Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program (SHRP 2) Letter Report: May 3, 2013

DETAILS

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AUTHORS

Committee on the Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

May 3, 2013

Mr. Victor M. Mendez
Administrator
Federal Highway Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Mr. David L. Strickland
Administrator
National Highway Transportation Safety Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Mr. Bud Wright
Executive Director
American Association of State Highway and Transportation Officials
444 North Capitol Street, NW
Suite 225
Washington, DC 20001

Subject: First Report from the Committee on the Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program

Dear Mr. Mendez, Mr. Strickland, and Mr. Wright:

In response to a request from the U.S. Department of Transportation (US DOT), the National Research Council (NRC) formed a committee to examine the long-term stewardship requirements for the second Strategic Highway Research Program (SHRP 2) driving-safety data and to provide advice on strategies for meeting those requirements. (See Appendix A for the committee's statement of task and Appendix B for biosketches of the committee members.)

At the committee's first meeting, which was held in February 2013, US DOT presented four overarching objectives for the driving-safety data: maximum accessibility by qualified researchers commensurate with consent agreements signed by study participants, protection of the privacy of participants, data security, and development of tools to facilitate widespread and maximum use of the data.[1] US DOT asked that the committee's initial activities include providing input within a few months on the following topics:

- The ownership arrangement that best enables US DOT to meet its objectives, including consideration of possible ownership partnerships;
- Structure and/or models that will enable US DOT to meet its objectives in the best manner, taking into consideration the diverse needs of stakeholders; and
- Key elements to consider in a transition plan to the eventual owner, including necessary activities, overall costs (e.g., personnel, information technology requirements), and timeline.

[1] Presentation to committee by Tony Furst, Associate Administrator for Safety, Federal Highway Administration, U.S. Department of Transportation, Feb. 19, 2013.

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

500 Fifth Street, NW
Washington, DC 20001

Phone (202) 334-2934
Fax (202) 334-2003
www.TRB.org

This letter report responds to US DOT's recent request and provides consensus recommendations (shown in bold) within the context of the committee's statement of task. To inform its deliberations, the committee heard various presentations and considered written information (see Appendix C). This report has been reviewed in draft form in accordance with procedures approved by the NRC Report Review Committee (see Appendix D for a list of reviewers). The limited scope of this first report did not permit the committee to consider all aspects of its statement of task in detail at this time. The committee will continue to consider various issues discussed in this report as well as other issues, as it carries out the remainder of its study and prepares subsequent reports.

EXPECTED BENEFITS OF SHRP 2 SAFETY RESEARCH

SHRP 2 was authorized by Congress to address highly pressing needs related to the nation's highway system, including the reduction of highway deaths and injuries.[2] It is administered by the Transportation Research Board (TRB) of the NRC under a memorandum of understanding with the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO).[3,4]

The main goal of the SHRP 2 safety research program is to obtain a better understanding of the role of driver performance in traffic safety. This includes how the driver interacts with and adapts to the vehicle, traffic, roadway characteristics, traffic-control devices, and environmental conditions. The intent is to obtain a better understanding of how these factors and their interactions affect collision risk.[5]

Data collected under SHRP 2 include the Naturalistic Driving Study (NDS) data[6] and the Roadway Information Database (RID).[7] NDS data are collected about volunteer drivers in the context of their natural driving behaviors. NDS data, which are collected continually during a vehicle trip, include data such as driver performance, mechanical information about the moving vehicle, and aspects outside the vehicle (e.g., weather conditions, road conditions, and interactions with other vehicles). These data provide valuable information on conditions that existed immediately before a collision or a near miss.

[2] SHRP 2 was authorized under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Section 5210 (Public Law 109-59), through federal fiscal year 2009. Continuing resolutions extended the program through March 2015.

[3] http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/General.aspx.

[4] The AASHTO executive director is included as one of the addressees of this letter report because state departments of transportation are highly involved in SHRP 2 implementation and they have provided funding for it. Thus, the financial implications of the committee's advice may be relevant to funds distributed by those departments.

[5] http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/The-SHRP-2-Naturalistic-Driving-Study-472.aspx#objective.

[6] http://forums.shrp2nds.us/.

[7] http://www.ctre.iastate.edu/shrp2-s04a/.

The Virginia Tech Transportation Institute (VTTI) provides technical coordination for the NDS data-collection sites and houses all the NDS data. Data for the RID (e.g., number and type of lanes and road curve characteristics) are being collected by the Center for Transportation Research and Education (CTRE) of Iowa State University. RID is important for relating driver actions to the roadway characteristics. Development of the SHRP 2 driving-safety data required funding of greater than $70 million. This money came from funds that otherwise would have been provided to state DOTs for highway construction and related activities. At the request of AASHTO, Congress dedicated some of the highway funds for SHRP 2 research. In addition, new funds for implementing the results of SHRP 2 (including the results of SHRP 2's safety research) are being provided by the state DOTs from funds that otherwise would have supported each state's planning and research activities.

The data offer the highway safety community an extraordinary opportunity to study direct relationships between driver behaviors and safety outcomes. There is substantial potential that the data will produce unique and important research results over several decades, leading to public benefits through improved highway safety. Improved safety could be realized through the development of new and improved countermeasures, including targeted policies for mitigating risky driving behavior, in-vehicle safety technology, roadway countermeasures (e.g., improved signing and marking), and advances in vehicle design.

The collection of SHRP 2 driving-safety data is scheduled to be completed by November 2013. The full set of data will be complex and huge (about 4 petabytes of data describing 4 million vehicle trips). It includes categorical data (e.g., vehicle type), samples collected at different rates (e.g., speed and GPS position), and video data from four on-board cameras. Preparation of the collected data for use by researchers is ongoing and will be completed in 2014. A critical issue in collection, processing, and dissemination of the data is maintaining the protection of privacy for participating drivers in a manner that is consistent with the requirements of the consent agreements they had signed.

Because SHRP 2 is scheduled to end in March 2015, planning for what comes next is imperative if steps are to be taken to have a new regime in place by that time. The benefits of increased safety, including lives saved, will not be substantially realized without an effective and rapid transition from data collection to widespread data use by researchers.

An important priority is planning for the long-term administration of the driving-safety data to ensure it will be available and accessible to researchers after SHRP 2 ends. A successful transition from data collection to user access will involve important decision making about data pricing and accessibility, availability of skilled support for researchers, and adequate protection of confidential information about study subjects.

A PHASED APPROACH FOR MAKING LONG-TERM DECISIONS ABOUT THE SHRP 2 DRIVING-SAFETY DATA

At the committee's February 2013 meeting, Mr. Tony Furst, Associate Administrator for Safety, FHWA, indicated that US DOT is proceeding rapidly with a process for deciding the long-term disposition of the completed driving-safety data. He indicated that the committee's input is needed very soon concerning the eventual owner and steward of the data, as well as key elements to consider in transition to the eventual owner.

The committee agrees that there is urgency in addressing these issues. We are fully supportive of the need for making the data available without delay, because a delay can cost lives. However, based on the committee's review of the available information and the members' knowledge and judgment, the committee's principal finding is that there is far too little experience with the use of driving-safety data at the scale and complexity of the SHRP 2 safety data and there are far too many uncertainties to make firm decisions about long-term institutional and financial arrangements concerning the data at this time. The committee believes it would be a mistake to make long-term commitments that could close the door on other options in the absence of additional information that will only come from experience with research and analyses of these unique data, not all of which have been collected at the time of this report.

Therefore, the committee recommends a phased approach to the long-term administration of the data. The first phase (referred to in this report as Phase 1) would be used to develop and assess structures and processes for subsequent phases. Phase 1 would provide the means of reducing key uncertainties in particular areas, such as the extent of data usage by researchers, costs, possible funding sources, willingness of researchers and others to pay for access to the data and for analytic support, and types of facilities and technologies for user access (e.g., remote terminals). It would provide a basis for evidence-based decision making and thus substantially lessen the risk of implementing an organizational structure that is based on faulty assumptions about costs and market response, which is an outcome that could disrupt ready access to the data by researchers and compromise future research projects.

Phase 1 needs to be of sufficient duration to obtain enough experience with the uses of the data in order to assess long-term implications, including data use, data protection, and costs. Many topics must be considered and users with a variety of backgrounds will likely be involved. For individual projects that will be conducted during Phase 1, time will be needed for project selection and funding. If funding is to be provided through the Phase 1 program, it may take 6 to 12 months to issue a request for proposals, evaluate proposals, and establish funding contracts with the researchers. If researchers were to provide their own funding to support their analyses, time would be needed to confirm that the proposed analysis could be supported by the driving-safety data and that required privacy provisions could be met. Before the full analysis is carried out for a particular project in Phase 1, trials would be needed to determine if a proposed approach produces the desired data. Additional time would likely be needed for projects requiring video reduction. Rather than conducting all the planned projects in parallel during Phase 1, it would be more practicable to stagger the start times of the projects to spread out the operator's workload. Time would be needed to produce reviewed and published research results.

In addition to conducting analysis projects, it is important for Phase 1 to include time to develop and test strategies for disseminating information about the data to researchers in an effort to foster and encourage data use, evaluate efforts to ensure confidentiality, and identify long-term sustainable funding strategies for subsequent phases. Work is currently under way to develop smaller data sets, with personally identifying information (PII) removed or transformed. This will allow users to access data sets directly through a web-based interface. There will need to be some evaluation of both the kinds of reduced data provided and the usability of the interface. There may also be a need to test different modes of data access and identify those that work best for different types of researchers. This may involve testing remote secure access sites. Also, it may be necessary to develop special hardware and software capabilities to support secure remote access sites.

To allow sufficient time for completing **the kinds of activities noted above, Phase 1 should last about 5 years. Governance planning should begin as soon as possible in 2014 or earlier while SHRP 2 is still in effect. During Phase 1, planning for future phases should consider a full range of options for institutional arrangements and funding. Planning for subsequent phases should neither assume nor rule out a priori any options for institutional arrangements and funding.** It may be that such institutional arrangements will need to make multiple transitions over the years as conditions and technologies evolve, results are produced, and the community of researchers who use the data develops.

DEFINITIONS OF KEY ROLES IN ADMINISTERING THE SHRP 2 DRIVING-SAFETY DATA

The committee considered the definitions of key terms presented by US DOT for the roles of ownership, stewardship (i.e., governance), and operation with respect to the SHRP 2 driving-safety data (see Appendix E). Stewardship would involve a board of stakeholders and other experts who develop policies for the governance of the data. The board would be convened by the owner (see Figure 1).

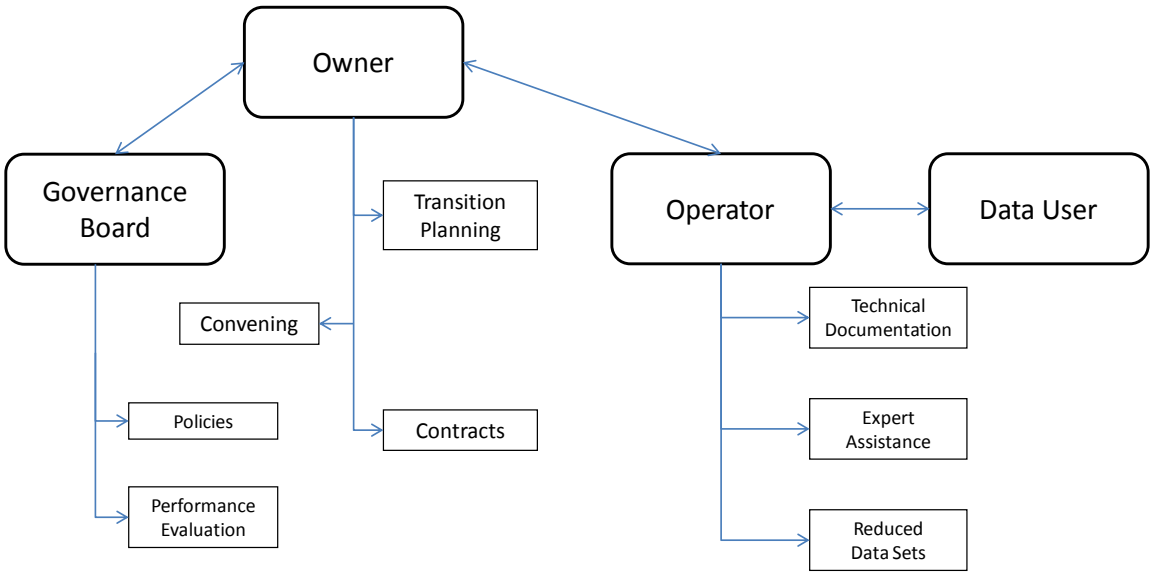

FIGURE 1. Illustration of various roles of the owner, governance board, and operator in the proposed Phase 1.

Ownership

The owner of the driving-safety data is responsible for upholding privacy protections, working to meet legal requirements, promoting ease of data access to qualified users, working to ensure adequate user support, working to secure ongoing financial support from various sources (including public and private sources), promoting use of the data, and overseeing the operation and

maintenance of the data.[8] The owner also assesses the value of the results produced by the driving-safety program for the purpose of guiding the development of access rules, pricing, and promotion of specific applications. This would help ensure that the data are used effectively to promote the public good and provide support for continued funding. The data owner may also be the system operator and may participate in governance activities. The owner ensures that governance decisions are implemented by the operator. In addition, the owner will need to ensure that its responsibilities and the responsibilities of the governance board and operator are clearly described**.**

The owner would have additional responsibilities related to Phase 1 that involve obtaining information needed to make long-term decisions about the driving-safety data. The owner would be responsible for planning the transition from the SHRP 2 safety program to Phase 1. The owner would also convene the governance board, contract with the operator, and ensure that technical documentation is in place for the SHRP 2 infrastructure and collected data. Because some researchers will not have had experience working with data of such large size and complexity, the owner will need to ensure that expert assistance is made available to the researchers so that they can get maximum value from using the data. **The owner should ensure that the operator develops reduced data sets[9] containing events of interest to safety researchers, which will lessen the resource burden on individual projects.**

Governance

The committee recommends that US DOT move away from using the term "stewardship" and replace it with "governance," which is a more precise and descriptive term for the functions required (e.g., making critical policy decisions about data access, information privacy, security, pricing, types of product offerings, and performance evaluation). Governance more explicitly connotes the responsibility for policy management regarding data use and data protection, and the obligation to work within legal and institutional requirements.

These functions are best accomplished by a governance board or oversight committee composed of stakeholders and other interested individuals with relevant expertise. It would be incumbent upon the board to stay abreast of new technical developments relevant to the housing and access of the data, as well as new developments in data protection. The policies developed by the governance board would be put into practice by the operator.

As discussed later in this report, the governance board may have several unique responsibilities in Phase 1 regarding planning for and transition to subsequent phases. The governance strategy for future phases during the long-term use of these data may be different from the strategy in Phase 1.

[8] The concept of "ownership" in this context is intended to mean that an organization has responsibility and accountability for meeting legal and other requirements associated with controlling and managing the data.

[9] Reduced data sets are formed by extracting certain information from the raw data and transforming it into a more accessible format, consistent with protection of confidential data.

Operation

Following policies developed by the governance board, the operator provides the infrastructure and support necessary to house the data and make it available to researchers. This includes hardware and software, operation and maintenance, access control, and researcher support. The operator must have a thorough understanding of the data and expertise in working with very large and complex data sets that include personally identifying information, because users will present a range of research questions and have varied skills to answer them. In addition, the operator should be able to make various types of assistance available to researchers, such as:

- Help in setting up research questions and sampling the data within their cost constraints;
- Reduced data sets that can be used to become familiar with the data and answer multiple research questions;
- Evaluations of the suitability of computer code to be used for sampling and analysis;
- Advice for complying with institutional review board (IRB) requirements; and
- Educational workshops and training materials.

During Phase 1, the operator will need to provide substantially more assistance to researchers than is typical in order to foster the growth of the user community. This will require a broad skill set with multiple types of expertise to train and assist researchers in formulating and implementing effective analytic approaches. Also, to inform long-term decision making, the operator will need to collect data on user demand and the actual costs involved with providing user access and maintaining the data.

ADMINISTERING THE DATA DURING PHASE 1

Phase 1 Owner

As SHRP 2 comes to an end, critical work needs to be done in transitioning from collection of the data to developing a system that offers access to the data in an appropriate manner. The ownership of the data during Phase 1 needs to be decided as quickly as possible so that a governance board can be convened and planning can begin. The committee closely examined the options for ownership of the data presented in a recent study carried out by the Volpe National Transportation Systems Center (Volpe Center) in response to a request from FHWA.[10] The Volpe Center report identified three options for the long-term ownership of the driving-safety data. In the first option, NAS would retain ownership of the data. In the second option, NAS would turn over ownership of the data to one or more third parties or consortia of interested parties. In the third option, NAS would transfer ownership of the data to US DOT.

[10] Volpe National Transportation Systems Center of the US DOT Research and Innovative Technology Administration, Cambridge, Massachusetts prepared a draft report (dated Jan. 2013) that was provided to the committee: *Options for Long-Term Stewardship and Ownership of the SHRP 2 Safety Data*.

The Volpe Center concluded that "Options 2 and 3 would require development of a new management structure, funding mechanism, and expertise on the part of the data owner," and that NAS ownership of the data (Option 1) would present "the easiest transition to a post-SHRP 2 program" because it relies upon the current institutional structure. The committee concurs with this assessment and believes that addressing the transitional issue expeditiously is highly important. This is the only option available for Phase 1 that would not result in substantial delay in making the data available to researchers for the period after SHRP 2 has ended. To change course at this point would likely result in a disruption of access to the data by researchers. If NAS were to retain ownership during Phase 1, NAS would implement the policies established by the governance board through TRB and carry out the tasks mentioned above.

It is important to note that the committee did not assess the suitability of NAS for long-term ownership. The phased approach recommended by the committee will provide an opportunity to make a decision about long-term ownership in a more deliberate manner based on several years of experience. This will provide empirical information about key aspects, such as costs, data usage, and research interests. Without the proposed phased approach, long-term decisions would be based more on speculative information that may not provide a satisfactory resolution to the issues of concern. All three options identified in the Volpe Center report (and possibly others) need to be considered more carefully in the future in light of what is learned from the Phase 1 experience.

Phase 1 Governance Structure

A governance board, consisting of about 12 volunteer members, should be convened as soon as possible by TRB to support Phase 1. The board should include representation of stakeholders and other experts from constituencies such as the following:

- **State DOTs;**
- **AASHTO;**
- **Potential users of the data, including driving-safety researchers, original equipment manufacturers (e.g., motor vehicle manufacturers), and other private-sector users (e.g., the auto insurance industry);**
- **Researchers not directly involved with driving safety but who have relevant expertise and experience;**
- **Organizations (public and private) that manage and provide access to large and complex databases;**
- **Personal privacy advocates from the public or private sector with expertise in the ethical, legal, and/or technical aspects of protecting personal privacy;**
- **Experts on other legal issues (e.g., intellectual property); and**
- **US DOT (including both FHWA and NHTSA).**

The governance board would discharge the responsibilities outlined in the previous section within the bounds and resources specified by any agreement between the funding agency and the owner and within the legal and institutional requirements of the owner. The board would also oversee various aspects of Phase 1 planning, as discussed later in this report. The oversight committee for SHRP 2 research provides an example for consideration of how the board might function.

Phase 1 Operator

The governance board would be the appropriate entity to select the organization that can best fulfill the duties of the operator in Phase 1, including requirements to be specified in future funding agreements. This operator selection by the governance board would be a recommendation to the owner, which would enter into a contractual agreement with the operator. Considerations in making the selection recommendation to the owner would include cost, the ability to provide ready access to the data by researchers during the few years immediately following the end of SHRP 2, and other functions mentioned in the previous section. Although in principle the owner could also be the operator, that would not be feasible in Phase 1 if NAS were the owner of the data. NAS does not have the staff or the infrastructure to carry out the operator functions. Any agreement between the owner and the Phase 1 operator would need to allow for the opportunity of transferring operator responsibilities to one or several other organizations after Phase 1.

US DOT's Distinctive Role

Continued public investments will be required during Phase 1. The federal government is in the best position to provide that funding, and US DOT, acting through FHWA and/or NHTSA, is in the best position to be the responsible agency—negotiating with funding recipients, monitoring the public benefits of the results, and participating in program direction with other stakeholders. It is possible that other federal agencies, such as the National Institutes of Health and the Centers for Disease Control and Prevention, may contribute as public-sector funding partners.

By the end of Phase 1, the potential for revenue from users and various private sources should be better known and the need for US DOT to provide ongoing public support will be better defined.

OTHER LARGE-SCALE RESEARCH DATABASES

The committee considered a Volpe Center report, referred to as an environmental scan, that investigated how other organizations with large-scale research databases have met requirements similar to those of the SHRP 2 safety data.[11] The environmental scan report indicated that the databases it considered included at least some federal involvement, PII data or data with similar access restrictions, use of data primarily for research, and collection of fees for researcher support. The databases included the U.S. Census, particularly confidential data accessed through Census Bureau Research Data Centers (RDCs), and other data accessed through the National Center for Healthcare Statistics RDCs, Center for Medicare and Medicaid Services, and National Agricultural Statistics Service. The Volpe Center report did not identify any database with a significant amount of video or images that also contained PII or sensitive data.

The environmental scan report found that the driving-safety data will have characteristics, including funding mechanisms and vetting processes for data requests, that distinguish it from all the databases reviewed, making comparison of cost and requirements problematic. In addition, the report observed that a variety of approaches are used to respond to data requests from researchers, ranging from returning only sanitized results to providing encrypted hard drives. The report

[11] Volpe National Transportation Systems Center of the US DOT Research and Innovative Technology Administration, Cambridge, Massachusetts prepared a draft report (dated Jan. 2013) that was provided to the committee: *SHRP 2 Safety Data Stewardship Environmental Scan: Case Studies*.

suggested that the future steward or owner of the driving-safety data may wish to consider a variety of approaches for access to the data, particularly remote access, which is employed to some extent by all the databases it considered.

PHASE I PLANNING ASPECTS

Phase 1 is essentially a developmental phase requiring an experimental attitude to define the basis for planning long-term policies, structures, and processes. **Although the contractual date for SHRP 2 extends to March 2015, the governance board should begin its work as soon as possible in 2014 or earlier to prepare a Phase 1 plan to obtain key empirical information, such as the types discussed in this section. The plan should include development of a process and timeline for the Phase 1 activities. An important early task of the governance board is to recommend selection of the operator for Phase 1.**

Policies are needed for overall operation, data access, protection of confidentiality of personal information, and program evaluation. Development of an appropriate system architecture (providing guidelines for information, software, and processes used to support the system) over the expected life cycle of the data is an important part of the planning effort. Such development involves identification of responsibilities of the governance board, data owners, operators, and users. It also includes development of a set of principles that would need to be considered for management, use, and protection of the data. Planning for Phase 1 also needs to consider development of quality standards for the data. Given the long time span of expected data use, a preservation plan and model needs to be developed as part of Phase 1 activities, because the data will most likely be managed, distributed, and analyzed through different technical infrastructures over the next 30 to 40 years.

Products Portfolio

Phase 1 planning should identify the potential user groups that might be interested in accessing the data and the data products (e.g., researcher-friendly reduced data sets) that will need to be developed in 2014 so that they are ready and available for users by early 2015. Reduced data sets that do not include PII are important products for expediting data access by researchers. Making some of the products available to users at low cost (e.g., through subsidies) in Phase 1 and developing a library of software tools that could be used multiple times to address research questions requiring similar types of analytic approaches would foster the growth of a user base. Other important considerations include alternatives for providing researcher access, such as providing remote access to data, and identification of and addressing potential intellectual property rights associated with the data products and tools.

Economic Data and Funding Mechanisms

Phase 1 will provide the opportunity to obtain empirical data to characterize the potential demand for SHRP 2 research data, actual costs of producing products and providing researcher access, and users' willingness to pay (price elasticity) and ability to pay. **During Phase 1, rigorous estimates of cost elements should be obtained, including fixed costs (expenses that**

do not change in proportion to the amount of data usage, such as computer hardware costs) and marginal costs (incremental costs associated with providing data access to the next researcher). Efforts should be made to explore various demand-side cost-sharing structures.

The governance board would need to decide on strategies for marketing the data to potential users. Development of long-term sustainable funding will require serious consideration of private sources of funding, including public and private partnerships. Actual experience over time with real-world research will be essential to support setting fees that will balance promoting access and covering costs.

Program Evaluation

Phase 1 planning should include development of evaluation criteria and a process for collecting lessons learned. Projects now under way that are using the data currently available are an initial source of lessons learned, including project costs and any problems encountered with using the data. **The governance board needs to specify early on the kinds of information the operator should collect and the format it should use in reporting the results of Phase 1. However, the board should strive to ensure that required evaluations of cost and other aspects are not overly burdensome for the operator and others who are implementing Phase 1.** Assessing impact and quality by using information readily obtained from electronic searches of published research would expedite evaluations. For example, requiring use of a standard format for citation of the driving-safety data in research products could allow Internet searches conducted for impact assessments to find the products efficiently.

It is the committee's hope that the input provided in this letter report is responsive to your needs in planning for the long-term ownership, governance, and operation of this very important driving-safety data. It was the committee's intention to provide advice primarily from a strategic level for launching an effective developmental effort before making long-term commitments. In future letter reports, the committee plans to address some of the topics mentioned in this report, as well as additional topics, in greater detail.

Sincerely,

Joseph L. Schofer
Chair, Committee on the Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program

Attachments

Appendix A

Statement of Task

An ad hoc committee will examine the long-term stewardship requirements for the second Strategic Highway Research Program (SHRP 2) safety databases and will provide policy and technical advice, in the form of written reports, to the Congress and the U.S. Department of Transportation (US DOT) on recommended strategies for meeting these requirements. The committee will focus its recommendations on plans and future actions by the US DOT and other organizations that will be involved in the long-term stewardship of the SHRP 2 safety database. The committee is expected to provide recommendations concerning the following: resource requirements, including specific federal budget requirements, to administer the program; administrative and oversight structures, including institutional arrangements and legal requirements to carry out the tasks involved in long-term stewardship of the data; database management and security; and user access and support. The study is intended to support the overall purpose of the SHRP 2 safety data—to provide maximum access to the data for researchers over the next 30 to 40 years, while ensuring conformity to the data use conditions contained in the participant consent forms.

The project is sponsored by the U.S. Department of Transportation.

Appendix B

Biographical Information on the Committee on the Long-Term Stewardship of Safety Data from the Second Strategic Highway Research Program

Joseph L. Schofer is professor of civil and environmental engineering and associate dean of the Robert R. McCormick School of Engineering and Applied Science at Northwestern University. He is also director of Northwestern's Infrastructure Technology Institute, which focuses on monitoring and protecting surface transportation infrastructure. He chaired the Department of Civil and Environmental Engineering from 1997 to 2002 and was director of research and interim director of the Transportation Center for various periods until 2008. Dr. Schofer's research interests focus on planning and management of transportation systems, particularly the provision and use of data and information for effective decision making and evaluation of systems, plans, and projects. His current research includes studies of the sustainability of transportation systems, decision support for infrastructure preservation and rehabilitation, privatization of transportation facilities, and transportation policy. Dr. Schofer has been significantly engaged in transportation data issues through the technical activities of the Transportation Research Board, including the Data and Information Systems Section of the Policy and Organization Group; the Special Task Force on Data for Decisions and Performance Measures; and the Task Force on Understanding New Directions for the National Household Travel Survey. He is also currently a member of the SHRP 2 Technical Coordinating Committee for Capacity Research. Dr. Schofer chaired the National Research Council (NRC) Committee on Equity Implications of Evolving Transportation Finance Mechanisms. He also chaired the NRC Committee to Review the Bureau of Transportation Statistics' Survey Programs. He is a member of other advisory organizations, including the Congestion Pricing Technical Group for the Chicago Civic Consulting Alliance, and the Transportation Committee of the Chicago Metropolitan Agency for Planning. He earned a B.E. degree from Yale University and M.S. and Ph.D. degrees from Northwestern University, all in civil engineering.

John F. Adam is the highway division director and chief engineer for the Iowa Department of Transportation. He was appointed interim director in January 2010 and was permanently appointed in September 2010. In this position, Mr. Adam is responsible for all aspects of highway infrastructure, including right-of-way management, project development from design through construction and contract administration, and operation and maintenance of the system, including winter maintenance operations. Prior to holding the position of highway division director and chief engineer, he spent 8 years as the statewide operations bureau director, where he was responsible for the functional areas of maintenance, materials, contracts, construction, local systems, and specifications. Mr. Adam is an active member of the American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Highways, and the AASHTO Standing Committee on Highway Traffic Safety. He is a member of the Industry Advisory Council for the Construction Engineering Program at Iowa State University. He also serves on the executive board for the National Concrete Pavement Technology Center. Mr. Adam served as a member of the Iowa Highway Research Board for 10 years, and served as board chair for a portion of that period. He holds a B.S. degree in construction engineering from Iowa State University. He is a licensed civil engineer in the State of Iowa.

Troy E. Costales has more than 20 years of experience in transportation safety. He has served as the transportation safety division administrator at the Oregon Department of Transportation and governor's highway safety representative since 1997. Mr. Costales also serves as a member of the executive management team for the Oregon Department of Transportation. Before joining the Transportation Safety Division in 1997, he supervised the statewide crash data system. He has served for seven terms as a member of the board for the Governors Highway Safety Association (GHSA) and as chair of GHSA from December 2011 through August 2012, and he led the member services committee. Mr. Costales served as a member of the American Association of State Highway and Transportation Officials (AASHTO)–Standing Committee on Highway Traffic Safety; and as a team member for the revisions to the NHTSA impaired driving program management course. He is currently serving as a member of the Transportation Safety Management Committee and the National Cooperative Highway Research Program Panel 17-18 for the Transportation Research Board. Mr. Costales is also currently serving as a member of the AASHTO Strategic Highway Safety Plan initiative, and he is on the Technical Advisory Panel of the International Association of Chiefs of Police–Drug Evaluation and Classification Program. Panel. Mr. Costales received a B.S. degree in management from George Fox University.

Forrest M. Council is a senior research scientist at the University of North Carolina Highway Safety Research Center (HSRC), where he served as director from 1993 to 1999. He is also a senior research consultant to VHB, a transportation engineering firm in Vienna, Virginia. In his 40 years at HSRC, Dr. Council directed more than 20 projects and authored more than 150 articles and reports. His research has ranged from studies of motor vehicle injury for specific populations (children, beginning drivers, seat-belted occupants) to projects aimed at identifying and strengthening research methodologies in the roadway safety field. He has directed the planning, development, and implementation of FHWA's Highway Safety Information System, a database that contains crash, roadway inventory, and traffic volume data for nine states. Dr. Council chaired the National Research Council's Committee for Review of the Federal Motor Carrier Safety Administration's Large Truck Crash Causation Study and served on the Research and Technology Coordinating Committee and the Committee for Guidance on Setting and Enforcing Speed Limits. He has also served on several Transportation Research Board standing committees and National Cooperative Highway Research Program project panels. Dr. Council is chair of the SHRP 2 Safety Technical Coordinating Committee for Safety Research. He earned B.S., M.S., and Ph.D. degrees from North Carolina State University, all in civil engineering.

James P. Foley is a senior principal human factors engineer at the Toyota Technical Center in Ann Arbor, Michigan. At the center, he is a team leader for human factors research in the Collaborative Safety Research Center. He has more than 30 years of experience in automotive human factors, traffic safety, and intelligent transportation system (ITS) technologies. Previously, he worked at Noblis, where he provided support and human factors expertise to the U.S. Department of Transportation and worked closely with the National Highway Traffic Safety Administration and the ITS program office. Dr. Foley is active in both SAE Safety and Human Factors and ISO WG8 committees. He is a member of the TRB Technical Expert Task Group on Data Access for the Naturalistic Driving Study. He received a Ph.D. degree in industrial engineering from Purdue University.

Michael J. Franklin is a professor of computer science at the University of California, Berkeley, specializing in large-scale data management applications and infrastructure. He works primarily in database and operating systems and networking technology areas. Dr. Franklin is director of the Algorithms, Machines and People Lab (AMPLab), an industry- and government-supported collaboration of students, postdocs, and faculty who specialize in data management, cloud computing, statistical machine learning, and other topics necessary for making sense of vast amounts of varied and unruly data. He is a founder of Truviso, a high-performance analytics software company in Foster City, California, that has been acquired by Cisco. Dr. Franklin is a member of the NRC Committee on the Analysis of Massive Data. He received a Ph.D. degree in computer science from the University of Wisconsin at Madison.

Nicholas J. Garber is the Henry L. Kinnier Professor Emeritus of Civil Engineering in the Department of Civil and Environmental Engineering at the University of Virginia. He has authored more than 120 refereed publications and reports and has co-authored two textbooks. He is a registered professional engineer in the Commonwealth of Virginia and a chartered engineer of the United Kingdom. He is also a Distinguished Member of the American Society of Civil Engineers (ASCE) and a Fellow of the Institute of Civil Engineers of the United Kingdom. He is a member of ASCE's Committee on Highway Safety and Traffic Operations and a former member of the editorial board of ASCE's Journal of Transportation Engineering. He has served as the principal investigator for many research projects sponsored by federal, state, and private agencies. His research areas include traffic operations and highway safety, with particular emphasis on intelligent transportation systems, speed management on high-speed roads, work zones, and large truck safety. Dr. Garber has served on the following committees of the Transportation Research Board: the Executive Committee, the Oversight Committee for the Second Strategic Highway Research Program, and the Committee on Research Priorities and Coordination in Highway Infrastructure and Operations Safety. Dr. Garber served as chair of the Transportation Research Board Committee on Traffic Safety in Maintenance and Construction Operations. Before joining the University of Virginia faculty, he taught at the University of Sierra Leone and the State University of New York at Buffalo and worked as an engineer in London and Sierra Leone. Dr. Garber received a Ph.D. degree in civil engineering from Carnegie Mellon University. He was elected to the National Academy of Engineering in 2004.

Rochel Gelman is professor of psychology and cognitive science in the Department of Psychology and Center for Cognitive Science at Rutgers, the State University of New Jersey. She has extensive experience working with observational (usually, videotaped) data and in pairing the observational method with experimental ones. Ongoing research in her lab includes studies of both verbal and nonverbal representations of numbers and arithmetic. Part of her research is focused on the task of developing the kind of theory of learning that accommodates both the early learning that occurs on the fly and the later learning that requires effort and a protracted period of time. Prior to moving to Rutgers, Dr. Gelman was on the faculties of the University of Pennsylvania and the University of California, Los Angeles. She received a Ph.D. degree in psychology from UCLA. Dr. Gelman was elected to the National Academy of Sciences in 2006.

Dorothy J. Glancy is a professor of law at the Santa Clara Law School of Santa Clara University. Her academic research interests include policy issues regarding privacy and advanced transportation programs known as intelligent transportation systems. Professor Glancy has served as a privacy auditor for the Metropolitan Transportation Commission in the San Francisco Bay Area, worked with the U.S. Department of Transportation regarding privacy policy issues, and served as a consultant regarding legal and regulatory issues for US DOT's Rural Interstate Corridor Communications Study Report to Congress (2007). She received a J.D. degree from Harvard Law School and a B.A. degree from Wellesley College.

Joanne L. Harbluk is a human factors specialist with the Ergonomics and Crash Avoidance Division of Transport Canada, which is responsible for transportation policies and programs within the Canadian government. She is active in research investigating the interaction of the driver, vehicle, and road systems. Her current work is focused on the safety of in-vehicle information and communication systems and the efficacy of crash avoidance and mitigation systems for drivers. She is involved with the Canadian Naturalistic Driving Study, which was undertaken with the goal of obtaining data on driver performance and behavior in the moments leading up to a crash. Dr. Harbluk is an adjunct research professor in the Psychology Department at Carleton University and an associate member of the Center for Applied Cognitive Research (Carleton University). She is chair of the Transportation Research Board's Technical Expert Task Group on Data Access for the Naturalistic Driving Study. She earned a Ph.D. degree in cognitive psychology from the University of Western Ontario and was a Fogarty International Research Fellow at the National Institutes of Health, Laboratory of Clinical Studies in the Cognitive Neurosciences Section.

Julia I. Lane is a senior managing economist at the American Institutes for Research in Washington, D.C. Previously, she served as a program director at the National Science Foundation, where she led a program to document the outcomes of science investments. Dr. Lane also served as a senior vice president at the National Opinion Research Center at the University of Chicago, where she developed and managed a data enclave to provide a protected environment within which authorized researchers could access sensitive data remotely. She was a senior research fellow at the U.S. Census Bureau. Dr. Lane's specialties are science policy; innovation policy; development and analysis of large scale databases; administrative, transaction and survey data; confidentiality; and workforce and economic development. She received a Ph.D. degree in economics and an M.A. degree in statistics from the University of Missouri at Columbia.

Daryl Pregibon is a research scientist at Google, Inc. His work focuses on data mining, the interdisciplinary field that combines statistics, artificial intelligence, and database research. From 1981 to 2004, he worked at Bell Labs and AT&T Labs and served as head of statistics research for 15 years. He is a past member of the NRC Committee on National Statistics, NRC Committee on Applied and Theoretical Statistics (past chair), and NRC Committee on Technical and Privacy Dimensions of Information for Terrorism Prevention and Other National Goals. He also served on the National Advisory Committee for the Statistical and Applied Mathematical Sciences Institute and he is a former director of the Association for Computer Machinery's Special Interest Group on Knowledge Development and Data Mining. In 1985, he co-founded the Society for Artificial Intelligence and Statistics. Dr. Pregibon received a Ph.D. degree in statistics from the University of Toronto.

Jerome P. Reiter is the Mrs. Alexander Hehmeyer Professor of Statistical Science in the Department of Statistical Science at Duke University. Dr. Reiter participates in both applied and methodological research in statistics. He is most interested in applications involving social science and public policy. His methodological research focuses mainly on statistical methods for protecting data confidentiality, for handling missing data, and for making causal inferences. Dr. Reiter served as a member of the NRC Panel on Collecting, Storing, Accessing, and Protecting Biological Specimens and Biodata in Social Surveys. He also served on the NRC Panel on Confidentiality Issues Arising from the Integration of Remotely Sensed and Self-Identifying Data. Dr. Reiter received a Ph. D. degree in statistics from Harvard University.

Johanna P. Zmud is director of the RAND Transportation, Space, and Technology Program. She has 24 years of experience in survey research design, implementation, and statistical analysis. Prior to joining RAND, she served as founding owner and president of NuStats, a U.S.-based survey science consultancy specializing in complex and large-scale social research studies. She has used social science and survey science practices in many areas of transportation research. Currently, she is co-chair of the International Steering Committee for Travel Survey Conferences. Dr. Zmud served on the NRC Committee on Equity Implications of Alternative Transportation Finance Mechanisms. She also served on the NRC Committee on Strategies for Improved Passenger and Freight Travel Data. She earned a Ph.D. degree from the Annenberg School for Communication at the University of Southern California.

Appendix C

Information-Gathering by the Committee

In the course of preparing this report, the committee held a public session as part of its first meeting in February 2013 to hear presentations from representatives of organizations involved in driving-safety research. The committee wishes to thank the following individuals for making presentations: Monique Evans, Tony Furst, and Jeff Michael, U.S. Department of Transportation; Jurek Grabowski, American Automobile Association Foundation for Traffic Safety; Shauna Hallmark, Institute for Transportation at Iowa State University; Jon Hankey, Virginia Tech Transportation Institute; Kelly Hardy, American Association of State Highway and Transportation Officials; and Neal Hawkins, Center for Transportation Research and Education at Iowa State University. Some of the presenters were joined by additional representatives of their respective organizations. The committee made use of a variety of documents and other sources of information, including three draft reports from the Volpe National Transportation Systems Center.[12]

[12] Volpe National Transportation Systems Center of the US DOT Research and Innovative Technology Administration, Cambridge, Massachusetts prepared three draft reports (each dated Jan. 2013) that were provided to the committee: *Options for Long-Term Stewardship and Ownership of the SHRP 2 Safety Data*; *SHRP 2 Safety Data Stewardship Requirements Document*; and *SHRP 2 Safety Data Stewardship Environmental Scan: Case Studies*.

Appendix D

Acknowledgement of Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Research Council Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report: Bernard J. Arseneau, Minnesota Department of Transportation; Dan J. Crichton, NASA Jet Propulsion Laboratory; Stephen E. Fienberg, Carnegie Mellon University; Gerald W. Gates, privacy consultant; Michael Perel, safety knowledge engineer; and Loren Staplin, TransAnalytics, LLC.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Louis J. Lanzerotti, New Jersey Institute of Technology; Henry G. Schwartz, Jr., consultant; and Susan Hanson, Clark University (emerita). Appointed by the National Research Council, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the author committee and the institution.

Appendix E

Administrative Definitions Provided by US DOT[13]

Steward. Responsible for overall governance of the data, including establishment of policies for data access, privacy and information security. Could be handled by governance board or oversight committee.

Owner. Responsible for upholding privacy protections, meeting legal requirements, controlling user access to the data, and overseeing operation and maintenance of the data. May also be the operator.

Operator. Provides infrastructure and support necessary to house the data and make it available to researchers. Responsibilities include hardware, software, O&M (operation and maintenance), access control, and researcher support.

[13] Presentation to committee by Tony Furst, Associate Administrator for Safety, Federal Highway Administration, U.S. Department of Transportation, Feb. 19, 2013.