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ESTIMATES OF DIRECT STATE COSTS
RESULTING FROM TRAFFIC ACCIDENTS

by

Jairus D. Flora
Donald F. Huelke
Joseph J. Andary
James O'Day

Interim Report

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| 16. Abstract <p style="margin: 0;">This is an interim report for the project entitled "Estimates of Direct Costs to the State Resulting From Traffic Accidents," sponsored by the State of Michigan Office of Highway Safety Planning. The project aims to provide quantitative estimates of the costs of traffic accidents that come directly from state tax revenues.</p> <p style="margin: 0;">This interim report serves two purposes. The first is to detail the methodology and the sources of data. The second is to present preliminary estimates of the costs. With respect to the latter purpose, some estimates have been based on relatively hard data, and some are, at the present time, little better than guesses. The remainder of the project will be devoted to improving these estimates.</p> <p style="margin: 0;">With several large components of cost excluded, the estimated direct cost to the state has been computed to be approximately 8.7 million dollars annually. Since this estimate has been made without consideration of some major components, it is likely that the total annual cost to the state will turn out to be much larger than this.</p> | | | |
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1.0 INTRODUCTION

This is an interim report for the project entitled, "Estimates of Direct Costs to the State Resulting from Traffic Accidents," sponsored by the State of Michigan Office of Highway Safety Planning. The project aims to provide quantitative estimates of the costs of traffic accidents that are paid directly from State tax revenues.

Some previous research¹ has attempted to ascertain the societal costs of traffic accidents. Flora et al.² and Marsh et al.³ have attempted to estimate the costs to accident victims as a function of the injury severity. In this latter study, some attempt was made to determine who actually bore the various components of the cost. However, no previous study has attempted to identify governmental expenditures that result directly from traffic accidents.

It is already known that the Michigan state government incurs traffic accident costs in numerous ways. Portions of the client caseload in a variety of programs are accident victims. Included in these are Worker's Compensation benefits, vocational rehabilitation programs, crippled children's programs, Medicaid, Aid to Dependent Children, and sick leave for State employees whose injuries resulted from traffic accidents. In addition, the State bears some cost of repairs to highway furniture damaged in traffic accidents and may sustain expenses from liability judgments. What is not well known is the cost to the State of these various sources of expense, either individually or collectively. This interim report is intended to

¹ "Societal Costs of Motor Vehicle Accidents for Benefit-Cost Analysis: A Perspective of the Major Issues and Some Recent Findings." B. M. Faigin, Office of Program Planning, NHTSA, In Proceedings of the International Congress on Automotive Safety. July, 1975

² "The Financial Consequences of Auto Accidents," by J. D. Flora, J. Bailey, and J. O'Day, in Hit Lab Reports, Volume 5, number 10, June 1975.

³ "Financial Consequences of Serious Injury," UM-HSRI-77-27, University of Michigan Highway Safety Research Institute, December, 1977.

describe the general approach and methods, the sources of data, and to provide preliminary estimates of State costs where possible. Future work on this project will aim to improve these current estimates and to provide more complete information for components not presently detailed.

Section two presents the estimates currently available for each component, together with an assessment of the accuracy. Probably the largest component of cost to the State is through the state's contribution to Medicaid payments. However, data are not available on this source as yet. Also, no estimate is yet available for costs from the Crippled Children's Fund or from costs of Special Education for children injured or crippled in traffic accidents.

Conservative estimates for the cost components presently considered lead to a total estimated annual cost of \$8,700,000 from traffic accidents. Inclusion of data from the other sources will clearly increase it, and this estimate may be low for those cost components already included.

It is not yet clear which components of this amount might be amenable to reduction as a result of safety programs. Further work is outlined in section five. Part of this effort will aim at partitioning this total into components that can be identified with population subgroups that might be targets of specific safety programs.

2.0 COMPONENTS OF DIRECT STATE COST

Previous investigation has revealed several components of direct cost to the State due to traffic accidents. They are:

- (1) Care in state institutions for persons injured in crashes.
- (2) Medicaid payments to persons injured in accidents.
- (3) ADC payments for families in which the breadwinner was injured or killed in a traffic accident.
- (4) Workers compensation and sick/disability leave payments for state employees hurt in traffic accidents.
- (5) Litigation and judgment costs to the state highway department as a result of damage suits filed from traffic accidents.
- (6) Special education costs and Crippled Children's Fund payments for children injured in traffic accidents.
- (7) Cost to county or state road commissions for repair of damage caused by crashes.
- (8) Automobile insurance for state vehicles.

The eight components of cost mentioned above are summarized in sections 2.1 through 2.8. Information concerning data collection and estimates of the magnitude of these costs are given for each cost component. There are indirect costs to the state associated with traffic accidents such as loss of state income tax. These are discussed briefly in section 4.2.

2.1 Care in State Institutions

In this report, state institutions will refer primarily to mental care facilities. Each year, there are a few severe accidents where injured occupants require care in a state institution. These occupants incur substantial medical costs which are financed mostly by the state.

For example, there was one accident victim in Traverse City Hospital who stayed there for six years and incurred medical costs of \$50/day. This works out to be over \$18,000 per year and over \$109,000 for the six-year stay.

If sixty such accident victims live in state hospitals each year, then the total cost to the state would exceed one million dollars. If the average accident victim in a state hospital lives there for two years, then thirty new crash victims per year would produce an annual state cost of over a million dollars. This seems a bit high. However, it would not be unreasonable to assume that ten crash victims annually need to be sent to state hospitals. The annual direct cost to the state would then be \$365,000. Also, many accident victims who incur brain damage due to a crash and are sent to state hospitals stay there permanently or end up as outpatients for several years after they have been released from the institution. Thus, the two-year estimate for the average stay in a state hospital is conservative. This relationship is summarized in Figure 1 below. The graph relates the admission rate per year, and the average stay in months to the total annual direct state cost.

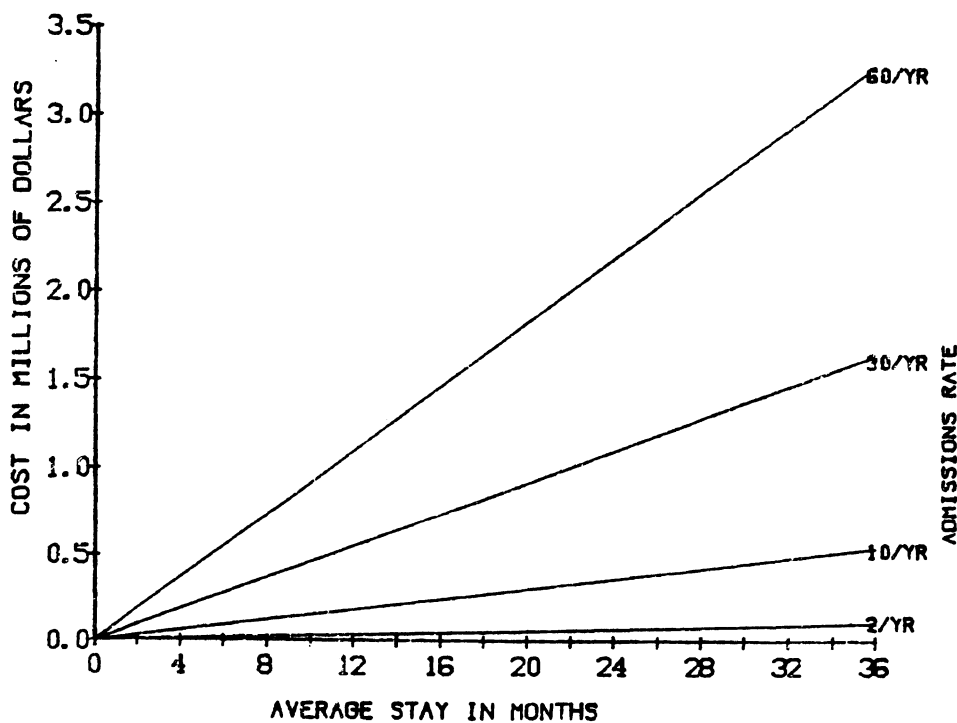


Figure 1

Since individual case histories must be consulted, identifying crash victims in state hospitals will be quite difficult. According to Marlene Boden, a Ypsilanti State Hospital employee, "Many of the case histories will not say whether or not the person was here due to a traffic accident."

The previous discussion indicates the difficulty of obtaining an exact estimate of this component of direct state cost. A rough estimate using state accident injury statistics is possible. However, its precision is open to question.

Estimation of the number of quadriplegics in Michigan traffic accidents. Two similar approaches can be used to estimate the number of quadriplegics resulting from traffic accidents in Michigan in a year. One approach is to take the surviving AIS-5 neck injuries estimated from the NCSS (11) times the ratio of missing data assumed in the NCSS (1.15) ratio times the ratio of the time of NCSS data collection to one year (0.8) times the ratio of occupants in Michigan passenger car towaway accidents to 62,026 (the number of occupants in NCSS). This results in an expected thirty-six quadriplegics per year.

A second approach is to take the estimate of Kraus et al. of 650 cases per year in the United States, and multiply it by $(8,875,083)/(203,235,298)$ the ratio of Michigan population to the U.S. population. This results in an expected 28 quadriplegics per year in Michigan from in-car injuries. Some additional quadriplegics from motorcyclists and pedestrians might be expected. Perhaps an equal number of paraplegics would be expected.

These two estimates are in rough agreement: an average of twenty-eight to thirty-six quadriplegics per year may result from traffic accidents in Michigan. If we choose the mean of these, we would estimate the number of such cases as thirty-two annually. Some, but presumably not all, of these wind up in state institutions and their support becomes a direct cost to the state. If we assume that one-half of these cases eventually enter state institutions and stay an average of two years, there would be about thirty-two such patients at any one time. Using the average cost of 50 dollars per day would result in the approximate estimate of an annual state cost of \$584,000.

Further information concerning this cost component can be found in section 3.0, where case histories concerning accident victims in state hospitals are given.

2.2 State Costs for Medicaid for Treatment of Accident Injuries

A large component of the direct cost to the state due to traffic accidents is Medicaid payments for treatment of crash victims. Medicaid payments are made to accident victims convalescing in three types of hospitals, they are:

- (1) General hospitals
- (2) Nursing homes
- (3) City-county institutions

There are approximately 225 general hospitals in the state of Michigan. About 200 of these are privately owned. The remaining hospitals are owned by the city, county, or state government.

Privately-owned general hospitals receive revenue from three sources: (1) private insurance (i.e., Blue Cross or Blue Shield); (2) Medicare or Medicaid; and (3) patients. Since health insurance is very widespread, the patients, on the average, pay less than 10% of their hospital bill directly.

To estimate direct costs to the state, one needs to examine hospital revenues obtained from Medicaid, which receives 50% of its funds from the state, while the other 50% comes from the federal government. It is necessary to identify the people insured under Medicaid who are in the hospitals as a result traffic accidents, and then to tabulate their medical costs.

Government-owned general hospitals and city-county institutions have an additional source of revenue, namely, the branch of government that owns them (e.g., U of M hospital in Ann Arbor receives revenue from patients, health insurance, Medicare and Medicaid, and the State of Michigan). In some city-county institutions there is a revenue-sharing program, where the local government finances most of the hospital's

costs, and the state finances the rest. Furthermore, when a government-owned hospital has liabilities that exceed its revenues, the state in many cases will lend the hospital an amount sufficient to make up the difference.

To summarize, privately owned hospitals receive a rather small portion of their funding directly from the state. Government-owned hospitals receive a larger amount that varies somewhat from year to year, and depends on which branch of government owns the hospital, as well as the difference between the institution's revenues and costs.

Nursing homes are, in general, privately owned, and are funded by the same sources as hospitals. However, Medicare and Medicaid pay a considerably greater proportion of nursing home billings than for hospitals. Furthermore, Medicaid influences the price charged to their insured patients. Instead of reimbursement based on nursing home costs, the insuring institution and the nursing home administrators convene to decide on an appropriate price. Since meetings between these two institutions take place for each patient, Medicaid knows exactly how much funding they give each nursing home annually. If the patients in the nursing homes due to traffic accidents can be identified, then an exact cost figure can be obtained from Medicaid.

Identifying people insured by Medicaid who are in hospitals due to traffic accidents should be possible. The Medicaid billing forms specifically ask whether or not the person was injured in a traffic accident. Also requested on the form is information about age, sex, provider of care (i.e., nursing home, private hospital, or other), type of treatment, and injury type. If all of the items mentioned above are contained in Medicaid's database, then accident victims and associated costs can be easily determined.

However, it has been recently learned that the variables mentioned above that are needed to identify accident victims are not automated by Medicaid. These variables will be computerized starting in January, 1981. Since HSRI cannot be sent a tape containing cases exclusively involving people who were injured in traffic accidents, an estimate of the magnitude of this cost component must be obtained by other means. Certain variables such as diagnostic ICDA codes are automated by

Medicaid. Using these data, criteria that can identify crash victims must be developed. Hopefully, Medicaid could send HSRI a tape containing cases that conform to these criteria. A ballpark estimate of Medicaid costs could then be obtained.

2.3 Aid to Dependent Children

During the last year, the State of Michigan spent approximately \$770,000,000 on ADC payments to something over 200,000 families. In August 1980 the number of claims rose to 233,700--up from the July 1980 level of 230,881. Costs have climbed proportionately. It is possible that some of these payments resulted because the breadwinner was injured or killed in a traffic accident. In the absence of other data, a gross estimate may be arrived at as follows.

The 200,000 families are assumed to have one licensed driver each. (Possibly there were two prior to going on ADC.) Assume that these drivers had the statewide accident rate per year. This is approximately $787,860/6,250,000 = 0.126$ accidents per driver per year. There were $223,400/787,860 = 0.2874$ towaway accidents per crash. From the NCSS, the proportion of occupants injured at various levels of severity was:

| | |
|------------------|----------|
| Non-Fatal AIS-3+ | 0.033380 |
| Non-Fatal AIS-4+ | 0.008228 |
| Non-Fatal AIS-5 | 0.002050 |
| Fatal Accidents | 0.008640 |

There were 6.5% as many pedestrians injured in Michigan as occupants. Estimates of the number of heads of families on ADC that were injured in automobile accidents at various levels of severity result:

Number Families x (Crash/Family) x (Towaways/Crash) x (Injury/
Towaway) x 1.065

$$= 200,000 \times (0.126) \times (0.2874) \times (0.0334) \times (1.065) = 258 \text{ (AIS-3+)}$$

$$= 200,000 \times (0.126) \times (0.2874) \times (0.0082) \times (1.065) = 63 \text{ (AIS-4+)}$$

$$= 200,000 \times (0.126) \times (0.2874) \times (0.0021) \times (1.065) = 16 \text{ (AIS-5)}$$

$$= 200,000 \times (0.126) \times (0.2874) \times (0.0086) \times (1.076) = 66 \text{ (Fatal)}s$$

Thus these numbers represent estimates of how many breadwinners would be expected to receive a traffic injury per year. Estimated time lost by injury is:

| | |
|-------|-------------------------------------|
| AIS-3 | 3.6 months |
| AIS-4 | 12 months |
| AIS-5 | 63 months (includes some permanent) |
| AIS-6 | Fatal--Permanent |

It would seem reasonable to expect about 66 families per year to go on ADC because the breadwinner was killed in a crash. An additional 16 might go on ADC because the breadwinner received a (non-fatal) AIS-5 injury and an additional 63 might go on ADC because of an AIS-4 injury, giving a total of 145 families added to ADC per year because of accidents.

This would represent about $145/200,000 = 0.000725$ of the families per year which would represent \$555,548. Clearly, the fatalities and the AIS-5 injuries would cumulate.

A family that goes on ADC stays on until its financial situation improves or until it no longer has dependent children. If a family is forced on ADC because the breadwinner is killed in a traffic accident, the family would likely stay on until either the children are well into school, permitting the surviving parent to work, or until the youngest child is no longer dependent. Usually a child would not be considered dependent after reaching age 18, or graduation from high school. However, there are situations when the dependency classification is extended longer. If the child is handicapped, dependency may continue indefinitely, or dependency may continue so long as the child is in school. If we assume that generally dependency ceases when the youngest child reaches eighteen, and if we assume that the accident may occur at any time during this period, then the average time from the accident until the youngest child reaches 18 would be nine years. As a result, if on the average, 66 families are added to the ADC rolls from traffic

accidents each year, there would be an average of $66 \times 9 = 594$ such families on ADC at any given time.

If a family is forced on ADC because of disability of the breadwinner resulting from a non-fatal accident, the family would remain on ADC until either the disability is removed or until the youngest child is no longer dependent. For AIS-5 level injuries, the disability time is estimated to be an average of 6.5 years. Since in some cases the accident would occur when the youngest child is old enough so that fewer than 6.5 years would remain until he/she were no longer dependent, the average time would be somewhat less. If, as before, we assume that the accident happens randomly with a uniform distribution, then the average time on ADC would be about 5.33 years. (About 64% of the cases would occur with an average of 6.5 years, the remaining cases would average 3.25 giving $5.33 = 6.5 \times .64 + 3.25 \times .36$.) With the estimated 16 families per year from AIS-5 injuries, there would be an average of about 85 at any given year.

The average time lost for injuries at the AIS-4 level is about one year, so such injuries would not cumulate from year to year. Consequently, the total number of families on ADC because of traffic accidents might be about $594 + 85 + 63 = 742$ families out of the total of about 200,000. Thus, approximately four tenths of one percent of the families on ADC might be expected to be there because of an injury resulting from a traffic accident. Assuming that these families receive the average payment, the estimated annual cost would be $\$766,272,518 \times 0.004 = \$3,065,090$. That is, in rough terms, over three million dollars per year might be spent on ADC payments because breadwinners were injured in traffic accidents.

This figure was arrived at assuming that the risk of injury in a traffic accident applied to only one person per household. That is, it was assumed that there was only one breadwinner. If in fact, both parents were breadwinners and if the injury to either would result in the family being forced on ADC, the above estimates would be doubled. While there are many families with two breadwinners, it does not seem likely that all of these would be in the situation that an injury to either would force the family on ADC. The number may be somewhat larger

than estimated here, but would probably be closer to the current estimate than to the doubled amount.

2.4 Costs Pertaining to State Employees

2.4.1 State Employees Sick Leave. A preliminary estimate of the sick leave cost to the State of Michigan caused by traffic accidents was arrived at as follows. From the National Crash Severity Study (NCSS) data we obtained the mean number of work days lost for occupants in passenger cars involved in towaway crashes. This was 1.15 work days. Using the Michigan State Police accident data from 1978, the number of occupants in passenger cars involved in towaway accidents in Michigan was found to be 223,400. There were approximately 6,250,000 licensed drivers in Michigan and 68,000 state employees. Assume that state employees are all licensed drivers and that they have the same rate of involvement in towaway crashes as all drivers in Michigan. The estimate of 1.15 excludes persons with permanent disability, since they would not continue to draw sick leave. The work days lost for permanently disabled persons is about the same as for all other injured persons, although very few persons are permanently disabled. Inclusion of the permanently disabled would raise the mean to about 3.3 work days lost per occupant.

Let WD = Average work days lost/towaway crash (from NCSS).

NM = Number of occupants in passenger cars in towaway crashes.

SE = Number of state employees.

LD = Number of licensed drivers. From the data we have, estimates of these numbers are:

WD = 1.15,
 NM = 223,400,
 SE = 68,000, and
 LD = 6,250,000.

Then the total number of work days lost by state employees involved in towaway crashes can be estimated as

$SEWDL = (WD \times NM \times SE) / LD = 2795$ work days per year. Also from the NCSS, the average number of work days lost in non-towaway crashes of

passenger cars was found to be $UD(NTW) = 0.33$ days per occupant. The number of occupants in cars involved in non-towaway crashes in Michigan in 1978 was $NM(NTW) = 564,460$. Combining these leads to an estimate of work days lost by state employees because of passenger car accidents that were not severe enough to require towing as

$$SEWDL(NTW) = WD(NTW) \times NM(NTW) \times SE/LD = 2027.$$

In Michigan there were 6.1% as many persons injured in motorcycle crashes as occupants in passenger cars. In addition, there were 6.5% as many pedestrians injured as occupants of passenger cars. If one assumes that pedestrians and motorcyclists had the same number of work days lost from each accident (which is probably an underestimate, since injuries to pedestrians and motorcyclists tend to be more severe than injuries to occupants) then the total number of work days lost by state employees from automobile accidents can be estimated as:

| | |
|-------------------------------|--------|
| WDL (Towaways) | = 2795 |
| WDL (Non-Towaways) | = 2027 |
| WDL (Motorcyclists) | = 204 |
| WDL (Pedestrians) | = 313 |
| Total work days lost per year | = 5429 |

If the average salary for a State employee is \$D per day, then the total cost for sick leave caused by traffic accidents can be estimated as $SLC = \$D \times SEWDL$. For example, if $D = \$75$, then the total cost would be estimated to be \$407,175 per year. A much larger proportion of motorcyclists and pedestrians are injured than are occupants of passenger cars. This comes about because a pedestrian accident is not an accident unless there is an injury. For example, 80% of occupants of passenger cars were listed as having no injury in the Michigan accident data from 1978, while 85% of motorcyclists and 96% of pedestrians were injured. Further, these injuries may be generally more severe than those sustained by occupants. Thus, the average number of work days lost may be larger for these categories.

State employees may take sick leave because of sickness or injury to a member of their immediate family. As a consequence, if a family

member is injured in an automobile accident, this is likely to result in some loss of work days for the state employee. Presumably this loss would not be as large as if the state employee were the injured person. It seems difficult to estimate how large this loss would be, but perhaps the number of work days lost might be on the order of one-fourth to one-half as many as if the state employee were injured.

Suppose on the average each state employee has f immediate family members. Further, suppose that if a family member is injured this will result in a fraction p work days lost from work. Here p is a fraction less than one and represents the fraction of work days lost by a family member when another family member is injured. Then the estimate of the SEWDL could be modified by multiplying it by $(1 + pf)$. That is, the increased time lost is estimated to be pf . The estimate of the total cost would be modified similarly by multiplying the SLC by $(1 + pf)$. Currently neither p nor f is known even approximately. However, for illustration, suppose that $p = 1/3$ and $f = 2$. That is, suppose that on the average, each state employee has 2 immediate family members, and if one of them is injured in an automobile crash, the time lost to the state employee is one-third of the days lost by the family member (the work days that the family member would have lost if working). With these assumptions, the estimated cost of lost time because of automobile accidents involving state employees or immediate family becomes \$678,625 per year.

Since half of unused sick leave is currently paid to the employee upon retirement, one might discount these costs by one-half. That is, one-half of these costs would accrue to the state eventually anyway, although at a later date. A discounted value could be used, but the amount of the discount depends on the length of time in the future, which would depend on the time to retirement of the employees injured. It seems better to ignore the possible future payments of unused sick leave.

An alternative method of estimating cost of state sick leave resulting from automobile crashes goes as follows. Determine the total amount of sick leave paid to state employees in a year. The reasons for taking sick leave are not recorded, so the amount attributable to

traffic accident injuries must be estimated. It is possible that some such estimate could be constructed from National Safety Council estimates. For example, if auto accidents are estimated to account for Y percent of all medical costs, it is reasonable to assume that they might be responsible for the same percentage of sick leave time. Then the estimate of cost to the state would be Y times the total sick leave cost. Estimates of Y have not been found published as yet and would need to be developed.

2.4.2 Workers Compensation. The only cost to the state for workers compensation is the premium for that insurance. Part of this premium is associated with the risk of injury associated with traffic accidents resulting from job-related travel. In a study of claims settled in New York State in 1973 for Workers Compensation (Accident Facts 1977, p. 31) nine percent of claims were caused by automobile accidents. These claims amounted to twelve percent of the total dollar cost of the claims. It seems likely that automobile accidents might be a higher proportion of the claims for state employees than for all industry in general. Perhaps from ten to fifteen percent of the premium costs for workers compensation could be attributed to traffic accidents. However, it is questionable how much if any this would be reduced by a reduction in traffic injuries, since premium adjustments follow claim experience with some time lag.

2.5 Litigation and Judgment Costs to the State Highway Department

The State's total court costs consists of four components. They are:

- (1) Costs of funding the Highway Negligence Division of the Department of Transportation
- (2) Investigation costs
- (3) Costs of hiring contract attorneys for specific court cases
- (4) Actual dollars paid out in damages

The Highway Negligence Division consists of a group of lawyers (four or five) involved exclusively in traffic-related court cases. The

direct cost of this office to the State (including salaries, overhead, and expenses) is estimated at \$300,000 annually.

In many cases, investigators are sent to the scene of an accident. For example, if a vehicle hits a guardrail during a snowstorm and the driver claims the road was not salted, then the Investigations Section of the State Highway Department would send personnel to the scene of the accident to investigate the driver's claim. The Investigations Section is funded at approximately 150,000 dollars annually.

Contract attorney costs depend on the complexity of the court cases and have risen in recent years. Contract Attorney costs are summarized in Table 2-1 below:

TABLE 2-1
Contract Attorney Costs

| Fiscal Year | Contract Attorney Costs |
|-------------|-------------------------|
| 1975 | 80,000 - estimated |
| 1976 | 81,500 |
| 1977 | 80,000 - estimated |
| 1978 | 83,800 |
| 1979 | 156,800 |
| 1980 | 160,000 - estimated |

The 1975 and 1977 estimates were obtained from Ronald Hoffmeister, a spokesman for the State Highway Department.

An estimate for 1980 was obtained by utilizing data for the first 9 months of fiscal 1980. For the nine month period ending June 30, 1980, the state spent 120,000 dollars for contract attorneys. Assuming the court cases against the state will not drastically change in magnitude and complexity, the highway department will spend 40,000 dollars for contract attorneys during the last three months of fiscal 1980 and the total amount spent in fiscal 1980 will thus be 160,000 dollars as shown in Table 2-1.

The total litigation costs to the State Highway Department (i.e., the costs of the state and contract attorneys added to the investigations costs) is summarized in Table 2-2

Table 2-2 shows that litigation costs to the State Highway Department range from 500,000 to 600,000 dollars annually and are not highly variable.

TABLE 2-2
Litigation Costs

| Fiscal Year | Total Litigation Costs |
|-------------|------------------------|
| 1975 | 530,000 - estimated |
| 1976 | 531,500 |
| 1977 | 530,000 - estimated |
| 1978 | 533,800 |
| 1979 | 606,800 |
| 1980 | 610,000 - estimated |

Judgment costs are a major component of direct state cost. They occur when the state is sued and loses. Judgment costs are highly variable and seem to depend more on the number of cases and the amount awarded than on inflation. They are summarized in Table 2-3 below.

TABLE 2-3
Judgment Costs

| Fiscal Year | Judgment Costs |
|-------------|-----------------------|
| 1975 | 1,190,000 |
| 1976 | 235,000 |
| 1977 | 784,000 |
| 1978 | 1,885,543 |
| 1979 | 3,013,532 |
| 1980 | 2,000,000 - estimated |

The 1980 estimate in Table 2-3 was obtained by utilizing data for the first six months of fiscal 1980. The judgment costs for the six

month period ending March 31, 1980, were approximately one million dollars. Assuming judgment costs will not drastically change in the last six months of fiscal 1980, the state will spend approximately one million during this period. The total amount spent in fiscal 1980 will be two million.

The total court costs to the state (i.e., litigation plus judgment costs) are summarized in Table 2-4 below.

TABLE 2-4
Total Court Costs

| Fiscal Year | Total Court Costs |
|------------------|------------------------|
| 1975 | 1,720,000 - estimated |
| 1976 | 766,500 |
| 1977 | 1,314,000 - estimated |
| 1978 | 2,419,343 |
| 1979 | 3,620,332 |
| 1980 | 2,610,000 - estimated |
| TOTAL | 12,450,175 - estimated |
| MEAN | 2,075,529 - estimated |
| MEAN (1978-1980) | 2,883,225 - estimated |

Table 2-4 indicates that court cases have cost the state 12.5 million dollars since October 1974. The average cost to the State Highway Department was 2.1 million dollars annually. Court costs have increased significantly since 1977. The average annual cost to the state was 2.9 million dollars during the last three years.

According to Don Mercer, a spokesman for the State Highway Department, "Litigation costs may go up in the future because the number of claims filed against the highway department has increased." Mercer's information implies that the 2.9 million dollar figure is a better estimate of current and future court costs.

2.6 Costs Due to Special Education and the Crippled Children's Fund

The Crippled Children Fund which is governed by the Michigan Department of Public Health, provides 20 million dollars in payments to families of crippled children each year. The Crippled Children's Fund receives revenue from two sources. They are:

- (1) The State's general fund which, supplies 13.5 million dollars.
- (2) Miscellaneous contributions totalling 6.5 million dollars per year.

The Department of Public Health does not keep records identifying which children are receiving benefits due to traffic accidents. Consultation of individual case records may be helpful, but will not identify all the crippled children who are crash victims.

The previous discussion suggests that it will be necessary to derive an estimate of the proportion of crippled children fund beneficiaries receiving payments due to traffic accidents. This can be accomplished by taking a sample of recipients, and using the proportion of beneficiaries in the subset receiving awards due to traffic accidents, to estimate the fraction of all crippled children who were hurt in crashes.

The state's total special education costs consists of two components, they are:

- (1) Transportation costs--some children receiving special education require specific means of transportation, e.g., vans which are equipped to transport children in wheelchairs.
- (2) Classroom costs for teachers, supplies, and books.

According to Phil O'Leary, a spokesman for the Michigan Department of Education, "The state spends \$1600 per student per year for approximately 26,000 students requiring special transportation to schools." The total amount the state spends each year for transportation of children requiring special education is thus 41.6 million dollars.

The total classroom costs for the 12-month period ending September 30, 1979, was 44.8 million dollars and consisted of the following components.

- (1) Costs for children with learning disabilities totalling 36.8 million dollars.
- (2) Expenses for physically impaired children totalling 8 million dollars.

The State's total special education costs for fiscal 1979 was 86.4 million dollars.

The Michigan Department of Education does not keep records identifying which children are receiving special education due to traffic accidents. Since this information is also not available at the county level, it will be necessary to contact individual school districts within counties. This will be extremely difficult, since individual case records will have to be consulted. For example in Oakland County there are 18,000 students receiving special education in 28 local school districts. The student population and the number of districts in Wayne County will be much larger.

It should be possible to obtain an estimate of the cost to the state due to traffic accidents by initially sampling counties, then districts within counties. The total cost could then be obtained by appropriate weighting.

The multi-stage sampling process described above is a very tedious and complicated procedure that may not merit the time and effort needed. This can be explained as follows:

Let Y = the number of people per year who require special education as a result of an injury in a traffic accident.

Since the number of people annually requiring special education is large, and the fraction of these people who are accident victims is small, then Y has a Poisson distribution with mean and variance equal to \bar{Y} , the average number of people per year requiring special education as a result of a traffic accident.

The reduction in \bar{Y} resulting from traffic legislation will be a function of the original magnitude of this number. If \bar{Y} is small, for example 10, then Y has a standard deviation equal to 3.16 and there should be several years when Y is seven or lower. Suppose that a particular safety law will reduce Y , on the average, 10% per year. In this case, little or no reduction in \bar{Y} would be expected. If \bar{Y} is large, for example 100, then Y has a standard deviation equal to 10, and most of the time Y would be between 90 and 110. A significant reduction in \bar{Y} would be expected.

2.7 Cost to State and County Road Commissions

The State Highway Department and all of the county road commissions in Michigan receive revenue from three sources. They are:

- (1) The State gasoline tax
- (2) The sales tax on gasoline
- (3) The weight tax on license plates purchased by Michigan drivers

The gasoline tax is 11 cents per gallon and goes directly to the Secretary of State's office. The sales tax is 4% of the cost of the gasoline purchased, and is sent to the state's general fund where it is held for usage by state and county road commissions. The license plate tax is directly proportional to the weight of the vehicle, and is held specifically for highway purposes. The revenues from these three sources are combined and distributed to the state and county road commissions according to some formula, which is determined by the secretary of state's office. In recent years, approximately 40% of the revenue generated by the three taxes goes to the State Highway Department, while the remaining 60% is distributed to the city and county road commissions.

The previous discussion implies that the State of Michigan has total financial responsibility for the repair of highway damage caused by traffic accidents. To obtain an estimate of the direct cost to the State of Michigan due to traffic accidents, estimates of the expenditures of the State Highway Department and all county and

municipal road commissions (about 83 of these exist) are required. Summing these figures will yield an estimate of the direct cost to the state. Since it is unlikely that cost data can be obtained from all Michigan counties, a sample of road commissions may need to be undertaken.

Figures from the State Highway Department indicate that the costs to Michigan for accident-related street repairs are substantial. For the 12 month period ending June 30, 1979, the State billed drivers \$937,413 for damage to the state trunkline system (i.e., roads such as US-23, I-75, and M-59). Since a substantial portion of this money is recovered from private insurance companies, this figure cannot be interpreted as the direct cost to the State Highway Department due to traffic accidents.

Since in some cases the driver is not considered to be at fault in the crash, the money collected from the insurance companies is somewhat less than the amount billed. Also, according to Carl Otto, a state highway department employee, "Approximately 40% of the cases are written off because the highway department cannot find the drivers within a reasonable period of time." This difference between the money collected and the amount billed is the direct cost to Michigan.

For the 12-month period ending June 30, 1979, the state highway department collected \$637,948 from insurance companies. Therefore, the unreimbursed accident repair cost to the state highway department for that year was \$299,465 (i.e., \$937,413-\$637,948). It should be noted that this figure excludes expenditures for unreported crashes on the state trunkline system, e.g., if someone hits a guardrail on I-94 and drives away from the scene, then the state cannot charge the damage to any driver. The highway department does not keep a record of such occurrences. The above figure underestimates the direct costs to the highway department.

There are other factors concerning the precision of this estimate that should be noted. Major accidents have a substantial effect on both the amount charged and the money collected, e.g., in fiscal 1968, an accident occurred which resulted in structural damage severe enough to necessitate building a new bridge which cost the state \$500,000. The

variance of the amount charged and the money collected will be quite large.

However, it is the variance of the difference between these two figures that concerns us. Since most of the money collected is for accidents which occurred in the same year, the amount charged and the money recovered from insurance companies will be positively correlated. This relationship implies that the variance of the direct cost to the State Highway Department should be somewhat lower than the variability in the money collected and the amount billed. The direct cost to the State Highway Department should not vary greatly from year to year. However, it would certainly be incorrect to assume that the variance is negligible.

With this in mind, figures pertaining to the six calendar years from 1974 through 1979 were obtained. These figures increase the precision of the cost estimate, and are summarized in Table 2-5 below.

TABLE 2-5
Costs to the State Highway Department
for Repair of Damage Caused by Crashes

| Year | Amount Billed | Amount Collected | Cost to Highway Department |
|-------|---------------|------------------|----------------------------|
| 1974 | 566,284 | 538,901 | 27,923 |
| 1975 | 1,199,075 | 774,459 | 424,616 |
| 1976 | 980,388 | 698,257 | 282,131 |
| 1977 | 874,206 | 736,903 | 137,303 |
| 1978 | 821,466 | 633,891 | 187,575 |
| 1979 | 1,035,166 | 820,150 | 215,006 |
| TOTAL | 5,477,125 | 4,202,571 | 1,274,554 |
| MEAN | 912,854 | 700,428 | 212,426 |

The figures above have been rounded to the nearest dollar. The total row is the sum of the six calendar years, while the mean row is the average of the six yearly figures.

The average cost to the State Highway Department for the six-year period ending December 31, 1979, was \$212,426. If we exclude 1974, the year of the oil embargo and subsequent energy crisis from the analysis, the average cost was \$249,326. Due to the energy crisis, people drove less in 1974. The resulting low cost figure may be due in part to fewer miles being driven by Michigan drivers. Since these figures exclude costs to the 83 county road commissions, the total direct cost to the State for repair of damage caused by crashes will be substantially higher.

2.8 Automobile Insurance Costs for State Vehicles

The State of Michigan purchases automobile insurance for its fleet of cars, trucks, buses, and miscellaneous vehicles. This includes vehicles at all state universities that participate. Currently, three universities namely, Michigan State University, University of Michigan, and Oakland University purchase their own insurance. Their insurance costs are summarized below:

Oakland University purchases both liability and collision insurance. They have a \$500 deductible. Their approximate premium is currently \$14,000 per year. Information on losses under the deductible was not readily available.

The University of Michigan purchases liability insurance (currently from INA) and acts as its own insurer for physical damage. The costs for the past two years are summarized in Table 2-6 below:

TABLE 2-6
University of Michigan Insurance Costs

| Year | Liability Premium | Physical Damage | Total |
|-----------|-------------------|-----------------|-----------|
| 1978-1979 | \$58,984 | \$63,917 | \$122,901 |
| 1979-1980 | \$85,652 | \$78,056 | \$163,708 |

This is for approximately 500-600 vehicles, including cars, trucks, and buses (\$145 per vehicle).

Michigan State University purchases liability and acts as its own insurer for physical damage. Their liability premiums are summarized in Table 2-7.

TABLE 2-7
Michigan State University
Insurance Costs

| Year | Liability Premium |
|-----------|-------------------|
| 1978-1979 | \$61,005 |
| 1979-1980 | \$90,200 |
| 1980-1981 | \$112,000 |

This is for comprehensive liability with \$26,000,000 limit total. It covers 19 buses, 135 trucks, and about 600 cars, plus some trailers, 145 per vehicle.

MSU did not have a reliable estimate for the physical damage repair costs. The motor pool quotes about \$20,000, but it is not clear whether this was cost recharged to departments or cost incurred by the motor pool, i.e., not rechargeable to a specific source. Department-owned cars may be fixed off campus. No information on that source could be found. If a motor pool car is damaged, the first \$500 is charged to the department using the car at the time of the crash (which may or may not involve State funds directly).

Table 2-8 gives the premium cost, the approximate number of vehicles, the proportion of cars, trucks, or other, and the premium per vehicle for the State of Michigan's fleet of vehicles during the last five years. These figures pertain to all State agencies except the three universities mentioned above.

Total cost of insurance premiums was available for the earlier years back to the 1970-71 year. These were:

TABLE 2-8
State of Michigan Auto Insurance Premiums

| Year | #Vehicles | Premium | %Cars | %Trucks | Prem/Car | Prem/Truck | Prem/Other |
|--------|-----------|-----------|-------|---------|----------|------------|------------|
| 75-76 | 13,345 | \$540,272 | 65 | 23 | \$42.41 | \$42.41 | \$25.44 |
| 76-77 | 13,302 | \$943,382 | 64 | 23 | \$68.58 | \$68.58 | \$41.44 |
| 77-78 | 13,885 | \$818,627 | 64 | 23 | \$54.99 | \$54.99 | \$32.99 |
| 78-79 | 14,432 | \$973,412 | 65 | 23 | \$74.44 | \$70.24 | \$20.69 |
| *79-80 | 14,852 | \$996,284 | 65 | 23 | \$85.73 | \$49.87 | \$13.84 |

*Estimated

| <u>Year</u> | <u>Premium</u> |
|--|----------------|
| 70-71 | \$323,772 |
| 71-72 | \$955,814 |
| 72-73 | \$340,104 |
| 73-74 | \$402,008 |
| (If limited collision coverage was excluded, \$330,918.) | |
| 74-75 | \$ 99,266 |
| (Partial Year: to January 1, 1975--1/4 year.) | |

The insurance is carried with Wolverine Insurance. In addition to the cost of the coverage, property damage is self-insured. Damaged cars may be fixed at the state garage if convenient, or, if damage occurs too far for this to be practical, at private garages. In the last year, 628 cars were repaired, 32 were totally demolished in a crash, and 153 were damaged and sold at a loss rather than repaired.

The motor pool division reported a loss of \$144,028, of which \$44,183 was paid by the division that owned or was using the car at the time of the crash and \$99,845 was collected from other insurance carriers, leaving a net cost to the state of \$44,183.

Thus, the cost to the state for automobile insurance is currently about \$1,040,467 i.e., \$996,284 + \$44,183 for the 1979-1980 fiscal year. If we add in the cost of automobile insurance at state universities that were given above, the total cost of insurance and damage to state vehicles is \$1,308,375.

3.0 CASE HISTORIES ILLUSTRATING EXAMPLES OF COSTS TO THE STATE

3.1 Case 1

On August 1, 1980 Traverse City Hospital in Traverse City, Michigan was visited to review a case of an individual that had been hospitalized there for some time.

This 18-19 year old male had car trouble and a friend of his went to his place of employment and without permission used a pickup truck to drive the other individual home. The crash occurred at 2:30 a.m. when the truck hit a utility pole. The crash occurred on December 18, 1965.

The passenger was pinned in the vehicle for some time. He was taken to a local hospital where he was treated. The interesting sidelight to this is that they thought that he was the other individual and surgery was performed even though he was a Christian Scientist. The surgery was done and without parental permission, which probably would not have been given.

He was taken to a local hospital where he stayed for some ten months. He had, among other things, a severe head injury with fractures of the lower extremities as well.

Following this local hospital stay he was taken to the Detroit Rehabilitation Center in Detroit for approximately a four month period.

From February, 1967 to January, 1968 he was back at home where he received physical therapy.

He then was taken to the Traverse State Hospital and was hospitalized from approximately January, 1968 till July, 1980.

He not only had a personality behavioral problem but could not maintain his balance, and thus was either bedridden or in a wheel chair. He fell out of the wheel chair, sustaining a head injury (a subdural hematoma) and died on July 11, 1980.

From the available records at the hospital and from talking with the father, we were able to obtain the patient's medical costs. These are summarized below.

| | |
|----------------------------------|---|
| 1. Initial Rehabilitation | \$ 11,564 (Major Medical) |
| 2. Detroit Rehabilitation Center | 4,500 (Major Medical) |
| 3. Traverse State Hospital | 183,212 (90% State Money) |
| 4. Pre-Death Hospitalization | -- (Amount Unknown) |
| 5. Social Security Payments | 7,650 (Paid while in Traverse State Hospital) |
| 6. Burial Costs | 2,000 (Actual Cost Unknown) |

The Social Security payments while in the Traverse State Hospital are as follows.

| | |
|---------------------|-------------------------------|
| 1968-1976 (9 years) | \$600/year x 9= \$5,400.00 |
| 1977 | \$56/month x 12= 672.00 |
| 1978 | \$61/month x 12= 732.00 |
| 1979 | \$43/month x 12= 516.00 |
| 1980 | \$55/month x 6= <u>330.00</u> |
| TOTAL | \$7,650.00 |

2.2 Case 2

This accident occurred on January 28, 1972 when an automobile driven by a 55-year old male, on a snow covered road, at night, in a snow storm, was struck in the right side of the car by a train, at an unguarded railroad crossing. The driver sustained significant closed head injury. The 9-year old front seat passenger was killed.

The driver remained in critical condition for a number of months following which he was institutionalized in various hospitals and long term care facilities. Eight and a half years later he is still institutionalized, cannot speak, cannot care for himself, does have some motor ability, but cannot dress or take care of himself.

EXPENSES:

| | |
|---|--|
| St. Joseph Hospital | \$16,171.00 |
| Huron View Lodge | 2,383.00 (Blue Cross) |
| V. A. Hospital | 3,083.00 |
| Van Buren Convalescent Center (January 1973-January 1974) | 8,200.00 (Private Pay) |
| Wayne County General Hospital (January 1974-February 1974) | 2,218.00 (Blue Cross) 945.00 (Wayne County) |
| Whitmore Lake Convalescent Center | 15,988.11 |
| Huron View Lodge (August 1976-September 1980) | 63,239.00 (Private Pay) |
| | <hr/> |
| TOTAL | \$112,237.11 |

Civil action against the County Road Commission and the railroad resulted in a settlement of \$687,000.

4.0 TOTAL COSTS TO THE STATE
DUE TO TRAFFIC ACCIDENTS

4.1 Summary of Total Direct Costs
to the State

A summary of the estimates of the components of direct state cost is given in Table 4-1 below.

TABLE 4-1
Estimates of the Components of Direct State Cost
Resulting from Traffic Crashes

| Component | Estimated Annual Direct State Cost |
|--------------------------------|--|
| Care in State Institutions | \$584,000 |
| Medicaid Payments | Unknown |
| Aid to Dependent Children | \$3,065,090 |
| State Employees Sick Leave | \$678,625 |
| Litigation and Judgment Costs | \$2,883,225 |
| Special Education Costs | Unknown |
| Crippled Children's Fund | Unknown |
| Unreimbursed Road Repair Costs | \$212,426 |
| Auto Insurance Costs | \$1,308,375 |
| TOTAL | \$8,731,741 |

The direct cost to the state for those component shown in Table 4-1 is estimated at 8.7 million dollars per year. This estimate is conservative and incomplete. Also, the estimates for care in state institutions, aid to dependent children, and sick leave payments for state employees are educated guesses that could be significantly different from the actual costs to the state due to these components. However, (see section two) the assumptions made in the calculations of these costs are reasonable, and components of these costs have been consistently left out when their existence was doubtful. For example, the estimate of the state ADC costs excludes cases where both parents

are breadwinners and injury to either would result in the family being forced on ADC. Certainly such cases exist, but since their magnitude is unknown and unlikely to be large, they have been excluded. Since these educated guesses are conservative, it is likely that they underestimate the actual cost to the state.

Most importantly, the estimate of 8.7 million dollars excludes large components of state cost. Medicaid payments is probably the largest component of state cost. Since data were not available, this cost has been excluded from the total. The estimated cost for road repair is incomplete because it excludes costs to the 83 county road commissions. These are likely to be substantial. Special Education and Crippled Children's Fund costs have also been excluded.

The previous discussion implies that the total direct state cost per year due to traffic accidents is quite large. These costs are much larger than 8.7 million dollars and in fact, are probably at least twice this much. The remainder of this project will be concerned with estimating the components of cost that are presently unknown, and providing a revised estimate of the total direct state cost.

4.2 Indirect Costs

As mentioned in section 2.0, there are indirect costs to the state resulting from traffic accidents. Components of indirect cost to the State of Michigan include the following:

- (1) Traffic (civil and criminal) cases handled by State courts
- (2) State income tax lost because of lost work time
- (3) State police time in accident investigation and assistance
- (4) Prisoner and probation costs resulting from criminal convictions

A decrease in the number of accidents result in a proportional reduction in court cases, state police hours, and prisoners in state-

operated prisons. These reductions can be perceived as financial benefits to the State.

Promoting highway safety will also decrease employee absenteeism. The result will be more hours worked and increased State revenue from income tax.

However, it is debatable whether or not the events described above would actually happen. If the number of accidents were reduced, the state police may elect to reduce the work load of each policeman, or redefine their jobs to include other responsibilities. This would be a non-monetary benefit.

Since the State courts are presently overloaded, reducing the number of traffic accidents will not necessarily lower the number of court cases annually. The effect of a decreased number of accidents will be reduced waiting time for litigation. The proportion of the total number of court cases saved by reduced traffic cases will determine whether or not the state courts can reduce their annual case load. If suits involving accident victims constitute a significant portion of the state court cases annually, then a reduction in the number of traffic accidents will result in a decrease in the number of cases handled by the state courts.

Since jails are currently overcrowded, a similar argument can be formulated to debate whether or not the number of prisoners would be significantly reduced.

The large number of traffic accidents annually, obviously results in a loss of State income tax. However, it is questionable whether or not this loss is substantial. If someone is injured in a traffic accident and cannot work for a short period of time, (i.e., less than three months) the state could suffer a loss of income tax equal to 4.6% of the employees wage adjusted for the number of exemptions claimed (\$57.69 per exemption). In some cases, sick leave would be received and tax revenues might not decline. However, if the accident victim becomes disabled for a long period of time, it is likely that someone will be hired to take his place. Assuming this person was previously

unemployed, the loss of state income tax in such cases would not be substantial.

The effect of the high rate of unemployment on potential lost state income tax is unclear. If high unemployment exists, many companies will have to reduce their work force. This implies that if one of their employees cannot work due to injury in a traffic accident, it is unlikely that the company would immediately hire a replacement. However, if they wanted to replace the injured worker, the existing unemployment implies that there would be more people in the labor force seeking employment, and it would be easier to find a replacement. The converse is true when there is full employment in Michigan.

The most undesirable characteristic of indirect costs is that they are extremely difficult and at times impossible to measure. Further, whether or not they are a cost is debatable. Perhaps the best that could be done is a ballpark estimate of the number of court cases, prisoners, and state policemen hours saved by reducing the number of traffic accidents. Any determination of the amount of state income tax lost and whether or not an injured worker will be subsequently replaced, would involve some extrapolation.

With this in mind, little attention will be given to the measurement of indirect costs in this project although rough estimates will be provided wherever possible.

5.0 CONCLUSION

The estimates of the components of direct state cost given earlier are incomplete. Some of these costs have not been estimated while others have been estimated by deriving educated guesses from state accident statistics. The remainder of this project will be concerned with obtaining better estimates of the cost components.

Perhaps the largest and most important component of direct state cost that has not been estimated is Medicaid payments for treatment of crash victims. Since the variables needed to correctly identify accident victims are not automated by Medicaid, other criteria must be developed (see Section 2.2). Subsequently, Medicaid could send HSRI a tape containing cases satisfying these criteria.

Costs for care in state-run mental institutions need to be more precisely estimated. By using state accident injury statistics, it may be possible to estimate the number of crash victims sent to these institutions each year. An estimate of the direct state cost could then be derived (see Section 2.1). Also, more case histories need to be found which will further illustrate the necessity to reduce the number of traffic accidents.

In section 2.7, the costs incurred by the State Highway Department for repair of damage caused by crashes was given. This excluded costs to the 83 county road commissions, which have not been estimated. It is possible that the County Road Association located in Lansing Michigan, will have cost data for all 83 counties. If they don't, county road commissions will be undertaken. Data from each sampled county will be collected, and an estimate of the total state cost will be derived by weighting according to demographic characteristics that will be determined later.

It is possible that the estimates of state cost due to ADC and workers compensation payments can be improved. Data concerning these cost components could be automated, which could lead to more precise estimates.

A breakdown of the components of direct state cost by age, injury type, vehicle type, and other relevant categories is desirable and will be carried out as time permits. This breakdown should result in policy suggestions that will promote traffic safety. For example, to determine whether or not wearing motorcycle helmets should be mandatory, one might investigate head injuries to motorcyclists.

Preliminary analysis of direct state costs have resulted in suggestions for further research. One such proposal is the writing and implementing of an interactive computer program, which could evaluate the expected effectiveness of future traffic legislation. The program would have available the results of this study, which would include the estimates of each component of direct state cost, a breakdown of these costs as described above, and other relevant information. The program would then prompt the user for certain parameters that would describe the piece of legislation in question. Using the results of this study, the program would do a cost-benefit analysis of the proposed legislation, and thereby give the user some implications of enacting such legislation. As estimates of the state cost components became more precise, the program could be updated accordingly.

As mentioned above (see Section 2.2), the variables needed to identify people who were injured in traffic accidents will be automated by Medicaid starting in January, 1981. It would be useful to acquire a tape containing a sample of cases involving people who were injured in traffic accidents from the Medicaid Information Division. These data should be available shortly after January, 1981 and would yield a more precise estimate of the costs due to Medicaid payments. Medicaid may also have data that would make possible a breakdown of these costs by age and other factors. Since this may be the largest component of direct state cost, an accurate estimate of the magnitude and breakdown of Medicaid costs by age and other factors is essential.

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