APPENDIX E

LETTER FROM RICHARD WILSON
GENERAL MOTORS CORPORATION

February 4, 1975

General Motors Environmental Activities Staff
Safety Research and Development Laboratory

General Motors Proving Ground, Milford, Michigan 48042

February 4, 1975

Dr. Lawrence A. Goldmuntz
Economics and Science Planning
1200 18th Street, N.W.
Washington, D.C. 20036

Dear Dr. Goldmuntz:

You are to be complimented on your recent Automobile Collision Data Workshop. The free interchange of ideas from such a wide cross-section of data gatherers and data users should be most useful as you formulate your recommendations to the Office of Technology Assessment. I was happy to participate and hope the following comments and the attached material will add to your study.

GM believes there is a need for better accident data so that the true benefits of safety standards can be assessed along with their cost of implementation. This applies to current standards just as well as it does when considering future rulemaking. The value of better data is to improve vehicle safety and to decrease the risk of making an incorrect decision on a standard. The incorrect decision may result in enacting or failing to rescind a standard which is not cost beneficial, or, on the other hand, rescinding or failing to enact a cost beneficial standard. NHTSA should move ahead only with those standards on which they have sufficient information to support a favorable benefit/cost relationship.

You specifically asked for an estimate of the "potential societal cost of not having better accident data". One way to look at this is to consider that the cumulative cost to the consumer for safety standards to date is estimated to be approximately $245 per car (exclusive of bumper provisions). An additional $250 per car are forecast if proposed new safety standards take effect. This $495 per car total related to current and proposed safety standards (bumper standards would be a further addition) translates to about $5 billion per year if applied to production rates of 10 million cars per year. The need for reliable benefit data against which these costs can be evaluated is urgent. Accident data is one source for such information.

Basic requirements for a better accident data system have been presented before. GM has discussed NADS* and the University of Michigan Highway Safety Research Institute has presented SIR**. Other plans may be

* National Accident Data System - Paper by Terry and Schneider given at GM's June 1973 Automotive Safety Engineering Seminar (copy attached).

** National System for Collecting Multipurpose Accident Data - paper by O'Day given at the June 1974 Experimental Safety Vehicle Conference.

forthcoming from your workshop. While exact data system costs have not been formally worked out, they likely are in the area of 10 to 20 million dollars a year. If better accident data could increase the benefit/cost of safety standards by even a few percent (one percent of the above $5 billion would represent $50 million), the $10 to $20 million government investment per year seems very reasonable.

As a specific example, we estimate the cost of continued use of side guard beams, needed to meet MVSS 214, to be about $10 to $12 per car. Applying this cost to 10 million cars per year, this single item of standard represents a total amount to the consumer of $100 to $120 million per year. And yet, the current state of accident data does not even allow a determination of whether side guard beams have had any benefit or not. Again, $10 to $20 million per year for better data seems a minimum expenditure when viewed as a critical ingredient guiding the public's investment of billions of dollars in the costs of their cars.

I hope your project will pull together our country's need in the accident data area. We are convinced there is a need for this type of better decision-making information. I look forward to your final report.

Very truly yours,

R A Wilson

R. A. Wilson
Engineer-in-Charge

RAW/clw
Attach.

National Accident Data System

C. Thomas Terry – Section Engineer
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Safety R & D Laboratory
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Field accident data which reflect what is truly happening m the field today are necessary (1) for the automobile industry to **evaluate performance** and **guide future designs and (2) for the NHTSA to evaluate standards and guide future rule making. This type of data system is not available now. The multilevel system recommended by GM to accomplish this would use the expertise already available in many of the NHSTA-Sponsored multidisciplinary accident investigation teams. The system consists of several study areas which include exposure data and levels 1, 2 and 3 accident data. Another requirement of the system would be a central facility** which **would process the data and make it available to both NHTSA and industry.**

On June 12, 1970, at a Data Accident Investigation workshop* in Brussels, Belgium, GM outlined why field accident data is needed by automobile manufacturers. These needs to collect accident data are:

Data Needs

1. Evaluate present safety system% ,
2. Predict performance of proposed safety systems.
3. Identify problem areas & evaluate solutions on cost/benefit basis.
4. Estimate human tolerances to impact

1. Evaluation of Production Safety Systems

Early accident investigators saw the results of automobile accidents and identified those vehicle components which were producing frequent and severe types of trauma. This early work supported the introduction of items such as the high penetration resistance (HPR) windshield in 1966 and energy absorbing steering columns in 1967. These investigators were able to measure the relatively large performance improvements of those safety systems. More subtle changes in safety performance can be found only by data collection programs that are refined enough to exhibit statistical trends. For example, it is generally agreed that further changes made to the present windshield will result in a smaller improvement in injury reduction compared to that made in 1966. Measuring this potential change in performance will require a sophisticated accident data collection program.

* R. A. Wilson & C.T. Terry, NATO Accident Investigation Workshop, FIELD ACCIDENT RESEARCH – GM's APPROACH, unpublished presentation, Brussels, Belgium, June 12, 1970

2. *Prediction of Proposed Safety Systems*

Before implementing *any* change to safety systems already in the field, the performance of the new safety systems must be predicted. This is the second principle way in which accident data is used.

If the prototype safety system is an improvement on a production item such as the current windshield, then the field data gathered in evaluating the current windshield's performance is used as the injury pattern baseline. The modified system is then tested in the laboratory to compare its performance with the present system. This laboratory comparison provides data to subjectively project how the new windshield might modify the present injury pattern in the field. In this way, the prediction can be made with some confidence as to the performance in the field of the proposed new system.

If a completely new safety system, such as the air cushion restraint system is proposed, the injury patterns which the new system could somehow influence must be identified. In the case of the air cushion restraint, available accident data might be used to identify the injury patterns in frontal collisions where the air cushion is envisioned to be most useful. The air cushion's effectiveness, as determined from laboratory tests, could then be used to predict how the present injury patterns could be modified by the introduction of this new restraint system.

3. *Identification of Problem Areas and Evacuation of Proposed Solutions on a Cost/Benefit Basis*

This identification of problem areas requires an over-view of the total injury picture. The over-view consists of the frequency of particular injuries caused by various components and the severities of these injuries. The areas where the most improvement can and should be made are generally where the highest frequency of most severe injuries occur. A relationship between frequency and severity should indicate the areas of high payoff – those areas where the most good can be done. Once these high payoff areas are identified, the priorities of safety development can be established by cost/benefit studies.

As solutions to the more obvious problem areas are incorporated, the identification of the less obvious problem areas becomes more difficult. To identify the less obvious problem areas will require incorporating even more rigorous data collection programs. It may be possible that a point of diminishing returns will be reached. That is, the time and cost of acquiring even more detailed information may not justify the insignificant amount of improvement made from the data derived. To reach this point is a noble goal indeed.

4. ***Estimation of Human*** *Tolerances to Impact*

The three uses of the field accident data discussed above are specifically aimed at changing the design of the vehicle to reduce the frequency and severity of injuries. A different use of the data is to isolate particular accident situations so that information concerning human tolerances to impact can be generated.

Occasionally, from a large source of accident data, a particular occupant injury in a well-defined automobile accident situation can be attributed to a particular vehicle component. When this infrequent situation arises, and the mechanism of injury is understood, correlation of the accident or "field experiment" with a similar laboratory experiment is attempted. If the "field experiment" can be correlated to the laboratory, the occupant's impact situation might be quantified and the human tolerance to a particular type of trauma can be estimated. For example, an instrument panel may be identified as the cause of a particular type of head injury, A series of similar instrument panels are impacted in the laboratory until the damage to the instrument panel in the accident case is reproduced. The forces and accelerations to produce the damage in the laboratory are then correlated to the injury produced in the field, In this way, the human tolerance is quantified for this particular type of injury.

These needs remain as valid today as they did three years ago. Further mentioned were the qualities of a good field accident data system:

Data Qualities

1. Rapid feedback
2. Random data sample
3. Current model data
4. Data compatibility

1. Rapid Feedback

A prime goal in automotive safety is the reduction of injuries and deaths due to automobile accidents. The more injuries prevented and lives saved, the better the job is done. improved safety systems must be incorporated as rapidly as practicable to achieve this goal. An orderly implementation of improved safety systems depends in large measure on the collection and assessment of field accident data. Only after a sufficient amount of statistical and in-depth data is collected can problem areas be identified and further improvements be recommended and *implemented.*

2. Random Data Sample

Besides the quantity of data gathered, a random sample is essential to insure its quality. Basically, random data is needed so that conclusions aren't erroneously based on the consequences of a unique accident, or limited number of accidents. False accident and injury patterns can be created by generalizing from a small sample of non-random cases. In the past, most sources of accident data have not been random. Most accident investigations typically have been biased by geography, injury level, damage level, or other accident selection techniques. A valid data sample must be representative of the real world.

3. Current Model Vehicles

Each year safer automobiles are produced. Measuring these advances in safety performance from one year to the next requires a valid data baseline. it should be realized that resources are limited and it would be virtually impossible to collect enough data on the total vehicle population in one year. The most efficient use of resources is to concentrate investigation on the most useful data source - current model vehicles. Of course, as current model data is collected each year, in time, a data bank will be built which will allow a comparison of newer automobiles with trends based on many years.

4. Compatibility of Format

If various data sources are ever to be combined to form large data banks, they must, at least, be in the same basic format. This means that the same information is recorded for each accident and some means of easily combining information from different sources is provided. This is particularly important when in-depth data is being collected because of its inherent complexity.

However, even when it is physically possible to combine data from various sources, it is not always advisable. Each investigator tends to bias his accident selection in some manner such as injury only, rural only, etc. Since the data base for each investigator is usually different, a direct statistical comparison of their data is not advisable.

Again, these characteristics are still desirable today as they were three years ago. There is no known source today which satisfies all of these qualities. The one key quality which bears emphasis is the random data sample. The random data sample criteria implies that the accident cases selected are representative of the national accident experience. This representativeness is critical for sound decision making regarding automobile design and government rule making.

Making decisions with national implications in highway safety using only data from rollover accidents in North Carolina is no more valid than predicting the Gross National Product from monitoring only the construction industry in Utah.

Current Data Status

In the three years since that NATO workshop, some other factors have become obvious regarding the value of accident investigation.

1. The information received not only can be used by the industry for evaluation and direction, but also can apply to Government at all levels for rule making.
2. Variation in the interpretation of current accident data results from two factors:

   a. Different analysis techniques
   b. Different data sources

Variation of results due to the first cause i.e., different analysis techniques, is healthy and promotes various problem solving strategies to be explored and compared. However, differences due to the second source are generally inefficient and result in problems of interpretation. This problem will remain unsolved until the many various data collection efforts are coordinated so that their results can be combined. This combination into a representative data set will then allow, the safety experts to base decisions on a sound technical basis.

These previously stated needs and system characteristics coupled with the conflicting conclusions which result from the uncoordinated data collection activities around the country have led GM to propose what is called a National Accident Data System.

Before outlining the proposal for such a system, one point should be stressed: the system being proposed is not the best system that theoretically could be designed. In fact, it is several steps away from being an optimum design. But it is also many steps closer to an optimum system than anything that exists today. Rather than wait for that perfect system to be implemented, it is imperative that the obvious contradictory nature of various data sources be eliminated now so that valid cost/benefit studies can be used in achieving the goal of reducing injury and death on the highway. Each change made to the system after it is begun should be directed toward the desired optimal system.

The proposal itself tries to incorporate many of the data collection activities that are now in existence while eliminating other unnecessary ones. But the design is primarily dictated by the desire to establish a coordinated National Accident Data System in a relatively short period of time.

DATA COLLECTION

The proposed system involves designating certain geographic regions of the country as sample areas where extensive surveying and profiling will be conducted. This is analogous to taking a Gallup Poll of the nationwide accident experience. Since many of the existing Multidisciplinary Accident Investigation (MDAI) teams sponsored by the NHTSA are somewhat randomly located and because expertise already is available from the teams, we are proposing that selected MDAI teams would form the nucleus for the data collection system. This proposal would convert existing MDAI teams into multi-level programs such that each team has the responsibility of coordinating the gathering of the following levels of information within their specific regions:

1. Exposure data (non-accident)
2. Level 1 accident data
3. Level 11 accident data
4. Special accident studies

Teams which could not reliably supply all these levels ***of information would not be included in this program.***

Exposure Data

Exposure data is profile information on the number and types of people, vehicles and roads in the area. this information is used to define the universe in which the accidents are recorded. Ideally, when all the regions are combined, the exposure should be “representative” of the total United States. Capturing data of this nature allows the various combinations of vehicles/drivers/roads to be described whether in an accident or not. Most of this information is available in existing state operational files. The system should allow specific surveys of additional data to also be conducted. For example, it may be necessary to establish how many miles various age groups drive annually.

Level I Accident Data

This level requires collecting a standard police report on ***all*** accidents in the region which meet a predetermined severity threshold. An alternate to the standard form would be a form with a common core of information with other elements decided upon by the local jurisdictions. This level of information briefly defines the nature of all accidents in the area. This information, coupled with the exposure data, make possible the computation of accident rates, such as fatalities/miles driven, accidents/make and model, or accident/driver age. Since the accidents described in this file contain both injury and no-injury cases, computing the probability of an injury occurring is also possible. Definitions or specifications of variables within each region and from region to region **must** be consistent. ***This standardization of definitions between regions is imperative, and will provide the program with one of its greatest challenges and one of its greatest advantages over current programs*** Emphasis upon the training of the police investigation people is important for this level of data. Definition of what an accident **is or of what the** various injury levels are must be explicitly stated and uniformly interpreted. Again, flexibility should allow specific, supplemental information to be collected when needed. As an example, the police could be asked to ascertain whether the head restraint was in the "up" or "down" position in a rear end accident.

Level II Accident Data

This level of data would collect information on all accidents in the region which involve a recent model vehicle and an injury. Information on all vehicles involved in the accident would be required. The injury may in fact occur in an older vehicle which impacted the recent model vehicle. This level data **has been most valuable from** the manufacturer's viewpoint and has historically been the source of injury causation information. Extending the coverage to include older vehicles would allow comparison of vehicles of different ages. in the past, information of this type collected by GM and other ***has led*** to improved vehicle design, examples being HPR windshields and the energy absorbing steering assembly. The information gathered would define the ***injury severity,*** the ***causes of the injury, the accident description,*** a ***measure of its severity,*** and some information relative to the ***cause of the accident.*** This information will allow the assessment of new safety systems as they are introduced such as air cushion restraint or starter-interlock webbing systems. Gathering the data on all accident modes and injuries will allow relevant safety evaluation tests to be specified. By combining this data with the Level I Accident Data, it may be possible to evaluate the relative safety performance of various makes and models of vehicles. The current thinking is that the information would be gathered on a modified version of the GM Field Form by investigators working for the MDAI teams. As with the present Field Form, a series of photographs will be required to supplement the information. The form would be expanded to collect information on pre-crash and post-crash phases of the accident which are not presently addressed on our existing form. This part of the system would also allow extra information to be collected on items of specific interest which are not in the GM Field Form. For example, the investigators may be asked to see if the starter interlock system has been defeated or if it had any effect on the occupant's usage.

Level Ill Accident Data

These special studies are performed to see why **particular** problem **areas exist. The special studies conducted are based on the Level I or Level [1 information already gathered. For example, a special investigation could be undertaken to more closely examine** why a particular class of vehicles for **"over-represented" in a particular type of accident.** The investigation may find that this type of vehicle is popular for owner modification which could result in unstable handling characteristics.

DATA COMPILATION

The next logical question is what to do with the data after it is collected in its relatively rough form i.e., police reports, GM **Field Form, and photographs.** To keep the interpretation of **raw data** consistent from **area to** area, it is proposed that the data be collected in a central location. At this location, the Level I data would be entered directly into a data bank. The information from the detailed Field **Form and photographs** in the Level II system would be analyzed and the final information entered into an automated data system. By centralizing this function, the number of subjective judgments are made more or less to be consistent because of the relatively few number of people involved. This situation is similar to that which is now used with the General Motors-MIC program, and has been found to be quite satisfactory. We feel the overall quality of data will be enhanced by increasing the consistency of the data. This central facility **would not only provide** common data entry and storage facilities, but would also offer a retrieval system for interested data users.

PROGRAM IMPLEMENTATION

Since this program should benefit the industry as well as the Government, it is recommended that **joint Government/industry support** for the implementation and annual operation of this program be solicited. The industry support could logically be under the auspices of either MVMA or SAE. Specifically, it is felt that the program offers a great opportunity for joint efforts between Government and the industry toward achieving a common goal. There **are** actions required of both industry and **government to implement the proposed program. The program is a national** goal **and therefore should be funded with Federal monies. However, the**

industry should be willing to participate in initiating the program and continue support to the end that the data will be valid and available.

After this program is initiated, data acquisition could begin in less than a year. As shown in Figure 1.

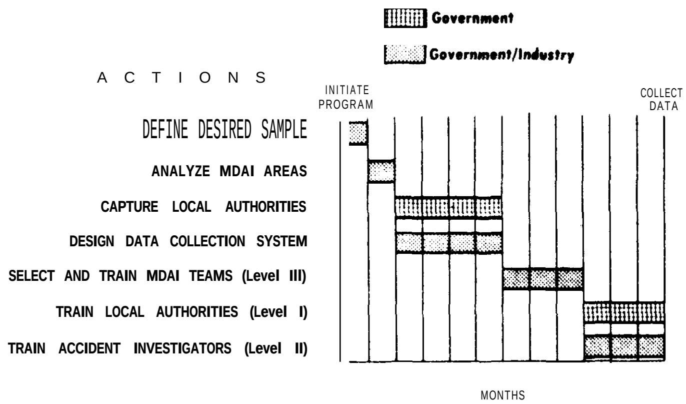

Figure 1

SUMMARY

Although this system is not a new idea, it is the basic simplicity which is most appealing. The program has been outlined in general terms only, although it has been given much more detailed thought as this general outline was developed. Rather than explore the details at this time, support is being solicited for the overall plan of action in the hope of gaining cooperation from other groups in the detailed planning phases of the program. Again, the payoff from such a system would be high, and achievable in a relatively short period of time.

It is GM's intent to act as a catalyst in the design and implementation of a National Accident Data System and encourage any of you today to accept this challenge with us.

C. Thomas Terry

C. Thomas Terry is a Section Engineer responsible for the Field Accident Research activity at the safety Research and** Development Laboratory located at the **GM Proving Ground.

His responsibilities include the collection and analysis of field accident data

He received a Bachelor of Science Degree in Civil Engineering from Rose Polytechnic Institute, Terre Haute, Indiana, and a Master of Science in Engineering Mechanics from Wayne State University, Detroit, Michigan. Mr. Terry joined General Motors in 1969 and was assigned to the biomechanics area with responsibilities in human simulation and volunteer testing. He was chairman of the SAE Crash Test Dummy Subcommittee during this time.

Mr. Terry then joined the Field Accident Research group in 1970 and was promoted to his present position in 1971. In 1972 he assumed the role of Chairman of the Motor Vehicle Manufacturers Data Collection Co-ordinating Subcommittee.

Among his publications are:

"Radiological Studies of Organ Displacement Due to Vertical Accelerations " presented at the 18th Annual Conference of Engineering in Medicine and Biology, November 1965, Philadelphia, Pennsylvania.

"Review of Mathematical Models of Response to Acceleration, " presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, November 1966, New York, New York.

"A viscoelastic Model of the Human Spine Subjected to $+g_z$ ***Accelerations, " Journal of Biomechanics, Vol. 1, pp 161-168, Pergamon Press.***

"Field Accident Research–GM's Approach, " R. A. Wilson, C. T. Terry, presented at NATO Accident Investigation Workshop, Brussels, Belgium, June 12, 1970.

"Benefits of the In-Depth Case Study, " presented at 1972 Annual Meeting of Society of Automotive Engineers, January 10-14, 1972.

"National Accident Data System, " C. T. Terry, R. W. Schneider, GM Automotive Safety Seminar, June 2&21, 1973.

Richard W. Schneider

Richard W. Schneider graduated from Grinnell College where he received the degree of B.A. in 1969 and a Masters Degree of Business Administration in 1971. He joined General Motors Proving Ground in 1971 where he was involved with field accident research. Mr. Schneider is currently senior project engineer with the Safety Research and Development Laboratory at the Proving Ground and active in the area of field accident research. He is a member of Operations Research Society of America.