

TRANSPORTATION RESEARCH  
**CIRCULAR**

Number E-C094

April 2006

**Safety Data Analysis  
and Evaluation**

*Research Problem Statements*

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OF THE NATIONAL ACADEMIES

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TRANSPORTATION RESEARCH CIRCULAR E-C094

## **Safety Data Analysis and Evaluation**

### *Research Problem Statements*

Transportation Research Board  
Safety Data, Research, and Analysis Committee

April 2006

**Transportation Research Board**  
**500 Fifth Street, NW**  
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## Introduction

This circular contains research problem statements produced by members and friends of the Transportation Research Board Safety Data, Research, and Analysis Committee (ANB20). This committee is concerned with transportation safety data in general: methods of gathering, storing, and, in particular, using the data for informed decision making.

The 12 problem statements contained in this circular cover a broad range of highway safety information issues of concern to the committee. The following are three general categories of problem statements included in this document:

1. Safety data improvement (four problem statements). This group of problem statements relates to improving the quality and accessibility of safety data.
2. Evaluation (two problem statements). This group of problem statements relates to proposed studies of specific safety issues.
3. Methodology (six problem statements). This group of problem statements relates to methods used to quantify safety issues.

## SECTION 1

# Safety Data Improvement

### SAFETY DATA INTEGRATION

*Ed Milton, Washington State Department of Transportation*

#### **Problem**

State and local agencies have multiple systems that capture highway and traffic safety data. It has been known for some time that effective linkage between systems is possible and that these merged data sets help in analyzing safety from a number of perspectives (see, for example, codes projects in several states). However, a lack of data linkages in what are the traditional core systems for safety data analysis (crashes, roadways, and driver–vehicle files) still inhibits the ability to understand our crash experience. Who are the most likely to be involved in a crash, and what are their important characteristics beyond age and gender? What can be done in states that still do not have a reliable way of coding locations (and crashes) for all public roadways?

#### **Objective**

To develop a synthesis describing the linkage of data systems recommending key variables to capture in each file, and suggesting methods for linking the data together for analysis.

#### **Related Work**

The codes projects involve probabilistic linkage between crash data files and health-care records (primarily). These efforts have been successful in showing the value of linked data. In addition, they prove the concept of probabilistic linkage when more direct methods are not possible (as is the case with health records). Other linkage projects have taken place on a state-by-state basis and for varied purposes (e.g., crash location, driver improvement–control, analysis of driver behavior).

#### **Urgency**

Linkage of data is a topic that can only grow in importance. As states engage in system upgrades, revise crash report forms, or set up new systems (e.g., injury surveillance systems, citation tracking systems, etc.), they could benefit from a synthesis of the best ways to improve the linkages between files. Having this information available now would help several states that are currently implementing new crash report forms. A delay in producing this kind of direct advice to states means that another generation of systems and forms is likely to be produced without taking advantage of some valuable improvements in linkage capabilities.

#### **Cost**

The synthesis should cost no more than \$50,000.

## **User Community**

The traffic records communities in each state are the primary benefactors. This includes crash, roadway, and driver–vehicle system administrators as well as the people who collect the data for these systems and use the systems for analytic purposes.

## **Implementation**

The synthesis would end up as a reference for system designers and forms designers in the coming years. It would give these professionals advice on how best to add linking variables to their systems in a way that will produce analytic benefits at a reasonable cost.

## **Effectiveness**

The synthesis would be effective in that most of the system redesign and forms redesign efforts in the states could benefit from the advice it would contain. It is probable that every crash report redesign and crash data system redesign effort in the country would make reference to the document. Redesign efforts for roadway and driver history systems would also make reference to the document.

## **IMPROVING DATA ON UNDERREPORTED EVENTS: PROPERTY DAMAGE–ONLY CRASHES, BICYCLES, PEDESTRIANS, AND SINGLE-VEHICLE ACCIDENTS**

*Lisa Aultman-Hall, University of Connecticut*

## **Problem**

It is generally accepted that police-reported crash databases are biased toward the more serious events. While this may allow transportation professionals to focus on the most critical types of events and countermeasures to them, the ability to incorporate safety as a complete measure of customer service is missed completely. Safety is more than whether a fatality has occurred; even a minor crash affects a person's satisfaction with their traveling experience. Minor events have social and economic consequences.

## **Objective**

The objective of this research is to determine the feasibility of routinely measuring under-reported events by using a combination of user surveys. The research should involve the design of a system of surveys that could collect these data. The size of a sample to produce statistically significant results on a regional level as well as the cost of collection would be estimated. If cost limits the routine collection of these data, recommendations on the frequency and extent of periodic collection should be made.



## **Related Work**

As one example, research with bicycle survey databases has estimated that only between 10% and 20% of all bicycle collisions are reported to police. Similarly NHTSA estimates that 50% of property damage-only and 20% of injury crashes are not reported to police. This suggests transportation professionals may be dramatically misrepresenting parts of the full transportation safety picture because of underreporting.

## **Urgency**

Medium.

## **Cost**

\$100,000.

## **User Community**

Police, federal, state, and local agencies, and safety educators.

## **Implementation**

The implementation of this research would require that data collection efforts be changed to accommodate collection of this additional data. The development of the prototype in this study might result in some states undertaking collection even if a national effort was not undertaken.

## **Effectiveness**

Given the current lack of knowledge on the extent of underreporting and the circumstances of the nonreported crash, this research will have an important impact in accessing the deficiencies in safety-related customer service. It may require that countermeasures be redesigned.

## **IMPROVING THE VALUE AND USEFULNESS OF CRASH DATA**

*Richard Raub, Raub Associates*

## **Problem**

Significant progress in crash reduction can arise only when better information is available about crashes. Under the current operating framework, investigation and reporting of crashes lie within the police domain. They are equipped with an extensive form and have received some training in its use. With this tool and knowledge, they are expected to produce quality information which can be used by researchers, engineers, police, and others in safety to understand why crashes occur and to propose countermeasures. However, attempts to use the collected data for anything more than some aggregate measures are frustrated because the data are of insufficient quality. A review of various literature related to the quality of crash reporting yields similar findings. There

are too many gaps in coverage, consistency, accuracy, and precision. As a result, application of the data to specific tasks, e.g., reduction of crashes at intersections or caused by drowsy drivers, generally falls short.

For example, in one state, more than 65% of work zone crashes were coded as non-work zone. Even when properly coded, the location of the crash was problematic. More critical, the reported contributing factors when compared to actual case studies were found to misstate the actual factors. As a result, the state may have been misdirecting their efforts at attempting to correct work zone crashes. The following four issues were noted:

1. The crash report is designed by safety experts for their use; contains too many entries; and is not easy to use by the persons expected to complete it (and duplicating the form on a laptop only automates the problems). This results in less than adequate attention paid to collecting and reporting on the part of the police officer responsible for handling the crash and is manifest by low quality data. An excellent example of how crash reports can lead to inadequate efforts is the recently revised report for Louisiana, which contains 12 pages and more than 300 entries. The too typical response is that quality would improve “if only the police received better training.”

2. At least 75% of all crashes result in property damage only. Unless there is an implied likelihood of subsequent tort action, police rarely investigate these crashes. A report is prepared on the basis of what the officer can observe and what the involved parties might tell that officer.

3. In many larger cities, a current trend is for reports covering minor crashes to be taken at the station rather than in the field (as many as 60% crash reports in Chicago fall in this category). The resulting report is useful only for count statistics; other critical data including location are likely to be in error.

4. Many police officers, with the exception of those in urban areas (and even then some officers may never be assigned to a crash), complete few crash reports annually. Each report represents refresher learning. There is insufficient time to provide frequent retraining of the officers in how to investigate and report crashes.

What is needed is a new approach to collecting data on the basis of what can be reported at the field level given the typical conditions under which the crash reports are prepared. Instead of someone specifying the desired outcome to be collected, reporting and investigation need to be reexamined from the perspective of the officers filling out the reports.

## **Objective**

The proposed research should enhance the quality of crash investigation and reporting. The research would lead to a “basic” field report, which then would be enhanced, either with linked data or through additional investigation on a sampling basis. The research needs to answer the following questions:

1. What data are most likely to be collected at the field level for all crashes given the environment of the police officer and constraints that most police agencies now face related to handling crashes?

2. What tools can be made available and how can these tools be used to produce quality data within the scope of the two constraints: time and frequency of handling crashes?

3. What methods need to be employed to allow collection of other needed data, and how often do these other data need to be collected (sampling)?

4. What system is needed to integrate relevant data that are available elsewhere, and at what cost?

### **Related Work**

The *Manual on Minimum Uniform Crash Criteria* was the latest in an attempt to reduce the number of elements to be collected on a crash report. This effort follows the work by NHTSA on CADRE (Critical Accident Data Reporting Elements) and the ANSI 16.1 standards. Each document however is a top-down approach; that is, these data are considered to be an absolute minimum needed, without a comprehensive study of how well the data can be collected under field conditions. None of the efforts have started at the bottom, the actual effort of investigating and reporting.

Several studies from FHWA on the economic analysis of safety data have identified how improvements in data quality could derive from the integration among data systems so that data from others sources can be made part of the crash data and database. Included in these studies were estimates of the time and costs required to perform the linkages.

### **Urgency**

Until a change is made, even the crash reporting that is considered as good, will continue to leave gaps. Attempts to use corrective action will continue to fall short.

### **Cost**

The cost of this program will be that of employing personnel who understand safety needs in the investigation and reporting of crashes in the field. Their job is to work directly with police officers to design this basic field report and to test its effectiveness. Because of the extensive field contact needed, travel will be relatively high. Developing the minimum field-level report could require more than \$100,000. That would be Phase I.

Phase II involves the design of data linkages and the cost of systems that will allow integration of the data. This second phase also will identify how additional data can be gathered to supplement the basic field reporting document.

### **User Community**

The FHWA, NHTSA, National Association of Governors' Highway Safety Representatives, American Association of Motor Vehicle Administrators, National Security Administration, International Association of Chiefs of Police, and ITE all have users who would benefit from better data. Other users who need good data include driver licensing services, automobile and related manufacturers, the medical community, and the emergency medical service providers.

## **Implementation**

Implementing the program can be done as soon as the structure of reporting is outlined. The systems integration may take somewhat longer, but because the data needed to supplement the basic report generally exist, these additional data can be added even without sophisticated integration. The results of the research will provide a better method of collecting the basic data and then supplementing those data to provide a quality database which can be used for safety analysis.

## **Effectiveness**

The process will yield better, higher quality crash data, collected at lower costs and with less use of resources than is currently done.

## **TRAFFIC CRASH DATA COLLECTION INSTRUMENT (FORMS) EVALUATION**

*Robert A. Scopatz, Data Nexus, Inc.*

## **Problem**

Each state in the United States has its own unique crash report forms. Each form represents a series of historical additions and changes that accumulate through the years because of new federal data requirements or models, state legislative initiatives, input from safety advocacy groups, and the concerns of state and local engineers and law enforcement personnel. The result is a wide variation in forms from state to state and a wide variation in the quality of data collection supported by the forms. The real problems arise not just because data from different states are not easily combined for national-level data analysis, but from the fact that data collected with these instruments are not of sufficient quality to support data analysis and decision making at the state or local level either. An audit of data collected in several states and the forms-level issues that support or impeded collection of quality data is needed.

## **Objective**

To research the data quality of crash reports in several states with a special emphasis on identifying form design and user training issues and to develop a synthesis of the proper methods for conducting forms-level audits of crash report information.

## **Related Work**

The American Automobile Association Foundation for Traffic Safety and the Federal Motor Carrier Safety Administration have sponsored audits of report forms for crashes involving commercial motor vehicles. Massachusetts recently conducted a full audit (all vehicle types) of their crash reports. In all published cases to date, the audit identified serious structural (built-in) problems with existing data collection forms. These issues include fields on the form that are incorrectly completed 50% to 90% of the time and render the data from these fields useless at the state or local level. In addition, many problems identified are easily and effectively addressed by

simpler designs rather than training (and retraining) users. In essence, the form itself is a cause of bad data in a surprising number of cases.

The proposed research would involve forms-level data audits of crash report information in several states. Ideally, all states would participate, but in reality the largest states would be most useful in terms of generating overall improvements and a general sensitivity to the issue in all states. It is therefore proposed that a 10-state audit be pursued.

### **Urgency**

The basic data of highway and traffic safety are crash information collected on state crash report forms. If existing research is accurate, the usefulness of this information is called into question. Even the best engineering and analysis cannot overcome the decision-making flaws that must result if unreliable data are used. The ultimate goal of this study is to encourage states to improve the quality of data, in part through forms design but also through simple attention to the issue.

### **Cost**

\$400,000 for a study of 10 states' crash reports. This assumes that a valid sample of recent years' crash reports can be provided by the state at minimal (or no) cost.

### **User Community**

The entire highway traffic safety community relies on crash data for key aspects of their work. The flaws in basic data are important to each practitioner.

### **Implementation**

The audit should be conducted in a team approach with expertise in crash data collection in the field. Specific knowledge of a particular state's practices should be sought through team members who participate for their own state's audit alongside a core team who would work on the audits for all states. A standardized methodology for sample selection and the conduct of the audit should be followed.

### **Effectiveness**

The primary benefits of an audit of this type are in convincing the responsible state agencies to review and redesign their crash report form. The foreseeable result from such an effort is improvement in data quality, which in turn would help decision makers at the state and local level. It is possible that many might adopt a national standard form (a template or sample) at the same time. If that is the case, then federal data analysts and decision makers would benefit as well.

## SECTION 2

### Evaluation

#### **OLDER DRIVERS: REEVALUATING THE COSTS AND BENEFITS**

*Lisa Aultman-Hall, University of Connecticut*

##### **Problem**

The elderly are the fastest growing segment of the population in the United States. At the same time the elderly driver population also has increased rapidly. Elderly drivers, in particular, are experiencing high crash rates, which have been increasing over time. These safety trends require further research efforts to improve the current understanding of the crash circumstances and thus to assist in the development of means to counterbalance them. It has been well documented that the aging process generally reduces one's capabilities to operate an automobile safely. Reduced visual skills lead to longer reaction times for detecting and responding to objects on the road. These deficiencies contribute to highway crashes and increase the likelihood of elderly drivers being involved in a crash.

##### **Objective**

At the same time the number of older drivers is increasing, our land use patterns are becoming more incapable of providing mobility without the use of an automobile. Walking, public transit, or access by proximity is not a possibility for many elderly, not just for those in rural America but also for those in suburbs. For many older people the cost of unsafe driving ability must be weighed against the benefits of mobility.

The objective of this research is to measure these benefits and costs, as well as to understand the travel needs of the elderly and how lack of mobility options factor in to the elderly driver's decision to drive.

##### **Related Work**

Previous research has indicated differences between elderly male and female drivers as well as decreasing safety with increased age. Analysis of cohorts has suggested that the newer generations of elderly drivers will perform better than their earlier counterparts. Elderly drivers have been found to compensate for their physical limitations but are still overrepresented in certain types of crashes, especially those related to limited visual abilities. Research has found that although the elderly often change their travel patterns, they are reluctant to give up driving altogether.

Researchers in the field of transportation planning have moved to activity analysis rather than trip analysis to model travel behavior better. This research would essentially be the application of these activity analysis techniques to understanding the travel patterns and needs of the elderly and how they relate to land use patterns.

## **Urgency**

Medium.

## **Cost**

\$100,000.

## **User Community**

Planners of urban and suburban regions and people who work with and care for the elderly.

## **Implementation**

The implementation of this research will involve redesigning our communities and transportation systems to prepare better for the era when the baby boomers reach their senior years. The travel needs of this group must be understood to provide services to meet them.

## **Effectiveness**

It is unlikely that the mobility issues of this large aging group can be completely addressed in advance, but information to understand the activity patterns of the elderly better will be needed as service providers seek to provide transportation to this group.

## **ASSESSMENT OF BILLBOARD DISTRACTION LEVELS: WHAT CAN BE LEARNED FOR CONSIDERING THE SAFETY IMPACTS OF FUTURE ITS TECHNOLOGIES?**

*John S. Miller, Virginia Transportation Research Council*

## **Problem**

The minimization of driver distractions is a critical goal for improving roadway safety. One aspect of the motorist's environment that transportation agencies control directly [transportation control devices such as traffic signals, changeable message signs (CMSs), highway advisory radio, and regulatory signs] are designed and implemented with the motorist's safety in mind. For example, Section 6F-2 of the *Manual on Uniform Traffic Control Devices* clearly states that a CMS should be visible 650 ft away and should be limited to a two-screen message; part of the motivation is that drivers could quickly glean the information from the CMS without having to avert their eyes from the roadway for an inordinate amount of time. Even factors that are outside of the transportation agency's sphere of control are considered in terms of their potential to distract motorists. For example, some jurisdictions have banned or restricted the use of hands-on cellular phones so that motorists would not have their attention diverted from the task of driving.

As communications methods advance, motorists are going to be given more opportunities to have more information while en route; in fact, this is a major thrust of intelligent transportation system (ITS) efforts. To evaluate whether these new practices and technologies (e.g., CMSs, cellular phones, and pagers) will have a distracting effect on drivers, deployment

tests with the technologies can be used to measure motorist distraction.

As of yet, a potentially rich data source does not appear to have been fully explored to tell us the effect of additional information on drivers' attention: billboards visible from the roadway.

## **Objective**

The objective of this research should be fourfold:

1. To synthesize the literature with respect to studies that have qualitatively or quantitatively studied the distracting effect (if any) that billboards have on motorists;
2. To identify quickly methods for measuring distracting effects, such as eye movement, head turning, change in steering, visual observation of volunteer drivers, etc.;
3. To select comparable test sections where billboards are present versus absent and to compare the levels of distraction offered by the billboards (if any); and
4. To illustrate how the findings may be related to the evaluation of the distractions from other technologies. (The fit will not be perfect, of course—a billboard and an in-vehicle display unit have different visual cues, for example—but findings might transcend the technologies, such as the relationship between the net increase in the amount of information conveyed and the net increase in driver distraction.)

## **Related Work**

Some available literature relates to this topic. One example is “An Evaluation of the Influence of Roadside Advertising on Road Safety in the Greater Montreal Region” (J. Bergerson, *Proc., 1997 Conference of the Northeast Association of State Transportation Officials*), where the authors argue that billboards have increased crash rates; from another perspective, “Influence of Visual Environments on Visibility of Traffic Signs” (Y. Akagi, *Transportation Research Record 1553*) argues that the presence of large numbers of billboards make traffic control devices less prominent.

Indirectly, literature on CMSs (e.g., FHWA, Dudek) may be helpful, but experiments and syntheses of driver distraction are more relevant. While a TRIS search under the term shows 47 citations for driver distraction, (and more should be obtained with variants of these key words), none seemed to use the rich data source offered by highway billboards.

Another track the literature search should take is to determine reliable methods to measure driver distraction. Simple metrics (interviews, head turning) may be the most appropriate, but there may also be more advanced techniques for measuring motorist distractions.

## **Urgency**

Because this effort is more basic and less applied in nature, its urgency is medium. It should provide a useful data source, however, for evaluating distractive effects of future ITS technologies and potential traffic control devices, both of which are fundamental to the safety of the roadway.



## **Cost**

The cost for the literature review is estimated to be \$50,000. Field data should be an additional \$200,000 to \$300,000, depending on the sample size.

## **User Community**

Two categories of persons should benefit from the data. First, persons in the role of evaluating future ITS technologies that require the motorists' attention while driving (e.g., wider deployment of in vehicle signing or other forms of route guidance) may use these data as a source of information for measuring driver distractibility. Second, persons who make decisions regarding how traffic control devices are deployed and the quantity of information available (e.g., using a CMS to relay route diversion information versus using a CMS to reference a highway advisory radio message versus not using a CMS at all) should be able to use these data to estimate the extent (if any) that increased information increases driver distractions.

## **Implementation**

The data set that is collected would be used to estimate the expected level of distraction from proposed communications technologies that require a motorist's attention while driving.

## **Effectiveness**

It has been remarked that in the ITS area the safety evaluation tends to be an afterthought. Yet the dearth of empirical evidence cannot be ignored—there can be a tendency to study what one can measure. For the foreseeable future, it appears that much of the ITS efforts are centered on providing real-time information to motorists. Given that some of this information will be coming to motorists en route and that the conventional wisdom (correct or not) is that motorists are already receiving possibly more information than they can absorb, it is only logical that one ask to what extent, if any, additional information would increase crash risk. While measuring the distractibility of billboards is an imperfect, crude data probe, it is one step toward developing and obtaining data to answer this question.

## SECTION 3

# Methodology

### IMPROVING TRAVEL EXPOSURE METRICS

*Lisa Aultman-Hall, University of Connecticut*

#### **Problem**

Highway safety analysis has typically relied on the aggregate exposure metric of vehicle miles traveled (VMT) to estimate crash rates in terms of crashes per million vehicle miles. However, as researchers and practitioners continue to increase their focus on human, vehicular, and environmental countermeasures, other, more disaggregate measures of travel exposure are needed. For example, crash rates disaggregated by age, gender, weather conditions, blood alcohol level, or with and without seatbelts are needed. Crash statistics disaggregated by these details are readily available; however, the corresponding measure of travel exposure is not. Therefore, it is not possible to calculate and compare disaggregate crash rates.

#### **Objective**

To determine a methodology to collect disaggregate travel exposure measures routinely and extensively.

#### **Related Work**

Several researchers have sought to overcome the lack of disaggregate exposure metrics by using the crash database itself to measure the relative amount of travel undertaken by different groups of drivers under various driving conditions. This quasi-induced exposure technique uses the not-at-fault drivers in two-vehicle crashes as a sample of the overall driving public.

#### **Urgency**

High.

#### **Cost**

\$300,000 (to include the development of a methodology as well as initial prototype data collection exercise).

#### **User Community**

Safety researchers, federal and state governments, police agencies, and insurance companies.

## **Implementation**

The implementation may require a change in the routine data collection mechanisms used by government agencies.

## **Effectiveness**

A properly conducted research project could influence government to improve their data collection efforts in this area. Researchers can no longer rely on extrapolating VMT from traffic counts. More creative techniques are needed. Methods to estimate disaggregate travel exposure based on sampling in random locations might include surveys, focus groups, or sophisticated video traffic counting measures.

## **WHEN CAN REGRESSION RESULTS YIELD ACCIDENT MODIFICATION FACTORS?**

*Ezra Hauer, Consultant*

## **Problem**

Results from statistical regression studies are often used to estimate the safety effect of grade, lane and shoulder width, sight distance, etc. The problem is that in such studies it is difficult to distinguish between cause and effect and between correlations that are not causal in nature. As a result, the estimates of accident modification factors so obtained differ from study to study and are unreliable. Yet, there is no practical substitute for multivariate regressions as a source of knowledge about the safety effect of many design decisions.

## **Objective**

To identify techniques of multivariate statistical modeling that has a good chance of yielding cause–effect interpretations and to specify the circumstances in which they do so.

## **Related Work**

This work is needed to fill a gap in the literature. A comparison of available multivariate techniques is called for.

## **Urgency**

Identifying the causal relationships between roadway features–configuration and safety is key to more efficient use of available funding. It would also be a boon to project designers, who often need to justify design elements that are believed to have a safety benefit.

## **Cost**

Estimated \$50,000 for research and report writing.

## **User Community**

Those who need to incorporate safety in design and operational decisions.

## **Implementation**

Once the results of the study are publicized, it is anticipated that two things will happen. First, researchers will adopt the recommended techniques in studies attempting to identify causal relationships. Second, those causal relationships will be used by the highway engineering community as a more firm basis for design of safety features.

## **Effectiveness**

The effectiveness of this research will depend on the ability, ultimately, to identify causal relationships by using multivariate statistical analyses. It is likely that appropriate techniques can be identified and validated.

## **STUDY THE RELATIONSHIP BETWEEN ACCIDENT PROPENSITY/RATE AND TRAFFIC CONFLICTS OR NEAR-MISS SITUATIONS**

*Safety, Data, Research, and Analysis Committee*

### **Problem**

For low-frequency, high-cost events, the lack of prior data dooms safety practitioners to a reactive (postevent) mode of operation. It has been proposed repeatedly that near-miss situations could provide the necessary volume of data to expand our understanding of real events such that a more proactive stance could be taken. Unfortunately, often the only way to validate a near-miss model is by having enough actual events available to support statistical comparisons between the near misses and actual events. One such area where sufficient data do exist is in traffic conflicts in comparison to actual crash frequency or dynamics.

### **Objective**

To develop a methodology for validating a model of near-miss crashes against actual events.

### **Related Work**

The FAA has extensive data on near misses and is able to compare the predictions arising from near misses to actual incidents. The problem in this case is that actual incidents (airplane crashes, accidents involving airplanes on the ground, etc.) are quite rare. As a result, the predictive power of near misses in commercial aviation cannot be verified.

In the realm of traffic and highway safety, traffic conflicts have been a matter of engineering concern for decades. The methods for characterizing the potential safety impact of conflicts are also well established. However, the data from actual incidents on highways (i.e., crashes) has not been well predicted by studies of conflicts or near misses have to date.

## **Urgency**

Near-miss analysis and traffic conflict analysis are both related to the identification and characterization of potential incidents, things that might happen if certain steps are not taken. As the volume of traffic increases, the chances that one of the predicted type of incidents will occur increases (opportunity grows). This research on linking predictions of incidents to actual incidents, and thereby validating the method for use in project design, will grow more urgent as traffic volumes increase.

## **Cost**

Estimated \$70,000 for the study.

## **User Community**

Highway and traffic engineers at the local, state, and federal level; safety advocates; and program managers.

## **Implementation**

The implementation of a new methodology making use of traffic conflict analyses and near-miss analyses could become part of the standard data collection and analysis methods employed by highway and traffic departments in the United States. In most cases, the necessary data on conflicts are already available. The data on near-miss events should be easy to gather through short-duration field studies and thus reduce the need for more expensive and often-delayed studies of accident data.

## **Effectiveness**

With a valid methodology linking predictions to actual events, it should be possible to implement proactive highway safety programs at specific locations.

## **METHODS TO IMPROVE ALCOHOL TESTING OF CRASH-INVOLVED DRIVERS**

*Dennis Utter, National Highway Traffic Safety Administration*

### **Problem**

Methods are needed to improve or increase reporting of alcohol involvement in crashes, especially fatal crashes. Much of the data currently published are modeled. Priority needs to be placed on the collection of this information to avoid conflicts in reporting between federal numbers and state and local numbers. Previous analyses by the California Department of Motor Vehicles (among others) have shown that the NHTSA imputed alcohol involvement rates in fatal crashes, which were not originally intended for state-level reporting, do not match the data collected and reported by the states. The mismatch between state and federal estimates is not entirely on account of underreporting. Some analysts have mistaken the imputed alcohol

involvement estimates at even the crash level—deciding that a given driver was drunk because the model says he was not because there is actual proof of the fact. The only solution to this problem is complete data collection and reporting of the blood alcohol content (BAC) for every driver involved in a serious or fatal crash.

### **Objective**

Develop a recommended standard operating procedure and methodology for law enforcement agencies to use at the scene of serious (potentially fatal) and fatal crashes.

### **Related Work**

NHTSA has developed accurate alcohol imputation methods for use at the national level. The imputation is added to the Fatal Accident Reporting System (FARS) data to give a more accurate estimate of the proportion of fatal crashes involving alcohol-impaired drivers. States have developed methods for collecting the data that are entered into the FARS system, including ways to follow up when required data are missing from the source documents (crash reports, death certificates, medical examiner reports, etc.). The goal of this project is to find practices that will work for the states and for law enforcement agencies within the states to provide a much higher level of reporting than is currently achieved.

### **Urgency**

The dispute over annual alcohol estimates is a serious concern for states and NHTSA. In addition, with missing data in the FARS system, analysis of alcohol's role in our crash experience is always flawed. If researchers use the raw data without imputation, it is certain that they are underestimating the proportion of alcohol-involved crashes and the proportion of drivers who had been drinking before a crash. In contrast, it has been demonstrated repeatedly that the imputation numbers are valid only at the national level, and yet researchers continue to use them on a case-by-case basis and thus perpetuate misconceptions about types of crashes and the relationship between BAC levels and crash likelihood.

### **Cost**

A review of state practices for no more than six medium to large states with a good record of reporting BAC levels of drivers in fatal crashes should cost no more than \$70,000.

### **User Community**

Alcohol-related safety researchers and program planners would be the primary beneficiaries of improved reporting. Decision makers at the state and federal level would also benefit by being released from a sometimes acrimonious debate over the “true” alcohol-involvement rate to focus more on solutions rather than trying to agree on the “real” extent of the alcohol-impairment problem.

## **Implementation**

It is anticipated that states would welcome guidelines on how to implement reporting improvement programs. Depending on the contents of those recommendations, it is also anticipated that state and local law enforcement agencies would be able to use the synthesis as a source of new training for field officers.

## **Effectiveness**

This is the only effective way to ensure good data on alcohol involvement and BAC levels. Its effectiveness will depend entirely on the ability of states to pursue the recommended changes in procedures and on law enforcement agencies' willingness to collect additional data, even when the officer at the scene does not think it necessary (i.e., when the officer feels certain that a given driver had not been drinking).

## **DEVELOP A RESEARCH METHODS HANDBOOK**

*Robert A. Scopatz, Data Nexus, Inc.*

## **Problem**

Most practitioners in highway safety have not had sufficient experience or training to allow them to conduct valid research studies or to procure data on key issues in a valid, reliable manner. As a result, the quality of data-driven decision making suffers.

## **Objective**

Development of a research methodologies handbook that focuses on safety evaluations (including ITS evaluations).

## **Related Work**

Recently, NCHRP produced a synthesis of statistical methods for highway safety evaluation. In addition, a major project was completed and resulted in a statistical data analysis guide for practitioners. The proposed research methods guide is viewed as a companion piece to these efforts. It would be a primer of research methods that would document issues in geographic, temporal and user sampling, random assignment, quasi-experimental and experimental design, critical thinking on causal relationships versus correlated (non-causal) relationships, and the like.

## **Urgency**

Most highway departments conduct studies of one sort or another (most typical are pre- or postaccident and matched locations comparisons). The quality of these studies is key to the ability of decision makers to use the results in a valid and reliable fashion later on. The problems of conducting valid research in a naturalistic traffic environment are such that most practitioners are likely to be unaware of key barriers to validity, or if they are aware of them, they do not

know of the tried and true ways of dealing with them. This synthesis is needed to provide easily accessible assistance that most practitioners would need.

### **Cost**

Estimated cost of \$100,000.

### **User Community**

The intended audience could be both researchers conducting advanced evaluations and practitioners needing guidance on local evaluations.

### **Implementation**

It is anticipated that every highway safety and safety program office in every state would wish to own a copy of this guideline. Many local jurisdictions might also be interested because it could help them to design studies better and these studies would then be eligible for grant funding.

### **Effectiveness**

The goal of providing assistance in statistical methodologies (as has already begun implementation through NCHRP and others) and in research methods is to improve the quality of data-driven decision making. To that end, a simple-to-use guideline written specifically for practitioners makes sense. If it is simple to use, practitioners will access it as a short-cut for designing studies. If that happens, studies will more likely be conducted with valid methods, and the resulting data will be reliable and useful for decision making.

## **METHODOLOGY FOR ASSESSING THE SAFETY IMPACT OF ITS TECHNOLOGIES**

*Safety, Data, Research, and Analysis Committee*

### **Problem**

ITS has potentially a major impact on safety. Research is needed to quantify this impact in terms of (a) currently implemented ITS technologies and (b) the potential of future ITS deployment.

### **Objective**

A framework of data-gathering procedures, safety evaluation, and safety impact estimation methods would result from this effort for various ITS areas. In particular, the goal would be to identify a set of standards for data collection and evaluation–impact estimation methods. The document would give examples of well-done studies making the ITS–safety link using valid methods. Major sections would discuss the incorporation of data collection functions into ITS technology, the importance of event-based or continuous data recording, the integration of various ITS technologies as data sources, and the use of data in evaluation or impact estimation.



### **Related Work**

The entire ITS effort is related to the need for safety data collection and analysis. More important, however, is the literature on statistical evaluation and research methodology. The goal is to set a minimum standard for ITS technology research making safety-related claims.

### **Urgency**

New technologies are being proposed and implemented on an ongoing basis. The research that shows a valid, reliable estimate of the impact of new technologies on safety is lacking. This lack not only impedes progress of implementing useful technologies but also means that the good cannot be sorted from the bad or less useful technologies.

### **Cost**

Estimated \$70,000 to complete a study and define a research methodology.

### **User Community**

The ITS community, safety advocates, and U.S. Department of Transportation.

### **Implementation**

The methodology will be designed for implementation by any research team attempting to validate the safety impact of a given technology.

### **Effectiveness**

By setting standards for data collection and analysis, the research proposed here would be useful in ensuring that new studies of ITS effectiveness are comparable and that the results are meaningful.

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