## 1. INTRODUCTION AND SUMMARY

At the request of the House Appropriations Committee, the Office of Technology Assessment, through contract OTA-C1l, engaged Economics & Science Planning, Inc. (ESP) to undertake a study of the need for and means to assemble detailed data on actual automobile collisions so as to develop realistic automobile design standards. The study examined the desirability, utility, design and cost of crash recorders and of the alternate approaches to gathering collision data, including computer crash simulation, controlled laboratory crashes and their correlation with observed vehicle deformations, and methods to improve the accuracy of accident investigation reporting and to increase the utility of national crash data files. Specific data collection programs previously proposed to Congress by the National Highway Traffic Safety Administration were studied and evaluated. This report contains the results of this effort.

We have concluded that the current national accident data base is inadequate to resolve the uncertainties in NHTSA's current and proposed motor vehicle safety programs. One of the major deficiencies is data relating collision forces and actual fatalities and injuries. The need has been clearly expressed by Professor B. J. Campbell (University of North Carolina):

> ". . . when one is forced to use nonhuman subjects [in laboratory crashes] then one is left in the situation of knowing a great deal about the physics of the crash but knowing little of the actual injuries that might have occurred in such a crash. On the other hand, in real world automobile crashes one can learn about the actual outcome in terms of survival and injuries, but the input variables mentioned before are unknown.

"The need to link these two systems is apparent. Engineers who design protective systems need to know about stopping distances, forces, decelerations, etc. But knowing these things is of too little help unless one has a way to relate them to real world injuries."

FINDINGS

1. The existing national data base is inadequate

-- only four of 40 existing standards have been shown to be beneficial based on statistical evidence.

-- the nationwide effectiveness of lap belts in mitigating fatalities is still unknown after five years; statistical evidence is available from only one state.

-- there is an immediate need for more and better crash data

º to support rulemaking and to estimate the benefits of proposed safety standards

º to determine the effectiveness of existing safety standards

º to determine causes of accident, injury and fatality to aid crashworthy vehicle design

º to identify new safety problems as they develop

º for predicting the impact of trends in motor vehicle design on accident incidence and outcome

-- Larger crash data collection expenditures than the $5 million to $6 million now programmed annually appear to be justified:

  - º Motor Vehicle accidents cost society $22 billion to $44 billion annually.

  - º Present safety standards cost consumers $2.5 billion annually

  - º proposed and possible safety standards could cost an additional $4 to $12 billion annually.

  - º Present and planned safety standards add weight to automobiles which increases gasoline consumption.

2. A Comprehensive Accident Data Program

-- must be designed with great care to assure that

  - º it is representative and avoids inadvertant biases

  - º it will answer the outstanding critical safety questions

  - º it is adequate in rate and quantity

  - º it provides uniformity in reporting and format

-- should be reviewed and approved by a broadly based body of experts before it is implemented.

-- elements for a comprehensive program could include:

  - º 500,000 to 1,000,000 crash reports per year for a mass data file at a cost of $3 to $10 million per year.

- the measurement and reporting of crash severity either by vehicle deformation measurement or a cheap and widely installed crash severity recorder, at a cost of $10 to $20 million per year.

- some measurement of crash dynamics using some mix of simulated accident reconstruction (SMAC) and collision history (disk or tape) crash recorders at a cost of $2 million to $4 million

- supplementary surveys to answer specific questions and the existing special programs now costing $5 to $6 million per year

- a cheap crash severity recorder at a development cost of about $500,000

- field trials of planned safety improvements whose costs are high and whose benefits are uncertain (as an example, the cost of a field trial of passive restraints would be $30 - $60 million)

3. The Federal Government, not States, manufacturers or insurance companies, should support the central data collision activities.

-- It is a national problem.

-- The Motor Vehicle Safety Standards are promulgated by the Federal Government.

-- The data has to be obtained in an unbiased and uniform manner throughout the nation.

-- The Federal Government has the resources and ready access to the sources of information.

4. Crash recorders provide data that may be admissible in a court of law.

5. Program alternatives include the following:

- Doing nothing to improve the current crash data acquisition system. If this course is followed, $22 to $44 billion in societal losses will continue to be incurred each year without developing adequate tools to analyze and correct the problem; $7-14 billion or more in consumer costs will be imposed yearly by current, proposed and advanced motor vehicle safety rule making whose benefits, in most cases, will continue to be uncertain.

- Upgrading current data collection programs without adding a mass data acquisition system. This course will neither provide statistically convincing measures of the reduced incidence of death or injury resulting from incorporation of safety features nor will it give a timely response to questions regarding the impact of vehicle design changes.

- Providing a mass accident data acquisition program at a cost of $3 to $10 million yearly. This course will begin to permit timely statistical determination of safety system benefits and identification of automotive safety problems. However, crash severity measures will be inadequate and it will be difficult to associate injury with crash severity.

- Upgrading mass accident data acquisition program to provide accurate severity reporting at a cost of $10 to $20 million annually. This action would finally provide timely determination of safety benefits with ascertainable accident severity incidence and associated injury and fatality exposure bridging the gap between laboratory and field experience.

- Use of acceleration time-history (disk) recorders. A small (10,000 to 20,000 recorders; $2-4 million) program will permit: generating baseline statistical information such as severity distribution of all collisions; the calibration of vehicle deformation estimates as a severity measure; and calibration of computer simulated crash reconstruction (SMAC). A program as large as large as 100,000 disk recorders -- $10 million -- would overdo it from the standpoint of research and be inadequate from the standpoint of mass data gathering.

  Development of a cheap and proliferable causal severity measurement device at an estimated development cost of $500,000 and a production cost of approximately $2 per unit will provide a device capable of widespread installation that permits ready read out of crash severity magnitude and direction by an untrained investigator. The need for careful deformation measurement and transformation of these measurements to equivalent barrier speed would be eliminated.

  providing a federally sponsored field trial of uncertain and/or expensive safety aids. This program will permit the evaluation of safety aids, where normal market forces do not operate, prior to their being mandated on a national scale. (In the case of passive restraints, the one time cost would be $30 - $60 million. )

This study was accomplished by an extensive literature survey; by independent analysis by members of the ESP staff; by analysis of specific assigned topics undertaken by knowledgeable members of the automobile accident research community; and through an Automobile Collision Data Workshop, convened January 16 and 17, 1975, at which the requirements for, and various approaches to, better collision data gathering were presented and discussed in depth by experts in all aspects of the problem. Individuals who participated in the Workshop were the following:

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| B. J. Campbell | Highway Safety Research Center University of North Carolina |
| Charles Conlon, Jr. | AVCO Systems Division |
| J. Robert Cromack | Southwest Research Institute |
| John Edwards | Ford Motor Company |
| M. D. Eldridge | National Highway Traffic Safety Administration |
| Vincent J. Esposito | National Highway Traffic Safety Administration |
| William Fitzgerald | AVCO Systems Division |
| John Garrett | Calspan Corporation |
| Howard P. Gates, Jr. | Economics & Science Planning, Inc. |
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| James Hofferberth | National Highway Traffic Safety Administration |
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