

November 15, 2000

Ms. Julie Cirillo
Acting Assistant Administrator
Federal Motor Carrier Safety Administration
Room 6316
400 7th Street, SW
Washington, D.C. 20590

Dear Ms. Cirillo:

The Committee for the Review of Federal Motor Carrier Safety Administration's Truck Crash Causation Study (the Review Committee) held its first meeting on September 7 and 8, 2000 at the Holiday Inn, 2010 Wisconsin Avenue, Washington, D.C. The enclosed meeting roster indicates the members, liaisons, guests, and TRB staff in attendance. On behalf of the committee, I want to thank you for attending the meeting and providing background on the Truck Crash Causation Study (TCCS). I would also like to thank the staff members of the Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA) for their presentations and responses to committee questions.

The TCCS is a congressionally mandated study of causes of truck-involved crashes resulting in fatality or serious injury, i.e., serious crashes. The results of the study will be used to design and select cost-effective measures for reducing the number and severity of serious crashes involving large trucks. The study consists of in-depth investigations of a nationally representative sample of large truck crashes. These investigations will be performed by teams of trained investigators from NHTSA's National Automotive Safety Sampling System (NASS) project and FMCSA-funded truck safety inspectors. (See the Appendix for details of the ongoing NASS activity.) FMCSA and NHTSA have developed data forms and procedures and are currently testing them at four pilot study sites. After the pilot study is completed and appropriate adjustments are made to the data collection forms and procedures, the full study is expected to begin at twenty-four data collection sites in 2001.

The Review Committee was convened by the National Research Council to review and provide guidance on progress on major TCCS milestones. The first meeting of the committee focused on study design, proposed sample size and approach, data collection forms, and data collection procedures. The original plan for the Review Committee's activities called for its first meeting to take place in early 2000 prior to the proposed initiation of the full pilot study in July, 2000. Both the meeting and the initiation of the full pilot study were delayed. The committee plans to meet again in early 2001, prior to the start of data collection at all TCCS sites, to review preliminary results of the pilot

study. That meeting will examine whether the pilot study results suggest the need for changes in the data collection methodology, data collection forms, sampling design or analysis techniques and procedures.

The meeting began with a series of presentations from FMCSA and NHTSA staff in an open session. Staff presented an overview of the TCCS goals and objectives and provided a brief history of truck crash causation studies at FMCSA and its predecessor organization, the Office of Motor Carriers of the Federal Highway Administration. Brief presentations then followed on several important study components—study design, data forms, data collection plans, and data processing. The Review Committee met in closed session to deliberate on its findings and begin the preparation of this report which was completed through correspondence among the members.

General Comments

The TCCS is a valuable undertaking because crash causation is important to highway safety and a key concern to policy makers, the commercial motor carrier industry, highway safety and law enforcement officials, and highway users. More knowledge about truck crash causation can help focus future truck safety inspection programs and other enforcement efforts, truck safety regulation, and the design and implementation of appropriate vehicle, motor carrier, highway, and driver safety countermeasures. It is clear that the TCCS cannot possibly answer every question about truck safety, or even truck crash causation. However, its results, when combined with other past and current research, should yield valuable information on truck crash causes, both in terms of truck-related causes and non-truck-related causes. Study success requires that the TCCS be performed on a sound scientific basis with methods, data, and procedures that are thoroughly documented and reviewed for sensitivity for diagnosing causes, reliability (including consistency and repeatability), and validity for measuring the causal factors selected to the focus of the study.

The committee identified several critical issues that warrant consideration by FMCSA before the initiation of the full study. These issues fall into three broad categories: (1) choice of study methodology, (2) specific issues related to the methodology, and (3) concerns about data items, data collection, and causal analysis procedures. Some committee concerns in this latter category might stem from the committee's lack of familiarity with the detailed accident investigation forms and other documents being used to summarize each crash investigation. The documents given to the committee at the meeting could not be thoroughly reviewed and discussed in the time available. Even though the committee was assured that several of its concerns are being addressed in the pilot study, all such concerns, except those related to the data forms, are noted below. FMCSA agreed to report to the committee when actions are taken on these items. In addition, issues related to study implementation, which cannot be addressed in the absence of results from the pilot study (e.g., effectiveness of crash notification procedures, whether the estimated time for follow-up investigation is sufficient), are not addressed in this letter but will be considered at the committee's next meeting.

The roles of FMCSA and NHTSA were discussed in general terms at the meeting. Nevertheless, the committee believes that FMCSA should prepare a statement for the record that clarifies the roles of the agency and NHTSA in the study, including which agency will be responsible for analyzing the data. The agency should also indicate the roles that contractors will be expected to play in the study. Such a statement would be helpful to the committee and others interested in the TCCS.

Choice of Methodology

Much of the committee's discussion focused on the case analytic methodology FMCSA has chosen for the study. This approach uses accident reconstruction methodology to identify crash causes, such as vehicle and highway defects and driver errors. It can yield considerable information about crash causes for the sample of crashes studied, e.g., driver fell asleep, ran-off-the-road, and struck a pole. However, accident reconstruction does not address less direct contributors or related factors such as driver sleep schedule. The roles of these contributors are better identified by comparing their occurrence in a crash sample with their occurrence in the population-at-risk. Since several of these indirect factors are included in the data collection forms, FMCSA should carefully document both its rationale for choosing the reconstruction methodology and how it plans to make inferences concerning the contribution of these indirect causes to crashes. The committee would like to review such documentation at its next meeting.

The committee believes there is a clear need for a thorough analysis plan that documents agency plans for interim and final analyses for the study. Such a plan can help determine if all key data elements are being collected, provide guidance on how crash data should be interpreted by the NASS crash cause analysts, and help assess the adequacy of the TCCS study design. Regardless of methodology, data collection must be based on the research questions being addressed and the analysis to be undertaken.

The analysis plan should include a list of basis questions concerning crash causation FMCSA is attempting to answer together with the data elements that correspond to these questions. The analysis plan should also include a description of the types of statistical analyses that will be used for estimating parameters, testing hypotheses, examining subpopulations, etc. The plan should document how FMCSA will minimize inter-analyst variability, especially where the procedures rely on analyst judgment. Finally, FMCSA's schedules for releasing its data for general research use and for publishing causal analyses should be highlighted. There is considerable interest in the TCCS from the highway safety field and the trucking industry as well as policy makers and public officials at all levels of government, and the general public. Such schedules can help allay concerns and may reduce the pressure on FMCSA for unduly accelerated results.

Specific Methodological Issues

Sample Size and Selection

The TCCS as presently structured will be based on in-depth investigations of 1000 truck-involved crashes. A sample of 1000 truck-involved crashes is very small in light of the large number of potential truck-involved crashes, the many potential causal factors, and the eventual need to partition the data for analysis. (In 1998 nearly 94,000 truck-involved crashes resulted in fatalities or serious injury.) In-depth investigations of the type being undertaken are costly and the sample size is understandably constrained by the project budget. However, the small sample size will provide challenges to data analysis. The committee would like to know more about the basis for the selected sample size and the statistical considerations involved. Because results of previous studies suggest that the sample will yield fewer than 500 cases in which a crash cause can be attributed to a truck, the committee is interested in whether FMCSA plans to screen out potentially unproductive investigations in the crash selection process (e.g., collect only minimum data on crashes in which non-trucks are the primary cause). If so, the committee would like to know more about the screening method and how screening might affect the intended representative sample. If not, then the committee would be interested in FMCSA's reaction to whether approximately 500 cases can give them all the causal information they need to make truck-related treatment decisions.

To select crashes for the nationally representative sample of truck-involved crashes, FMCSA is relying on a sampling plan based on NASS data for all highway crashes, not just truck-involved crashes. TCCS project staff indicated that they could document that the sampling plan based on all vehicle crashes is suitable for TCCS. The committee strongly recommends that FMCSA document that the sampling plan will not compromise the ability to draw inferences about causality of truck-involved accidents. It is particularly important that differences between various regions be taken into account in the sampling plan; for example, some states although not necessarily large in size or population, are border or corridor states, with considerably large truck traffic flows. These states can experience proportionally greater exposure compared to other states of similar size and population that are not border or corridor states. The committee plans to review the document and comment as appropriate.

Definition and Determination of Cause

Fundamental to crash causation studies are *the definition of cause and the method chosen to determine crash causation*. Although FMCSA described in broad terms how it plans to determine crash causation, the agency provided no details for the approach. As a result, the committee remains unclear how causality will be determined, including how potential multiple causes will be evaluated, weighted, and summarized, and how these determinations will be tested to ensure objectivity, and reliability of results. It is also unclear how the NASS crash analysts who will make the cause determinations will be trained, monitored, and reviewed to achieve reliability across analysts.

Since crash causation is the focus of this study and the method of crash cause determination is a potential topic of future criticism when results are published, FMCSA should prepare a detailed description and justification of the fundamental approach it plans to use to determine and analyze cause. Such documentation should be written to be clearly understandable by all interested parties. The committee notes that following the

meeting FMCSA distributed a resource paper that the agency has used as the basis for its internal discussions and plans. After reviewing the document, the committee will prepare comments and forward them to you in a separate letter.

Expert Knowledge

Several committee members noted that the study crash investigators and the NASS crash analysts determining the causes of each crash need to be knowledgeable about trucking company business operations and truck vehicle dynamics to assist them in conducting their investigations. Such knowledge will be of particular value when the investigators examine crash sites and the trucks involved and when they interview truck drivers and truck company representatives. Lacking such knowledge, the crash investigators will be limited in their understanding of what they see and hear and their ability to question the truck driver and the motor carrier, and so may be likely to overlook specific details about key facts. In addition, the committee believes the NASS causal analysts who will determine crash causation need to be knowledgeable about highway design and truck driver human factors so that items in these categories are adequately considered and understood in the determinations of crash causes. This is particularly important because much of the NASS work has focused on non-truck-related human factors rather than truck-related human factors and has addressed roadway effects in a limited fashion. The committee suggests that the issue might be addressed by having the conclusions of the causal analysts checked by a panel of human factors and highway design experts.

Definition of Trucks for the TCCS

FMCSA's regulatory responsibilities extend to all trucks with a gross vehicle weight of 10,000 lbs. and more. This is a wide range of trucks including pickup trucks, delivery trucks, and vans. The committee recognizes that in choosing a definition of trucks for this study FMCSA must address not only methodological but also policy issues. However, the committee believes the TCCS should focus on crashes involving single unit trucks with three or more axles and all combination trucks and not consider smaller trucks. Using such a definition will yield a larger sample of crashes involving larger trucks, and the information gained from this sample will be more valuable than the information lost by not including crashes involving smaller trucks. This suggestion is based on the increasing number of combination trucks in the total truck fleet, their importance in serious truck crashes, and the potential for high payoffs if more is known about crashes involving these large trucks. This revised definition also incorporates the

vehicles of most concern to highway safety advocates, highway users and policy makers concerned with truck safety. It also reflects how FMCSA deploys most of its resources.

Other Issues

Specific Variables

In light of the limited opportunity for thorough review and discussion of the data collection forms and individual data items, the committee plans to review these documents and prepare a separate report to the agency.

In-Vehicle Recording Devices

Some trucks and passenger cars are currently equipped with in-vehicle recording devices. The committee urges FMCSA to collect as much information as possible from such equipment on vehicles involved in the crashes investigated. While the portion of the vehicle fleet equipped with such devices is too small for the devices to be used for primary data collection, those that are in the sample of crash-involved vehicles might provide data helpful for validating the data that is manually collected.

Alternative Data Collection Method

One committee member supports an alternative method of data collection for the TCCS. It involves installing continuous-loop video cameras in a sample of trucks and extracting the data from cameras on trucks involved in crashes. The committee did not discuss this proposal and has not endorsed it. The proposal will be discussed at the committee's next meeting.

Future Meeting Plans

The committee has scheduled its next meeting for January 25 and 26, 2001 in Washington, D.C. I would like to invite you to join us at the meeting.

Sincerely,

Forrest Council
Chairman
Committee for the Review of Federal Motor Carrier
Safety Administration's Truck Crash Causation Study

MEETING ATTENDANCE

COMMITTEE MEMBERS

Forrest Council, Chair
Michael H. Belzer
John R. Billing
Kenneth L. Campbell
James Dally (NAE)
Lindsay I. Griffin, III
Anne McCartt
Hugh W. McGee

A. James McKnight
Raymond C. Peck
Lawrence A. Shepp (NAE, IOM)
Jack Stuster
Steven Vaughn
Frank R. Wilson

TRB Staff

Walter Diewald
Susan Garbini
Stephen Godwin

LIAISONS AND VISITORS

Nancy Bondy, NHTSA
Stephen F. Campbell, Commercial Vehicle Safety Alliance
Julie Anna Cirillo, FMCSA
Ralph Craft, FMCSA
Jerry Donaldson, Advocates for Highway and Auto Safety
Lee Franklin, NHTSA
William Gay, Volpe National Transportation Systems Center
Donald Hendricks, Veridian Engineering, Inc.
Katrina Knight, Volpe National Transportation Systems Center
Robert Lemieux, Volpe National Transportation Systems Center
Tim Lynch, Motor Freight Carriers Association
Stephen Mavros, KLD Associates, Inc.
Dave Osiecki, American Trucking Association Foundation
James Page, Veridian Engineering, Inc.
Andy Schindel, Central Analysis Bureau
Terry T. Shelton, FMCSA
John Siebert, Owners-Operators-Independent Drivers Association
Marvin Stephens, NHTSA
Gary Toth, NHTSA

Disclosure Statement

As is standard policy for NRC committees, the members of this committee meet in executive session at the outset of each meeting to discuss any potential or perceived conflicts of interest that might have arisen for any of them. The committee has agreed to abide by TRB policies for dealing with conflicts of interest that may arise in the bidding for or winning of FMCSA contracts by firms or organizations with which members are associated. In the interest of full disclosure, we note the following FMCSA-related activities.

Michael H. Belzer's current research on driver pay and safety and an assessment of costs and benefits of the Federal Motor Carrier Safety Administration's proposed hours of service regulations is funded by the Federal Motor Carrier Safety Administration. Kenneth L. Campbell currently manages the Trucks Involved in Fatal Accidents (TIFA) data file. This file supplements data on fatal truck crashes that are reported to the federal government as part of the Fatal Analysis Reporting System. The Federal Motor Carrier Safety Administration and the National Highway Traffic Safety Administration provide substantial financial support for TIFA, which also receives funding from state and private sources.

APPENDIX

NATIONAL AUTOMOTIVE SAMPLING SYSTEM (NASS)¹

The National Automotive Sampling System (NASS) was established in 1978 within the National Center for Statistics and Analysis of the National Highway Traffic Safety Administration. NASS has two major operating components:

1. The General Estimates System (GES) which collects data on an annual sample of approximately 55,000 police traffic crash reports; and
2. The Crashworthiness Data System (CDS) which collects additional detailed information on an annual sample of approximately 5,000 police reported traffic crashes involving a towed passenger car, van or truck that is less than or equal to 10,000 pounds GVW

The purpose of NASS is to provide nationally representative data on fatal and nonfatal motor vehicle traffic crashes for use in better understanding the vehicle-trauma experience and to determine the national crash trend experience. This helps NHTSA develop an understanding of both the relationship between vehicle crash severity and occupant injury, and the scope of the highway safety problem.

NASS CDS has detailed data on a representative, random sample of thousands of minor, serious, and fatal crashes. There are 24 field research teams that study about 5,000 crashes a year involving passenger cars, light trucks, vans, and utility vehicles. Trained

crash investigators obtain data from crash sites, studying evidence such as skid marks, fluid spills, broken glass, and bent guardrails. They locate the vehicles involved, photograph them, measure the crash damage, and identify interior locations that were struck by the occupants. These researchers follow up on their on-site investigations by interviewing crash victims and reviewing medical records to determine the nature and severity of injuries.

Interviews with people in the crash are conducted with discretion and confidentiality. The research teams are interested only in information that will help them understand the nature and consequences of the crashes. Personal information about individuals - names, addresses, license and registration numbers, and even specific crash locations - are not included in any public NASS files.

NASS data have been electronically coded in computerized data files for statistical analysis since 1979. NASS CDS has investigated and collected detailed data on a representative, random sample of more than 119,000 minor, serious, and fatal crashes. Custom software incorporating automated quality control is used for data entry.

¹ Based upon information provided by the National Highway Traffic Safety Administration.

Separate contractors perform extensive quality control reviews of field case sampling procedures and non-automated data such as scene diagrams and vehicle damage sketches. Additional case data, such as vehicle photographs and scene diagrams, are retained for detailed analysis by the agency and the highway safety community. Contractor staff are trained in NASS investigation procedures at the Transportation Safety Institute in Oklahoma City, Oklahoma. Performance of contractor staff is carefully monitored against defined goals to assure accuracy and completeness of crash sampling and data collection.

Police reports used as the source for GES data are collected by CDS teams adjacent to GES sites or by part-time contractor personnel at remote GES sites. Data are converted to a common format and coded to the electronic file at one central contractor location. All CDS and GES data are carefully controlled to protect the privacy of involved persons. NASS data are available in electronic data files and in annual reports for selected years. These data are essential to a variety of regulatory and enforcement initiatives. Currently NASS data are supporting rulemaking in light truck side impact and vehicle rollover crash protection, head injury protection, and occupant ejection, and fuel system integrity. Other uses of NASS data include in-depth engineering analyses of crashes involving automatic occupant protection systems such as air bags and evaluation of pre-crash avoidance maneuvers for the problem definition stage of Intelligent Transportation Systems (ITS) specifications to improve the man/machine interface in crash events.

The data collected by the CDS research teams become permanent NASS records. This information is used by NHTSA for a variety of purposes, including:

- Assessment of the overall state of traffic safety, and identification of existing and potential traffic safety problems.
- Obtaining detailed data on the crash performance of passenger cars, light trucks, vans, and utility vehicles.
- Evaluation of vehicle safety systems and designs.
- Increasing knowledge about the nature of crash injuries, as well as the relationship between the type and seriousness of a crash and its injuries.
- Assessment of the effectiveness of motor vehicle and traffic safety program standards.
- Evaluation of alcohol and safety belt use programs.
- Evaluation of the effect of societal changes, such as increased traffic flow and increased large truck traffic.