rear of these trailers. A brief summary of the prior research on the potential benefits of rear underride guards follows.

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[2]R.D. Ervin and T.D. Gillespie, *Safety and Operational Impacts of 53-Foot Truck Trailers in Michigan.* Report No. UMTRI-86-13. Ann Arbor: The University of Michigan Transportation Research Institute, March 1986.

In 1977, Minahan and O'Day[3] examined all fatal accidents in Michigan from 1972–76 where a passenger car struck the rear of a truck or trailer. They concluded that some underride occurred in over 90 percent of these fatal accidents. At about the same time, the National Highway Traffic Safety Administration (NHTSA) and the Bureau of Motor Carrier Safety (BMCS) initiated a program to explore improved rear-end protection for trucks and truck trailers. This program resulted in a Notice of Proposed Rulemaking published in 1981 entitled "Rear Underride Protection."[4] The results are summarized in this notice. NHTSA stated that, in 1978, 338 occupants of passenger cars were killed in collisions with the rear of a truck or truck trailer. Excessive underride (penetration of the windshield by the rear of the cargo body) was estimated to have occurred in 30–40 percent of these fatalities. Approximately 12 occupants of passenger cars are killed per year in collisions with the rear of trucks or truck trailers in Michigan.

The existing standard for rear underride protection at that time was contained in Part 393.86 of the Bureau of Motor Carrier Safety Regulations, and applied only to trucks engaged in interstate commerce. The effectiveness of this underride guard was studied, and found to be inadequate primarily because the stipulated height of the guard (30 inches off the ground) was too high to appreciably reduce underride, particularly for small cars. The proposed underride guard was modelled after the existing European Economic Community (EEC) and Swedish regulation which requires an underride guard capable of withstanding a load of 45,000 pounds. The ground clearance was not to exceed 22 inches at any point across the full width. The agency estimated the additional cost of the proposed guard over the existing guard to be about $50 per unit. Despite little opposition, NHTSA has not proceeded with rulemaking on this rear underride protection standard. However, since the proposed 53-foot trailers will have a substantial rear overhang, it would seem necessary to require adequate rear underride protection in order to mitigate this potential hazard to the motoring public in Michigan.

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[3]D.J. Minahan and J. O'Day, *Car-Truck Fatal Accidents in Michigan and Texas*. Report No. UMTRI-77-49. Ann Arbor: The University of Michigan Transportation Research Institute, October 1977.

[4]*Federal Motor Vehicle Safety Standards; Rear Underride Protection.* Federal Register, Vol. 46 No. 5, January 8, 1981.

RECOMMENDATIONS

Initiate a Michigan Truck Accident Study. While the UMTRI TIFA file provides relatively accurate and comprehensive data on large trucks involved in fatal accidents in Michigan, comparable data on non-fatal accidents are not available except for the BMCS data. This study indicates that under-reporting of accidents to BMCS is a growing problem. Furthermore, the carriers not reporting to BMCS show the largest growth in 1983 and 1984. Without more comprehensive information on these accidents, further analysis cannot be pursued. A work plan is being prepared for the Michigan Office of Highway Safety Planning entitled "Michigan Large-Truck Accident and Exposure Study." The objective of this work plan is to develop a comprehensive project to address current large-truck safety issues. Specifically, this project will include a follow-up of police accident reports to verify the type and configuration of the involved truck, and collect supplemental descriptive information on the truck and the accident. If accidents involving trucks with longer trailers were identified on the police accident report, all of these could be included in the supplemental follow-up.

Speed up 1984 TIFA Survey Work for Michigan. The TIFA survey work is currently in progress for fatal accidents occurring in 1984. The Michigan cases could be given priority for completion so that more accurate fatal accident counts for Michigan in 1984 would be available in about one month. While not part of the current work, this task could be added.

Trailer Underride. Since the recommended axle placement for the proposed 53-foot trailers results in a substantial rear overhang, it is recommended that adequate rear underride protection be required in order to mitigate the potential hazard to the occupants of passenger cars that may strike the rear of these trailers. Underride cannot be studied in the existing accident data. Underride is not identified, nor is the rear overhang of the trailer or the presence and type of rear underride guard. We further recommend a supplemental follow-up of accidents where longer trailers are struck in the rear be initiated to monitor the effectiveness of rear underride protection.

TABLE 1

MICHIGAN 1978-84:
LARGE-TRUCK FATAL INVOLVEMENTS BY DATA SOURCE

Year	Single Units			Combination Units			All		
	Mich	FARS	TIFA	Mich	FARS	TIFA	Mich	FARS	TIFA
1978	76	34		121	149		205	183	
1979	61	42		122	129		190	171	
1980	55	43	45	78	80	80	133	123	125
1981	45	21	36	89	96	91	134	117	127
1982	44	24	28	62	72	70	107	96	102
1983	50	26	35	79	90	90	129	116	128
1984	56	24		80	90		139	114	

TABLE 2

FARS 1978-84:
COMBINATION TRUCK FATAL INVOLVEMENTS BY STATE

Year	48 States	Michigan	Indiana	Ohio
1978	4110	149	178	195
1979	4373	129	196	217
1980	3743	80	123	139
1981	3868	96	122	163
1982	3405	72	108	128
1983	3560	90	135	132
1984	3798	90	130	107

TABLE 3

BMCS INJURY ACCIDENTS, 1978–84:
TRACTOR-SEMITRAILER INVOLVEMENTS BY STATE

Year	48 States	Michigan	Indiana	Ohio
1978	16,000	502	821	1,260
1979	16,121	488	757	1,155
1980	13,793	356	656	927
1981	13,482	374	564	913
1982	13,064	276	513	817
1983	12,889	315	510	787
1984	14,289	344	621	943

TABLE 4

MICHIGAN 1978–84:
TRACTOR-SEMITRAILER INJURY INVOLVEMENTS BY DATA SOURCE

Year	Mich File A & B Injuries	BMCS Injury Reports	Non-BMCS Cases
1978	892	502	390
1979	849	488	361
1980	633	356	277
1981	651	374	277
1982	649	276	373
1983	714	315	399
1984	833	344	489

TABLE 5

MICHIGAN 1978–84
STRAIGHT-TRUCK INVOLVEMENTS BY INJURY LEVEL

Year	Fatal	Injury		Property Damage
		A & B	C	
1978	58	1161	1272	7988
1979	53	1092	1229	7286
1980	52	759	939	5218
1981	34	772	837	4942
1982	33	682	736	4926
1983	39	724	778	4812
1984	43	840	994	5528

TABLE 6

MICHIGAN 1978–84
TRACTOR INVOLVEMENTS BY INJURY LEVEL

Year	Fatal	Injury		Property Damage
		A & B	C	
1978	139	1279	1210	7154
1979	130	1270	1126	6855
1980	81	944	811	4839
1981	100	928	841	5102
1982	73	915	769	4925
1983	90	1007	858	5553
1984	93	1182	1088	6960

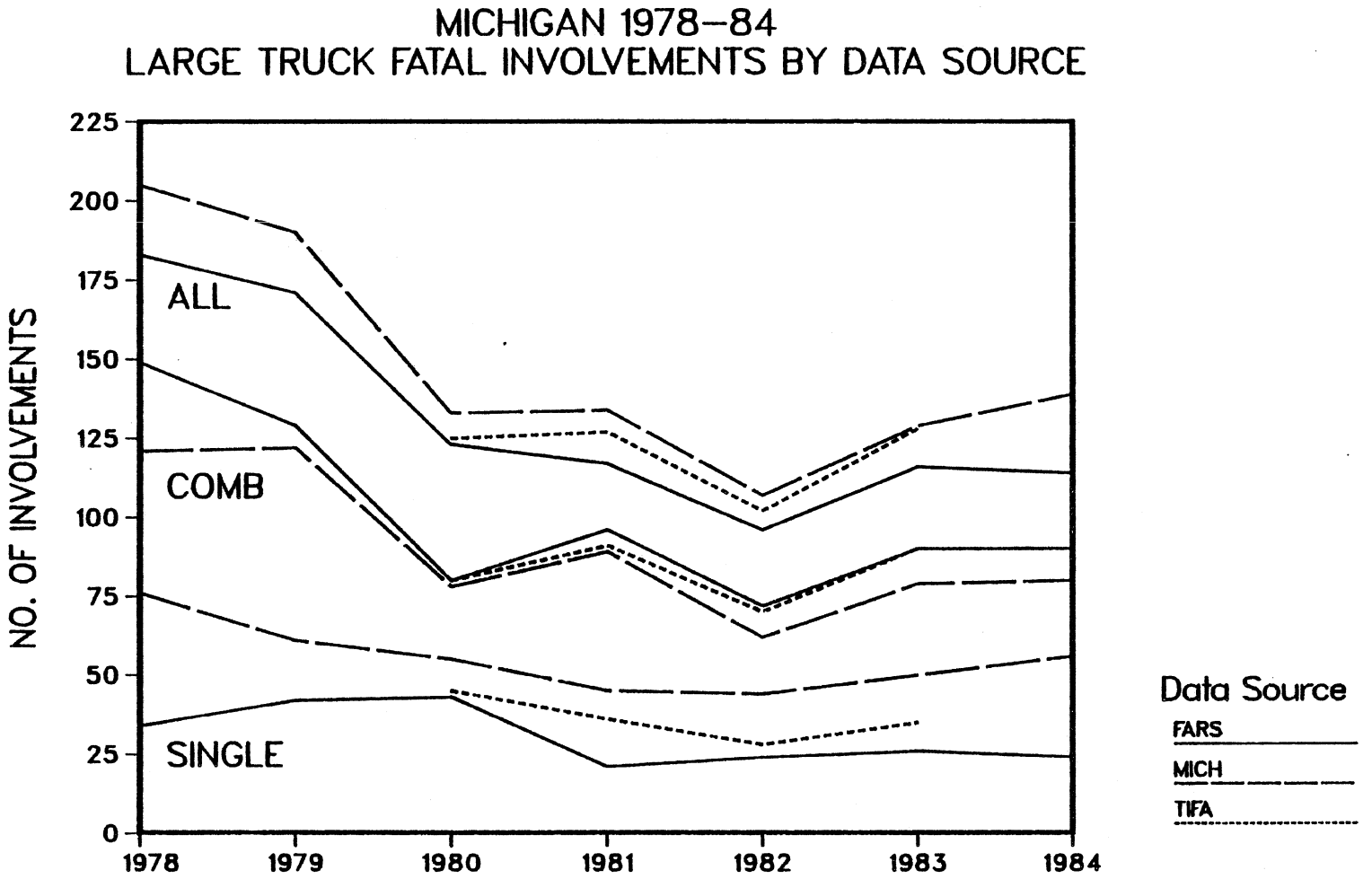
MICHIGAN 1978–84
LARGE TRUCK FATAL INVOLVEMENTS BY DATA SOURCE
NO. OF INVOLVEMENTS
225
200
175
150
125
100
75
50
25
0
1978
1979
1980
1981
1982
1983
1984
ALL
COMB
SINGLE
Data Source
FARS
MICH
TIFA

FIGURE 1

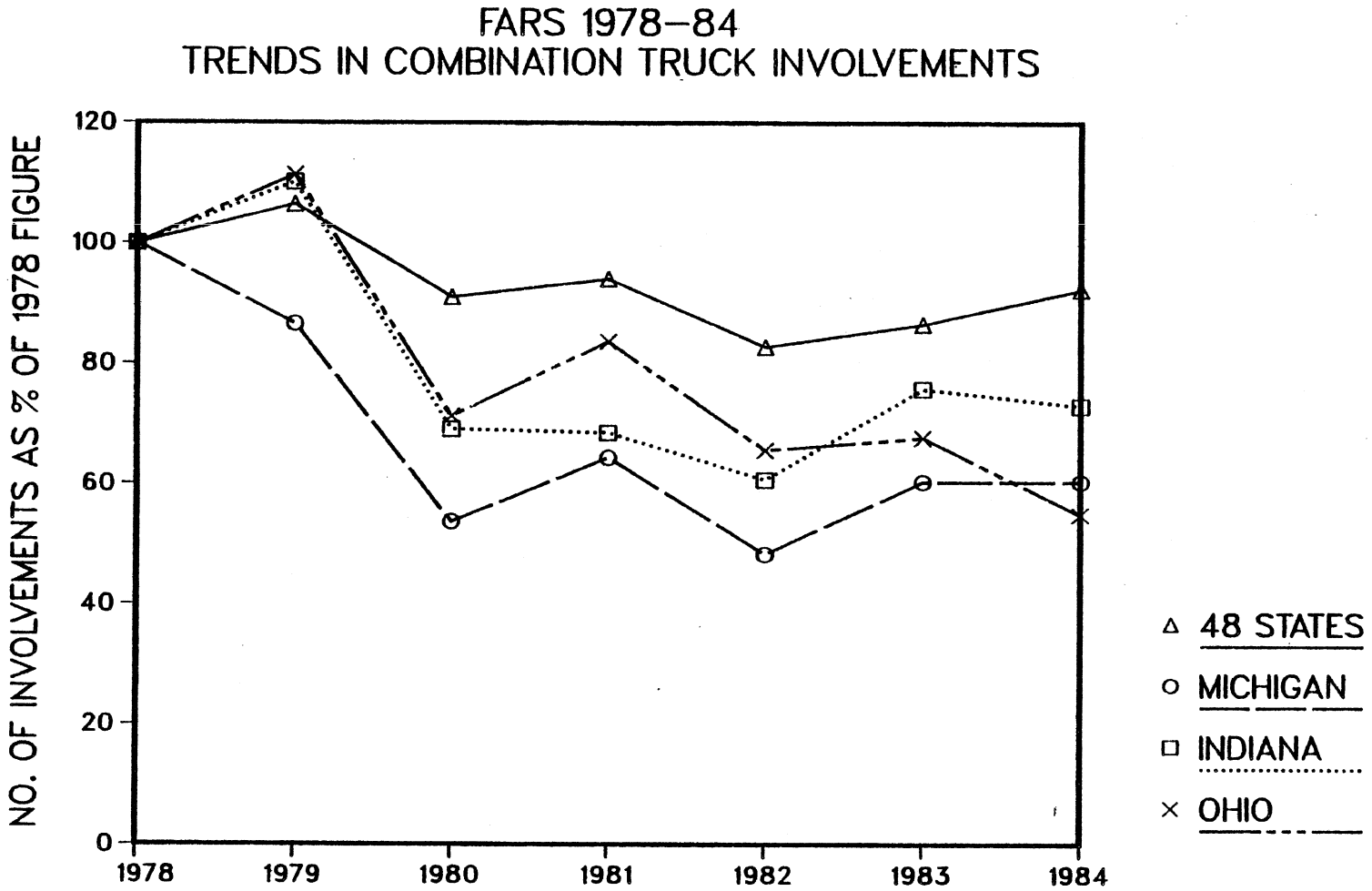
FARS 1978–84
TRENDS IN COMBINATION TRUCK INVOLVEMENTS
NO. OF INVOLVEMENTS AS % OF 1978 FIGURE
120
100
80
60
40
20
0
1978
1979
1980
1981
1982
1983
1984
48 STATES
MICHIGAN
INDIANA
OHIO

FIGURE 2

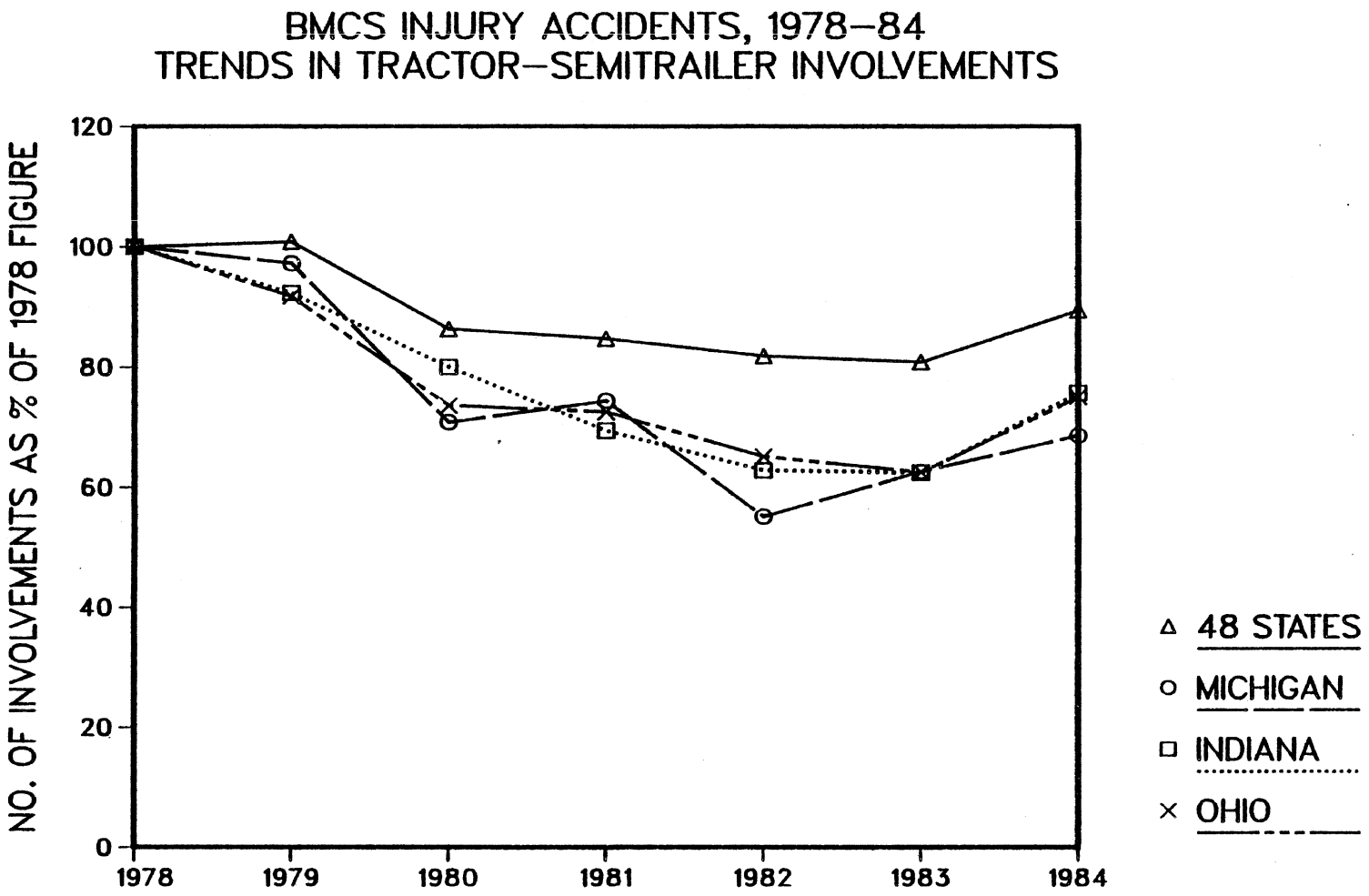
BMCS INJURY ACCIDENTS, 1978–84
TRENDS IN TRACTOR–SEMITRAILER INVOLVEMENTS
NO. OF INVOLVEMENTS AS % OF 1978 FIGURE
120
100
80
60
40
20
0
1978
1979
1980
1981
1982
1983
1984
48 STATES
MICHIGAN
INDIANA
OHIO

FIGURE 3

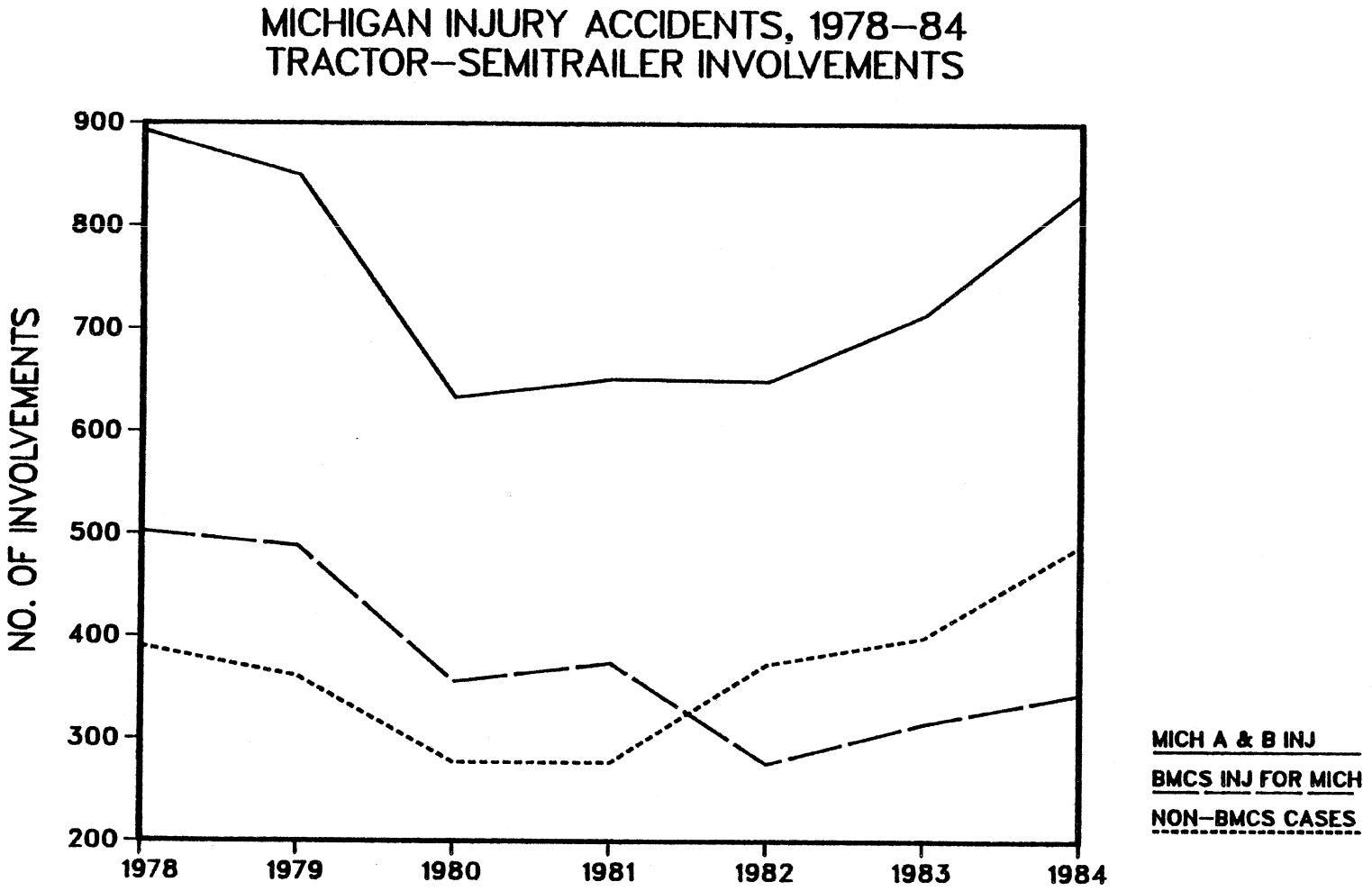
MICHIGAN INJURY ACCIDENTS, 1978–84
TRACTOR–SEMITRAILER INVOLVEMENTS
NO. OF INVOLVEMENTS
900
800
700
600
500
400
300
200
1978
1979
1980
1981
1982
1983
1984
MICH A & B INJ
BMCS INJ FOR MICH
NON–BMCS CASES

FIGURE 4

BMCS INJURY ACCIDENT INVOLVEMENTS IN 48 STATES, 1978–84
CARGO TYPE FOR SINGLE–TRAILER COMBINATIONS

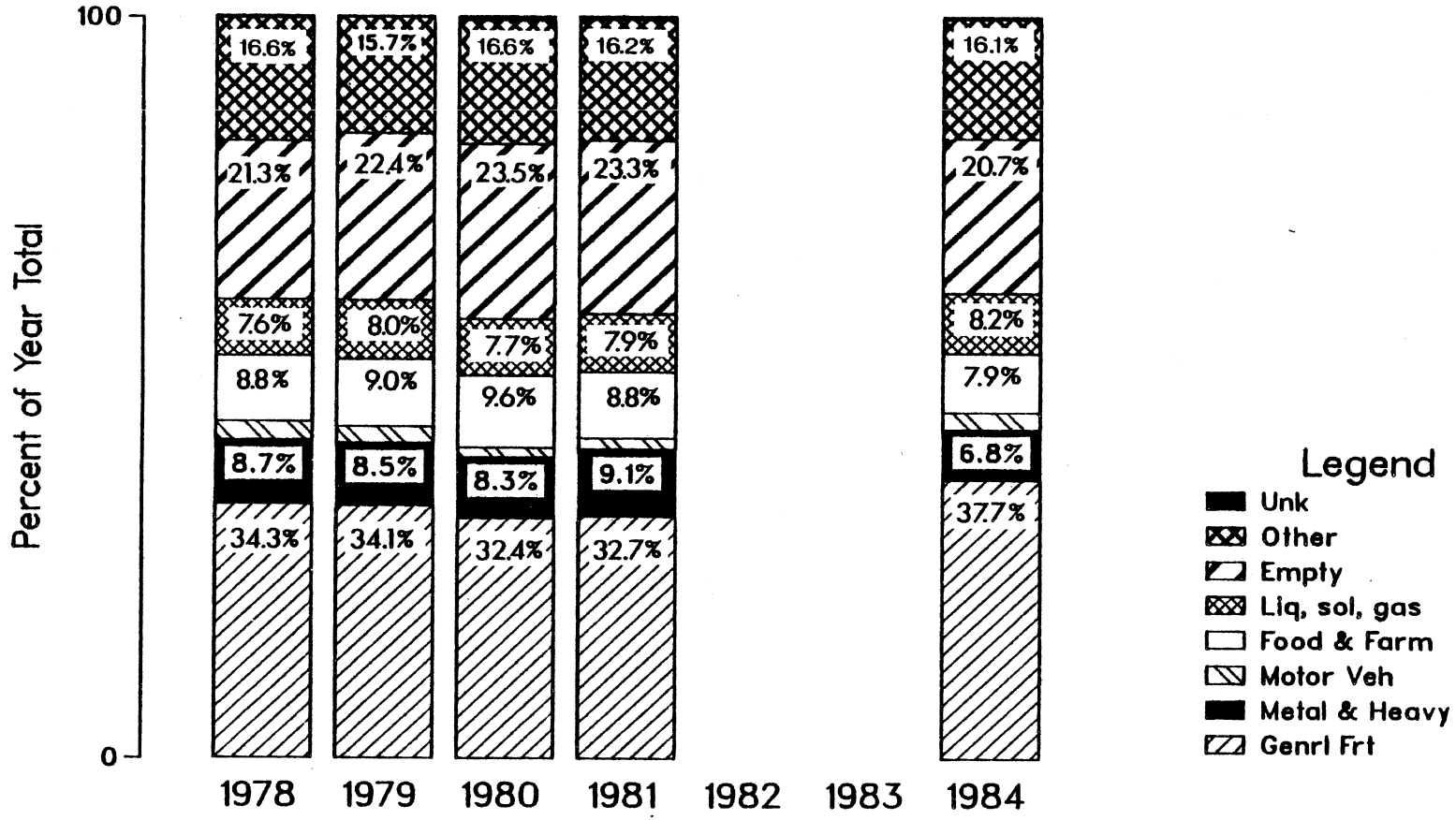

FIGURE 5

BMCS INJURY ACCIDENT INVOLVEMENTS IN MICHIGAN, 1978–84
CARGO TYPE FOR SINGLE–TRAILER COMBINATIONS

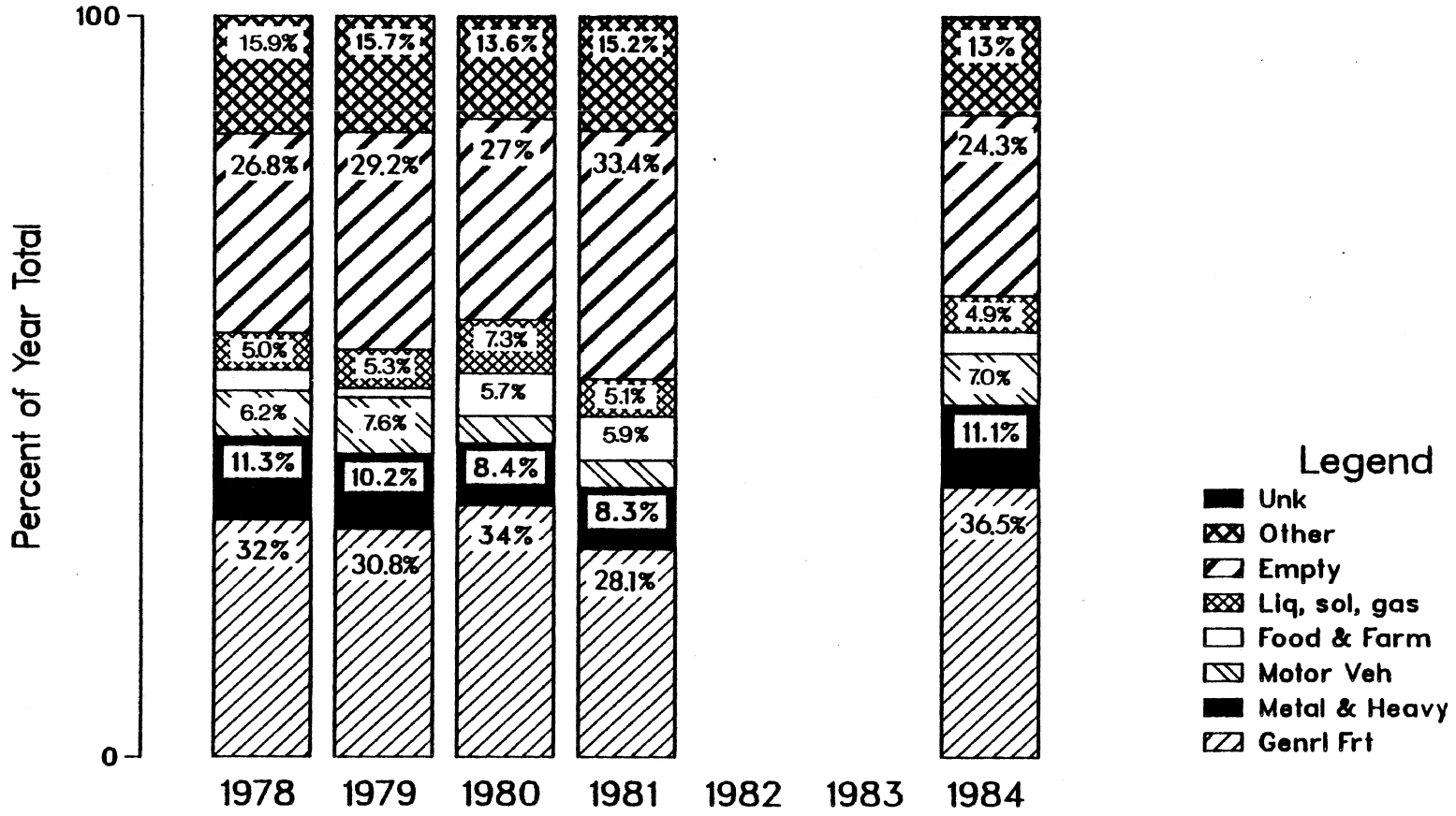

FIGURE 6

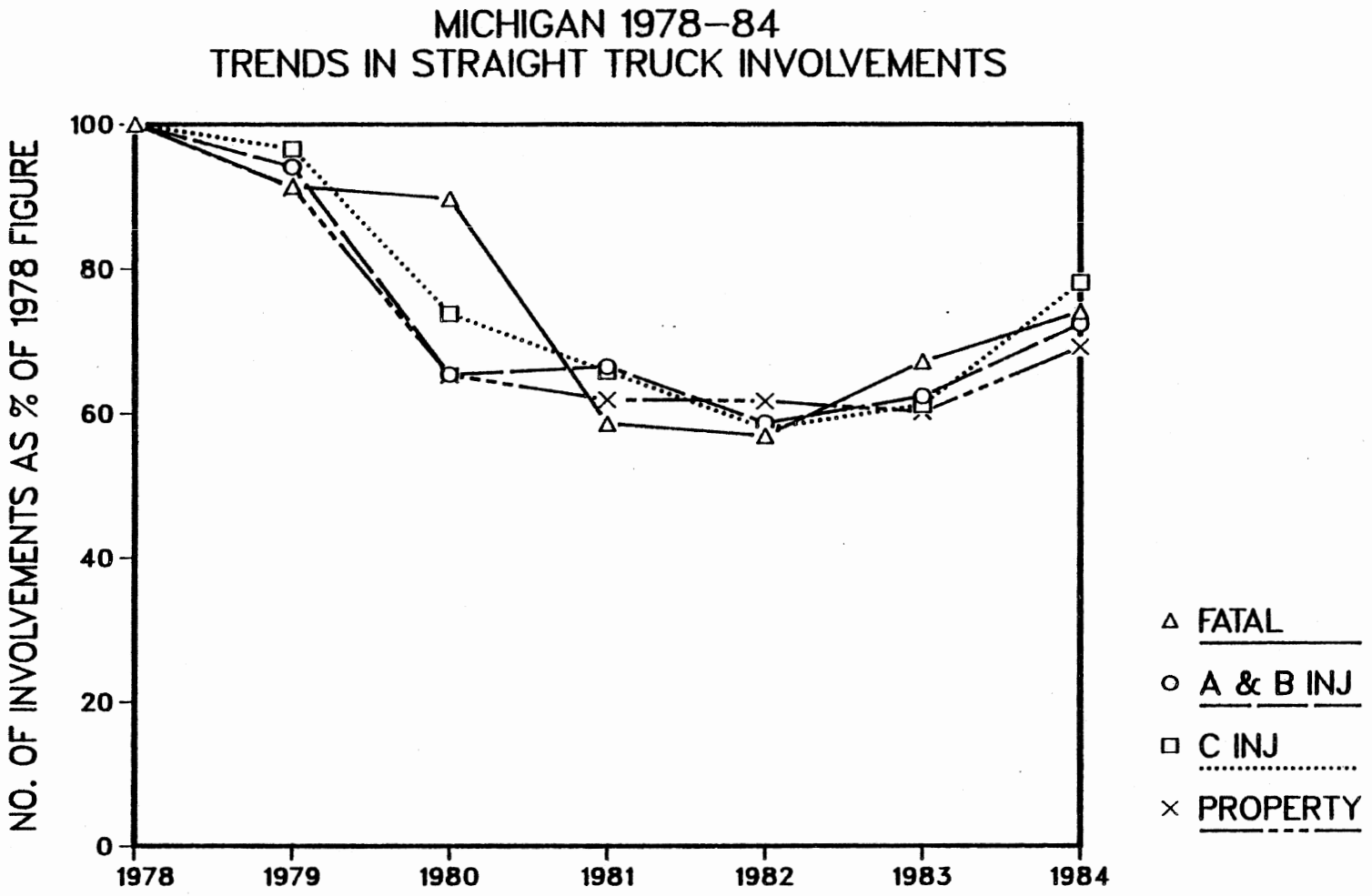
MICHIGAN 1978–84
TRENDS IN STRAIGHT TRUCK INVOLVEMENTS
NO. OF INVOLVEMENTS AS % OF 1978 FIGURE
100
80
60
40
20
0
1978
1979
1980
1981
1982
1983
1984
FATAL
A & B INJ
C INJ
PROPERTY

FIGURE 7

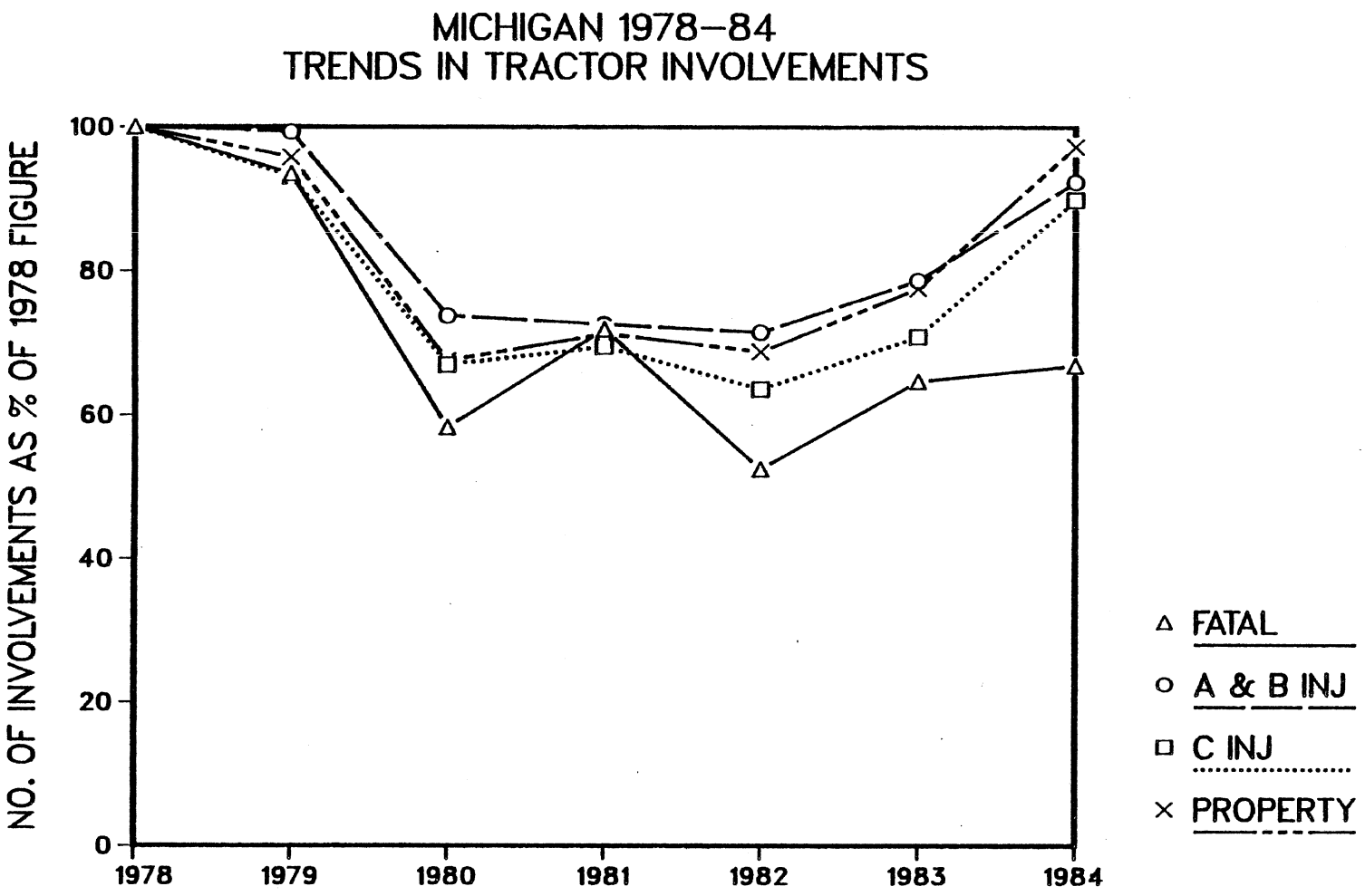
MICHIGAN 1978–84
TRENDS IN TRACTOR INVOLVEMENTS
NO. OF INVOLVEMENTS AS % OF 1978 FIGURE
100
80
60
40
20
0
1978
1979
1980
1981
1982
1983
1984
FATAL
A & B INJ
C INJ
PROPERTY

FIGURE 8

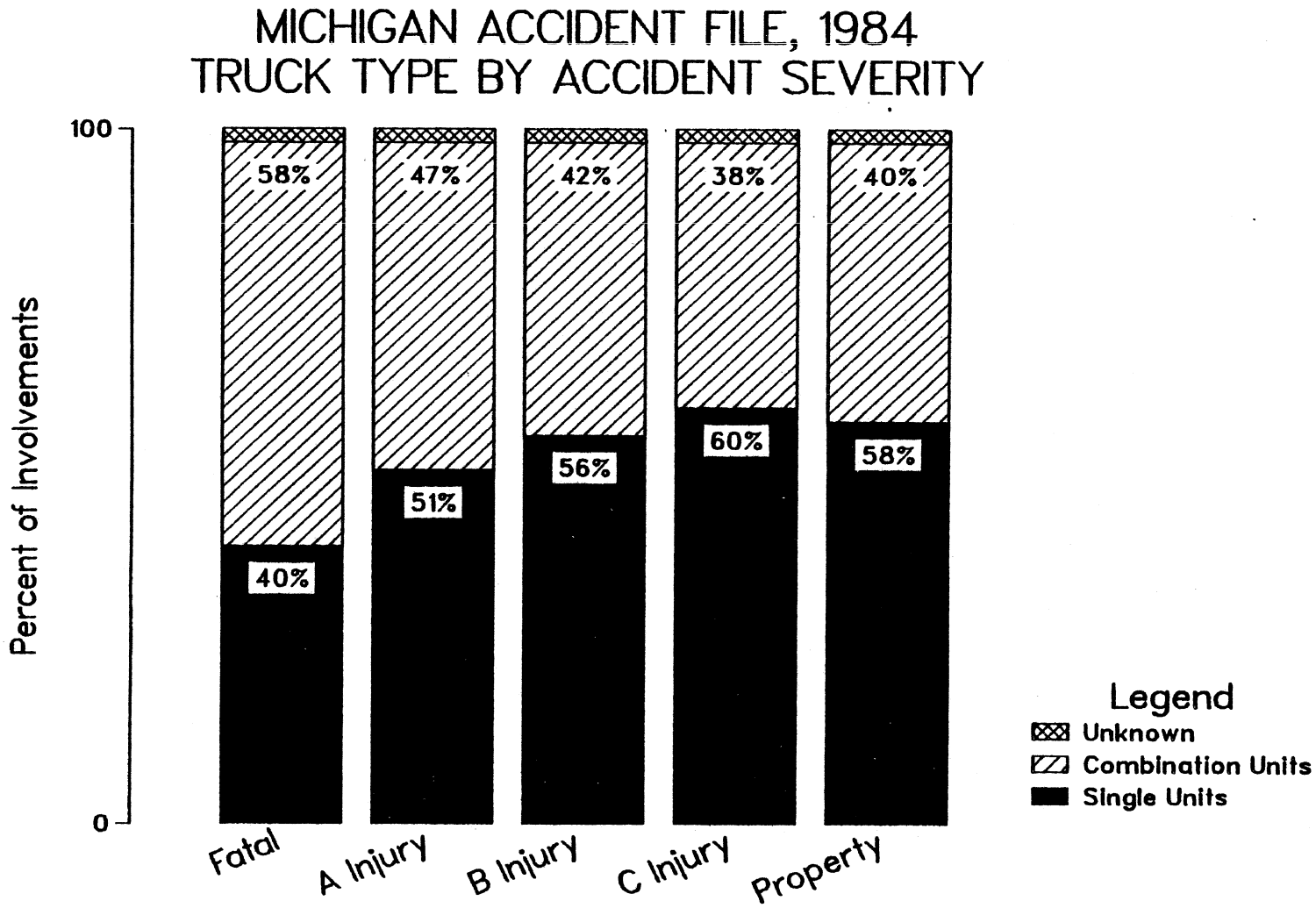
MICHIGAN ACCIDENT FILE, 1984
TRUCK TYPE BY ACCIDENT SEVERITY
Percent of Involvements
100
0
58%
47%
42%
38%
40%
40%
51%
56%
60%
58%
Fatal
A Injury
B Injury
C Injury
Property
Legend
Unknown
Combination Units
Single Units

FIGURE 9

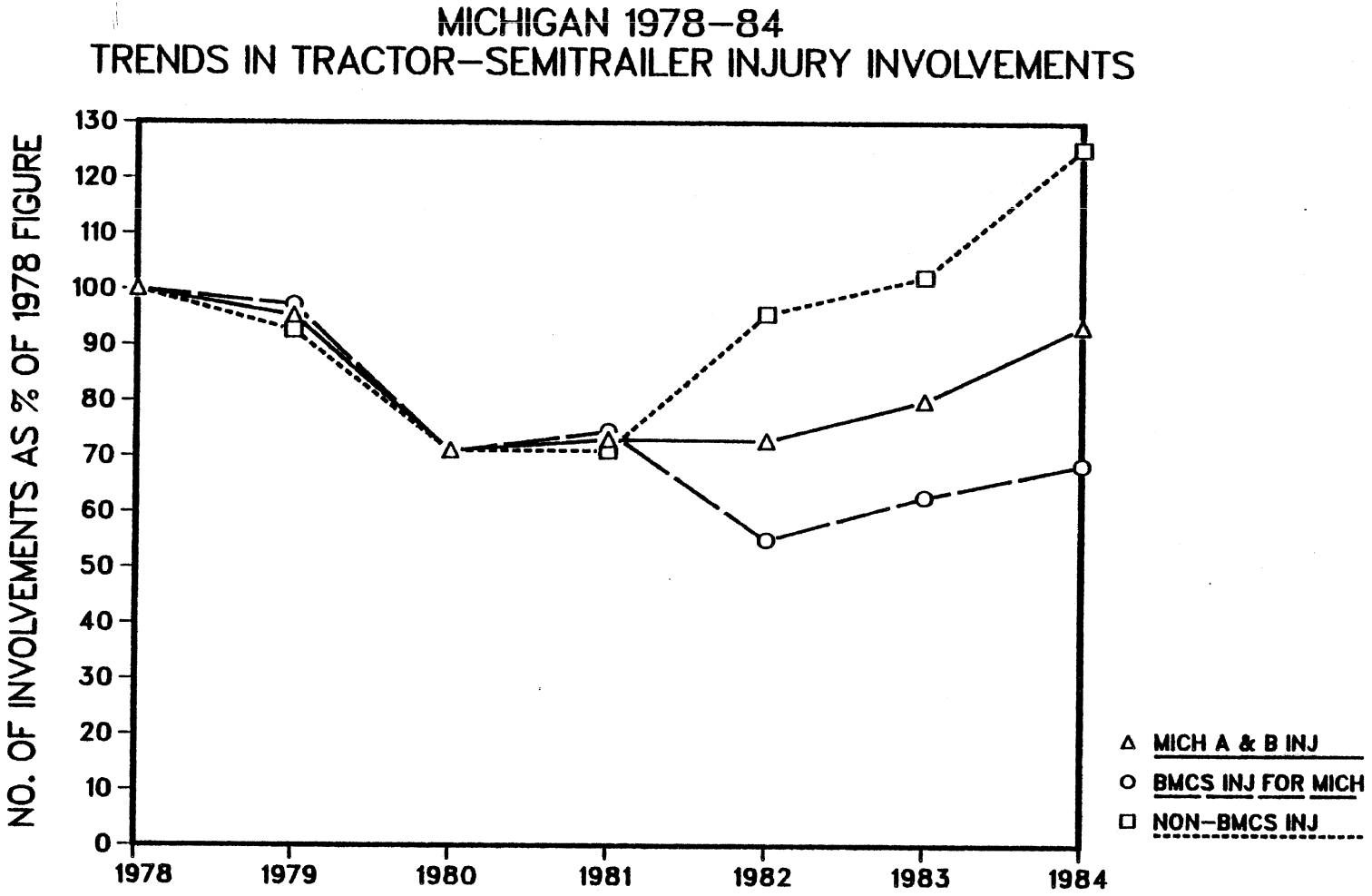
MICHIGAN 1978–84
TRENDS IN TRACTOR–SEMITRAILER INJURY INVOLVEMENTS
NO. OF INVOLVEMENTS AS % OF 1978 FIGURE
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1978
1979
1980
1981
1982
1983
1984
MICH A & B INJ
BMCS INJ FOR MICH
NON–BMCS INJ

FIGURE 10

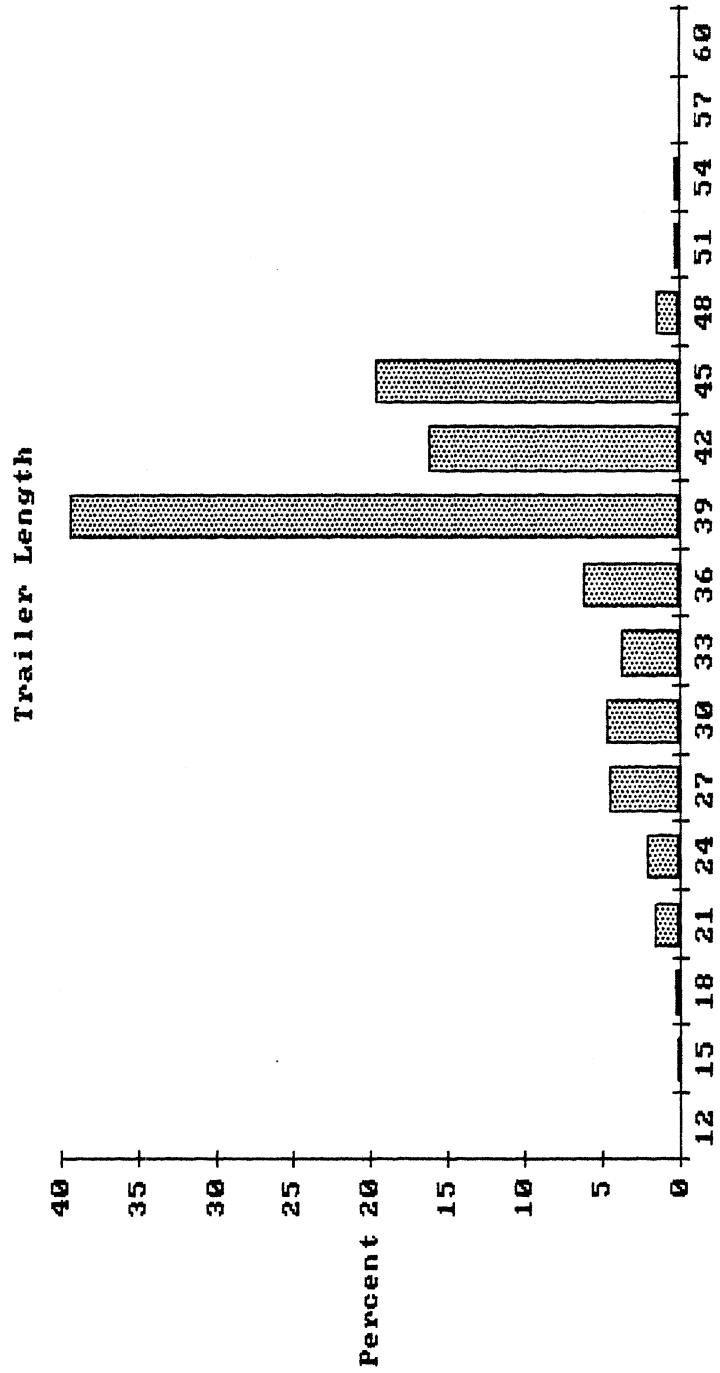
Trailer Length
Percent
40
35
30
25
20
15
10
5
0
12
15
18
21
24
27
30
33
36
39
42
45
48
51
54
57
60
Length

FIGURE 11