NCHRP SYNTHESIS 370

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Animal–Vehicle Collision Data Collection

A Synthesis of Highway Practice

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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CONSULTANTS

MARCEL P. HUIJSER

JULIE FULLER

MEREDITH E. WAGNER

AMANDA HARDY

and

ANTHONY P. CLEVENGER

Western Transportation Institute

Montana State University

Bozeman, Montana

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

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Cover photograph: White-tailed deer on road near Glacier National Park, Montana. Martin Gierus.

FOREWORD

By Staff
Transportation
Research Board

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice.*

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

This synthesis will be of interest to state departments of transportation (DOTs) and departments of natural resources (DNRs), as well as to others who work with them in the area of animal–vehicle collision (AVC) data collection. It examines the extent to which data from AVC accident reports and animal carcass (AC) counts are collected, analyzed, and used throughout the United States and Canada. Most survey respondents reported collecting AVC data; fewer reported collecting AC data. The primary obstacles to improving AVC and AC data collection and analysis were determined to be a lack of a demonstrated need, underreporting, poor data quality, and delays in data entry. The use of more rigid and standardized procedures was specifically mentioned to address problems and improve procedures, as well as to improve the coordination between DOTs and DNRs that share a vested interest in the data.

Surveys were distributed to DOTs and DNRs in the United States and Canada. In addition, a literature review of AVC data collection was undertaken.

Marcel P. Huijser, Julie Fuller, Meredith E. Wagner, Amanda Hardy, and Anthony P. Clevenger, Western Transportation Institute, Montana State University, Bozeman, Montana, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

ANIMAL–VEHICLE COLLISION DATA COLLECTION

SUMMARY

Animal–vehicle collisions (AVCs) affect human safety, property, and wildlife, and the number of AVCs has substantially increased across much of North America over the last several decades. Systematically collected AVC data help estimate the magnitude of the problem and help record potential changes in AVCs over time. Such data also allow for the identification and prioritization of locations that may require mitigation. In addition, systematically collected AVC data allow for the evaluation of the effectiveness of mitigation measures in reducing the number of AVCs.

In the United States and Canada, AVC data are typically collected by transportation agencies, law enforcement agencies, and/or natural resource management agencies. These activities result in two types of data: data from accident reports (AVC data) and data based on animal carcass counts (AC data). However, not all transportation agencies, law enforcement agencies, and/or natural resource management agencies record these types of data. Furthermore, the agencies that do record such data often use different methods, resulting in difficulties with data integration and interpretation, and ultimately with the usefulness of the data.

This synthesis examines the extent to which AVC and AC data are collected, analyzed, and used across the United States and Canada. The data were obtained through a survey of departments of transportation (DOTs) and departments of natural resource management (DNRs) for each state or province. For DOTs and DNRs combined, the response rate was 89% (56 of 63 states and provinces).

Most DOTs and DNRs collect or manage AVC or AC data, or both. Most AVC data are actually collected by law enforcement agencies, whereas AC data are typically collected by the DOTs and DNRs themselves. The two agency types have a somewhat different motivation for collecting the data. DOTs primarily collect data to improve human safety (AVC and AC data), for accounting reasons (AC data), and, to a lesser extent, for wildlife conservation reasons (AC data). DNRs are motivated by a mixture of human safety and wildlife conservation concerns (AVC data) or primarily by wildlife conservation concerns (AC data).

Both AVC and AC data typically have reporting thresholds. In addition, the search and reporting effort of the programs varies tremendously between states and provinces and is not always consistent within a state or province. Furthermore, there is an emphasis on large wild and domesticated animals (deer size and larger), especially in AC data collection programs. These factors typically lead to a substantial underestimation of collisions with animals, both for AVC and AC data.

DOTs typically train their employees in collecting information on date and location of the AVC or AC, but they do not necessarily train their employees in the identification of the species or any other animal-related parameters. DNRs rarely provide training to their personnel, but if they do it is often concerned with animal-related parameters such as species identification, sex, age, and sometimes necropsy. Based on these results, additional training for DOT personnel may have to place more emphasis on animal-related parameters, especially species identification, whereas training for DNR personnel may have to be initiated altogether.

The spatial precision of the AVC and AC data is usually relatively low; typically 0.1 mi/km accuracy, sometimes even less precise. This may pose serious problems when attempting to pinpoint a location that may qualify for mitigation measures. Many DOTs and DNRs are aware of this issue and stress the importance of increased spatial accuracy for the location of AVCs and ACs; for example, through the use of a global positioning system.

DOTs mainly have engineers analyze the AVC and AC data using frequency and cluster analyses to identify hotspots. DNRs typically have the AVC and AC data analyzed by biologists. DNRs are also interested in identifying hotspots; however, they also use the data to detect wildlife population trends through trend analyses.

DOTs and DNRs identified the lack of a demonstrated need, underreporting, and poor data quality [consistency, accuracy (especially spatial accuracy), and/or completeness], and delays in data entry as the main obstacles to implementing or improving AVC data collection and analysis. Using more standardized procedures, global positioning system technology, faster data entry, centralized databases, and geographic information systems were specifically mentioned to address some of these problems and improve the data collection and data analyses process.

Finally, based on the results of the survey, a summary of “successful” examples, and a list of the needs and benefits of AVC and AC data collection programs, suggestions were formulated for initiating new, or improving existing, AVC or AC data collection programs.

CHAPTER ONE

INTRODUCTION

BACKGROUND

Animal–vehicle collisions affect human safety, property, and wildlife. In the United States, the total number of annual deer–vehicle collisions was estimated at more than 1 million in the early 1990s (Conover et al. 1995). These collisions were estimated to cause 155–211 human fatalities, 13,713–29,000 human injuries, and more than U.S. $1 billion in property damage a year (Conover et al. 1995; Williams and Wells 2005). In 2000, Canada experienced more than 30,000 collisions with animals resulting in 23 human fatalities, 1,887 human injuries, and more than U.S. $60 million in property damage (Tardif & Associates Inc. 2003). Similar figures are available from Europe, where the annual number of collisions with ungulates was estimated at 507,000, causing 300 human fatalities, 30,000 human injuries, and more than $1 billion dollars in material damage (Groot Bruinderink and Hazebroek 1996). In several regions in the United States and Canada these numbers have increased even further over the last decade (Hughes et al. 1996; Romin and Bissonette 1996; Khattak 2003; Tardif & Associates Inc. 2003; Knapp et al. 2004; Williams and Wells 2005).

In most cases the animals die immediately or shortly after the collision (Allen and McCullough 1976). In some cases this can include young animals that may not have been hit themselves but that were orphaned, resulting in reduced survival probability. In other cases it is not just the individual animals that suffer. Road mortality may also affect some species on the population level (e.g., van der Zee et al. 1992; Huijser and Bergers 2000), and some species may even be faced with a serious reduction in population survival probability as a result of road mortality, habitat fragmentation, and other negative effects associated with roads and traffic (Proctor 2003). In addition, some species represent a monetary value that is lost once an individual animal dies (Romin and Bissonette 1996; Conover 1997; Huijser 2006).

Systematically collected AVC data help estimate the magnitude of this problem and help record potential changes in animal–vehicle collisions over time. Such data also allow for the identification and prioritization of locations that may require mitigation. Furthermore, systematically collected animal–vehicle collision data can assist in the evaluation of the effectiveness of mitigation measures in reducing the number of animal–vehicle collisions.

In the United States and Canada, animal–vehicle collision data are typically collected by transportation agencies, law enforcement agencies, and/or natural resource management agencies, resulting in two types of data: (1) data from crash forms and (2) data based on animal carcass counts. However, not all of these agencies record animal–vehicle collisions. Furthermore, because agencies that do record such data often use different methods, difficulties with data integration and interpretation can arise, and the usefulness of the data may come into question.

SYNTHESIS OBJECTIVE AND SCOPE

This synthesis examines the extent to which animal–vehicle collision data are collected, analyzed, and used across the United States and Canada. The data were obtained through a survey of transportation agencies and natural resource management agencies in each state or province. Other organizations or individuals that collect AVC or animal carcass (AC) data (e.g., hospitals and private individuals) were identified through interviews with representatives of transportation and natural resource management agencies, but were not approached for separate or additional interviews. In addition, this synthesis does not include data that describe human injuries or fatalities as a result of animal–vehicle collisions as collected by some hospitals.

In addition to the survey, this synthesis reviews the literature on animal–vehicle collision data collection practices. The review focused on the parameters recorded, other methodological aspects, and the management applications of the data. Furthermore, this synthesis describes successful examples of animal–vehicle collision data collection, the needs and benefits of data collection programs, and presents suggestions for initiating or improving such programs.

REPORT ORGANIZATION

Chapter two reviews the literature on animal–vehicle collision data collection practices. The review focused on the parameters recorded, other methodological aspects, and the application of the data. Chapter three reports on the survey of U.S. and Canadian transportation and natural resource management agencies. Chapter four gives successful examples of animal–vehicle collision data collection practices. The conclusions, the needs and benefits of data collection programs, and suggestions for initiating or improving data collection programs are cited in chapter five.

DEFINITIONS

Data Types

In the preceding sections of this chapter the term "animal–vehicle collision data" was used in a broad and general sense. The chapters that follow distinguish between two types of data:

- Animal–vehicle collision (AVC) data: accident reports (e.g., data on property damage and potential human injuries and fatalities), with or without corresponding animal carcass data (see next definition). These data are often collected by personnel from law enforcement agencies and submitted to the state or provincial transportation agency for further analyses.
- Animal carcass (AC) data: data on animal carcasses observed and/or removed on or along the road, with or without corresponding accident reports (see previous definition). These data are often collected by road maintenance personnel from the state or provincial transportation agency or by personnel from natural resource management agencies that may or may not submit these data to the state or provincial transportation agency for further analyses. AC data collected by other organizations or individuals were not part of this survey.

Distinguishing between these two types of data is important because the data are often collected with different or only partially overlapping objectives, resulting in different methodologies for data collection and separate databases and analyses.

Geographical Areas Surveyed

The survey was conducted among transportation agencies and natural resource management agencies in the United States and Canada. When this report refers to the "United States" it refers to the 50 states of the United States of America, excluding the District of Columbia (Washington, D.C.). When this report refers to Canada it refers to the 10 provinces and 3 territories (Northwest Territories, Nunavut, and Yukon Territory). In the following chapters, Canadian provinces and territories are referred to with the term "provinces," which includes the three territories.

Organization Names and Groups of Organizations

Transportation agencies at the state or provincial level are often named a "Department of Transportation (DOT)." However, transportation agencies of some states or provinces can have a different or slightly different name (e.g., Alaska Department of Transportation and Public Facilities and British Columbia Ministry of Transportation). For this synthesis report all transportation agencies at the state or provincial level are referred to as departments of transportation (DOTs).

Natural resource management agencies at the state or provincial level are often named a "Department of Natural Resources (DNR)." However, the natural resource management agency of some states or provinces has a different or slightly different name (e.g., Arizona Game and Fish Department, Ministère des Ressources naturelles et de la Faune de Québec). For this synthesis report all natural resource management agencies at the state or provincial level are referred to as departments of natural resources (DNRs).

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

Animal–vehicle collisions are not only a safety and economic concern for humans, but also typically result in road-killed animals (see chapter one). Road-killed animals are perhaps the most noticeable negative effect of roads and traffic on the natural environment, with publications documenting such incidents as early as the 1920s and 1930s (Stoner 1925; Dreyer 1935). However, road-killed animals are not the only negative effect of roads and traffic on the natural environment. Other effects can be grouped into the following categories: direct habitat loss as a result of the presence of a road, habitat fragmentation as a result of a linear barrier in the landscape, and reduced habitat quality in a zone adjacent to the road (see overviews by Forman and Alexander 1998; Evink 2002; Spellerberg 2002; Forman et al. 2003; Iuell et al. 2003; National Research Council 2005). However, this literature review focused on publications that dealt with animal–vehicle collision (AVC) data and animal carcass (AC) data only (see Appendix A). The 54 publications that were reviewed originated primarily from the United States and Canada. The publications were reviewed with regard to two issues: (1) What parameters were collected? and (2) What was the purpose of collecting and analyzing the data?

PARAMETERS COLLECTED

A survey of published literature revealed that the parameters most commonly collected and used in analyses are the date, location, and the species name of the animal involved (see Appendix A for summary table). The precision of the animal's location varies between studies, but usually ranges from within 5 ft through the use of global positioning system (GPS) technology, to one mile (Bissonette and Hammer 2000; Clevenger et al. 2003). Reference posts (miles or kilometers) are often used, and a vehicle's odometer is sometimes used to estimate the distance to the nearest 0.1 mi or 0.1 km from a mile marker (Garrett and Conway 1999). Many studies are species-specific, making species identification an assumed parameter (Bashore et al. 1985; Garrett and Conway 1999; Aresco 2005). Studies that examine road-killed animals for multiple species also usually identify the animals concerned to the species level. Studies involving small taxa are sometimes unable to positively identify the species because of severe mutilation (Oxley et al. 1974; Sielecki 2004). The inability to identify collision victims is less of a problem for larger species. However, data sets derived from crash forms may not report the species name of the animal involved, regardless of the size of the animal (see chapter three).

The sex and age of the animals concerned are the next most common parameters collected in AVC and AC data sets. However, these parameters are less likely to be collected for species for which the sex or age are not easily identifiable (e.g., amphibians, reptiles, and small mammals). "Time" is also collected; however, for AC data it is not always clear if the time corresponds to when the collision occurred or when the animal carcass was found. This ambiguity is less common in AVC data. Additional but less commonly collected parameters found in the literature include the fate of the animal (Biggs et al. 2004); condition of the animal (Gunther et al. 1998); and the occurrence or severity of property damage, human injuries, or human fatalities (Allen and McCullough 1976; Tardif & Associates 2003).

In addition to the characteristics of the accident or carcass itself, many studies collect parameters related to road and traffic characteristics, the surrounding landscape, and the location or status of mitigation efforts. Of these, vegetation types or land-use categories, topography, vehicle speed, and traffic volume occur most frequently (Finder et al. 1999; Huijser et al. 2006a). These additional parameters are commonly collected for studies that identify factors contributing to AVC and AC events or for studies developing explanatory or predictive models.

The usefulness of AVC and AC data partially depends on what parameters are collected. Studies investigating the magnitude of the AVC or AC problem or those evaluating the effectiveness of mitigation measures are more likely to describe only the characteristics of the collision event or carcass. Studies designed to identify factors influencing AVC or AC rates, hotspot characteristics, or to develop predictive models frequently use additional parameters in the analyses. Unfortunately, many studies that use AVC and AC data do not document how the data were collected, limiting the analyses, conclusions, and recommendations that can be drawn from them (Knapp et al. 2004).

PURPOSE OF DATA COLLECTION AND DATA ANALYSES

AVC and AC data are collected by individuals and organizations interested in gaining a better understanding of animal–vehicle collision events. The individuals and organizations include researchers, municipal planning organizations, DOTs, and DNRs. The data collected from AVC events and ACs are used for two main purposes: to assess and minimize the safety risk for humans from animal–vehicle collision events and to assess and minimize the effect of mortality on the population size or population viability of selected animal species. More specifically, animal–vehicle collision and AC data are used to:

- Investigate the magnitude of the animal–vehicle collisions (e.g., Kline and Swann 1998; Garrett and Conway 1999);
- Identify animal–vehicle collision and road-mortality hotspots (e.g., Clevenger et al. 2003; Huijser et al. 2006a);
- Identify road, traffic, human, and environmental factors that contribute to animal–vehicle collisions (e.g., Caro et al. 2000; Clevenger et al. 2003; Huijser et al. 2006a);
- Develop predictive models to determine where animal–vehicle collisions and ACs are most likely to occur (e.g., Finder et al. 1999; Malo et al. 2004; Seiler 2005);
- Prioritize mitigation efforts and assess AVC mitigation methods (e.g., Barnum 2003; Bertwistle 2003; Dodd et al. 2004); and
- Create an index of population size for selected wildlife species (e.g., Dickerson 1939; Case 1978; Baker et al. 2004).

Many of these uses of collision data are interrelated and most studies focus on achieving multiple goals such as hotspot identification and the factors that lead to them.

It is very rare that individuals or organizations are able to record all animal–vehicle collisions or animal carcasses on a given road section. One AC study showed that the actual kill rate may be 12–16 times greater than the reported rate, especially for small animals (Slater 2002). Even large and easily identifiable species such as deer may be underreported by perhaps 50% or more (Allen and McCullough 1976; Romin and Bissonette 1996). These data show that AVC and AC data often underestimate the magnitude of the problem unless they allow for a correction factor for the estimated number of "missed" AVCs or ACs (Conover et al. 1995). However, AVC and AC data can be extremely valuable, even if it is evident that not all AVCs or ACs have been reported. AVC and AC data obtained through consistent search and reporting efforts allow for more data analyses and conclusions than AVC or AC data obtained through incidental observations. Having a "consistent search and reporting effort" does not necessarily mean that all AVCs or ACs are recorded. It merely implies that the data qualify as "monitoring data," which allow the data to be compared in space and time. AVC and AC data that lack a consistent search and reporting effort may be referred to as "incidental observations" and are less valuable for detecting trends and identifying problem locations.

Magnitude of Problem

One of the most obvious and most basic uses of road-kill and collision data is an understanding of just how severe the mortality and collision problems are in terms of risk for both humans and animals, in order to assess the environmental, economic, and social costs (Lloyd and Casey 2005). Knowing how many accidents are occurring, how severe those accidents are, and who is involved is a necessary first step toward identifying and addressing the issue. Without this information, it is impossible to estimate the magnitude of the problem, the potential effect on human safety, society, and wildlife populations (Conover et al. 1995), let alone whether collisions have a seasonal or time component (Ramakrishnan and Williams 2005), whether there is an age or sex bias (Aresco 2005; Ramakrishnan and Williams 2005), or if there is even a problem at all.

By monitoring the number and severity of animal–vehicle collisions, it is possible to calculate their monetary costs in terms of property damage and medical expenses (Conover et al. 1995; Conover 1997; Sielecki 2004). It is also possible to calculate the cost to society in terms of the number of injuries, lives lost, and lost wildlife viewing and other recreational opportunities (Conn et al. 2004; Sielecki 2004). Combining animal–vehicle collision and animal carcass data helps natural resource managers estimate the minimum road mortality for certain species in an area and whether this may affect their population size or population survival probability (Brooks et al. 1991; Kline et al. 1998). Finally, knowing the costs to humans and wildlife can illustrate the need for improved safety and justify the expense of mitigation measures.

Identification of Hotspots

Although it is important to know how many animal–vehicle collisions occur, the information is even more effective when the locations of these collisions are known. Although wildlife–vehicle collisions cannot be predicted, their occurrence is not random in time or space (Barnum 2003; Clevenger et al. 2003). Certain road sections ("hotspots") and certain times of day have a much higher occurrence of wildlife–vehicle collisions than one would expect if these types of collisions would be truly random in time or space. Knowledge about the presence and location of hotspots can help planners design safer roads for humans and animals through incorporating mitigation efforts at the correct locations.

AC and AVC data are often plotted on maps using geographic information systems (GIS). The analyst typically uses a clustering algorithm to find locations or road sections that contain a greater than average number of points (Malo et al. 2004). When AVC or AC data are not available, other less precise hotspot identification techniques can be used. Predictive models based on landscape characteristics and habitat preferences of the species concerned (Clevenger et al. 2002a; Seiler 2005) examine multiple landscape characteristics to identify areas with a high likelihood of animal–vehicle collisions. Expert opinion models rely on experts who are familiar with the species and area concerned, including the road sections where animals may cross or are killed most often. Habitat modeling and expert opinion are usually followed by more detailed studies of ACs at the identified sites to more precisely locate hotspots that have a higher than average number of animal–vehicle collisions (Clevenger et al. 2002b; Ruediger and Lloyd 2003). However, the location of mitigation measures does not only depend on the location of potential hotspots based on AC or AVC data. The location and the number of mitigation sites, and the type of mitigation measures, are usually also influenced by, for example, local knowledge about the location of road-killed animals and areas where animals (successfully) cross the road; the topography of the terrain and its suitability for, for example, wildlife under- and overpasses; land ownership adjacent to the right-of-way; and potential plans for the development of the land adjacent to the right-of-way.

Factors Contributing to Animal–Vehicle Collisions and Animal Carcasses

It is not sufficient to simply know where hotspots occur; managers must also know what characteristics about a hotspot make it more prone to accidents to be able to effectively address the problem. Landscape spatial patterns can concentrate or funnel animals onto certain road sections, whereas certain road attributes can make a motorist less likely to observe wildlife or less able to respond in time. Once hotspots are identified, analysts can compare the characteristics of hotspots with road sections that do not have high collision numbers. This process allows for the identification of road, traffic, and landscape characteristics that may be associated with high numbers of AVCs. The vegetation or land use adjacent to the road (Gunther et al. 1998; Finder et al. 1999; Clevenger et al. 2003; Huijser et al. 2006a), animal trails (Lloyd and Casey 2005), migration patterns or mating season (Case 1978; Feldhamer et al. 1986), topography (Clevenger et al. 2003), traffic volume and speed (Gunther et al. 1998; Schwabe et al. 2002), and decreased visibility (Bashore et al. 1985) are just a few examples of the conditions that may contribute to the presence of hotspots. Road planners can use this information to design safer roads with effective mitigation efforts at the right location.

Development of Predictive Models

The information obtained from hotspot analysis and the factors that contribute to the presence of hotspots are sometimes used to develop predictive models of where future hotspots might occur or where previously unidentified spots may be found (Malo et al. 2004). This type of information is helpful when planning new roads, upgrading old roads, or making changes to road attributes such as the speed limit or road alignment. Predictive models allow road planners to build safer roads for both people and wildlife. Predictive models perform better when the data used to develop them are spatially accurate (Clevenger et al., in press). The methods used for this application are similar to those described for identifying hotspots (see earlier section).

Mitigation Methods

AVC and AC monitoring data often play an important and sometimes critical role when deciding that mitigation measures should be taken, where they should be placed, and what type of mitigation measures are required given the species concerned and the local situation. Furthermore, AVC and AC monitoring data help measure how effective these mitigation measures are in reducing animal–vehicle collisions (Bissonette and Hammer 2000; Dodd et al. 2004). However, mitigation measures should also be evaluated with regard to safe crossing opportunities for wildlife, because mitigation measures should generally not increase, and perhaps even decrease, the barrier effect of the road (Putman 1997). Examples of mitigation measures that have been implemented to reduce collisions with wildlife, regardless of how successful they have been, are standard wildlife warning signs (Pojar et al. 1975), enhanced wildlife warning signs (Sullivan and Messmer 2003; Al-Ghamdi and AlGadhi 2004), animal detection systems (Huijser et al. 2006b), wildlife warning mirrors or reflectors (Reeve and Anderson 1993; Ujvári et al. 1998), wildlife exclusion fencing (Ward 1982; Feldhamer et al. 1986; Romin and Bissonette 1996; Putman 1997; Clevenger et al. 2001), or wildlife inclusion fencing in combination with wildlife under- and overpasses (Foster and Humphrey 1995; Land and Lotz 1996; Clevenger et al. 2002a).

Population Size Index

Road mortality rates have been explored as an index of wildlife population size for some species such as pheasants (Case 1978), raccoons (Rolley and Lehman 1992), red fox (Baker et al. 2004), white-tailed deer (Jahn 1959; McCaffery 1973), and moose (Hicks 1993). Even though one may expect that as wildlife populations increase road-kill rates will also increase, and that a reduced population size should result in fewer collisions (e.g., Romin and Bissonette 1996; Lamoureux et al. 2001), this is not necessarily the case (e.g., Waring et al. 1991). Nonetheless, for white-tailed deer, the number of collisions is generally positively correlated with population size, at least when applied over a long period over a large area (Jahn 1959; McCaffery 1973; Seiler 2004). However, this relationship is not necessarily linear (Knapp et al. 2004; Seiler 2004).

CHAPTER THREE

SURVEY

This chapter contains the methodology and results for the animal–vehicle collision and animal carcass data survey. [See the introduction (chapter one) for the definitions of AVC and AC data.]

METHODS

Survey Questions and Design

The survey consisted of three sections: (1) an introductory letter including several introductory questions, (2) AVC data questions, and (3) AC data questions. The full survey forms are included as Appendix B. If the DOT or DNR concerned did not collect AVC or AC data, the respondent only filled out the introductory questions. If the DOT or DNR concerned did collect AVC and/or AC data, the respondent was asked to complete the remaining section(s) of the survey (AVC and/or AC questions) as well.

The questions covered a wide range of topics related to AVC and AC data, starting with the reasons the DOT or DNR concerned did or did not collect these data, and which road types and/or geographical areas were included. Other key sections of the survey focused on the parameters recorded and potential reporting thresholds; potential training and instruction for data collectors; data analyses and data sharing; and potential obstacles to implementing, advancing, or improving data collection and analyses. Finally, the respondents were asked to send in examples of data sheets used for the collection of AVC and AC data (Appendixes C and D).

The Topic Panel members requested that at least two key individuals be approached for each state or province: a representative of the DOT (with a focus on public safety) and a representative of the DNR (with a focus on natural resource conservation).

Interviewees and Response Method

The survey was sent to the official TRB representative for the DOT in each state and province (Table 1). In addition, the survey was sent to a known specialist at the DOT in each state and province, and to additional specialists at DOTs in selected states or provinces. The survey was also sent to a known specialist at the DNR in each state and province, and to additional specialists at DNRs (Table 1). For DOTs and DNRs combined, the total was 247 contacts. The above-mentioned contacts occasionally forwarded the survey to others within their organization if they believed these individuals would be more knowledgeable with regard to the subject. The number of people who were forwarded the survey could not be tracked.

Apart from the list of the official TRB representatives for each state and province, the following sources were used to select potential contacts in each state or province: (1) the panel members' networks, (2) the Western Transportation Institute–Montana State University (WTI–MSU) network, and (3) suggestions from individuals at the state or provincial DOTs and DNRs.

The survey was posted on a website and the interviewees were encouraged to fill out the survey on this website. The survey was also available in MS Word (with check boxes and drop down menus) and PDF format that could be returned by e-mail, fax, or mail.

TRB sent the survey to the interviewees on March 6, 2006, with reminders sent on March 15, March 27, and April 3, and the website was closed for responses on April 5, 2006.

The Institutional Review Board for the Protection of Human Subjects at Montana State University declared that the questionnaire was exempt from review in accordance with the Code of Federal Regulations, Part 46, section 101 (b)(3) on February 9, 2006.

Crash Forms

In addition to the survey, and in addition to the AVC and AC forms that the interviewees forwarded in response to the survey, the crash forms posted on the website for the National Center for Statistics and Analysis of the NHTSA ("Crash Forms" 2006) for all 50 states were reviewed. The review focused on the following topics:

- Are animal–vehicle collisions recorded?
- Do the forms differentiate between wild and domestic species?
- Do the forms allow for the entry of the species name of the animal that is involved in a collision?
- Are there reporting thresholds (e.g., $1,000 in vehicle damage, a human injury, or a vehicle towed)?
- How is the location of the accident described [e.g., use of coordinates (GPS or map) and distance to the nearest landmark]?

TABLE 1
NUMBER AND TYPE OF INDIVIDUALS APPROACHED FOR SURVEY

Individuals Approached for Survey	United States	Canada	Total
TRB representatives for DOT (one per state or province)	50	13	63
Known specialist for DOT (one per state or province)	50	13	63
Additional representatives for DOT	43	7	50
Subtotal	143	33	176
Known specialist for DNR (one per state or province)	50	13	63
Additional specialists for DNR	8	0	8
Subtotal	58	13	71
Total	201	46	247

TABLE 2
NUMBER OF STATES AND PROVINCES RESPONDING TO EACH SURVEY

Responding States and Provinces	United States	Canada	Total
Response to some portion of AVC or AC survey (DOT or DNR)	43	13	56
Response to some portion of AVC or AC survey (DOT)	30	10	40
Response to some portion of AVC or AC survey (DNR)	30	6	36
Response to some portion of AVC survey (DOT or DNR)	25	8	33
Response to some portion of AVC survey (DOT)	19	6	25
Response to some portion of AVC survey (DNR)	9	4	13
Response to some portion of AC survey (DOT or DNR)	21	4	25
Response to some portion of AC survey (DOT)	10	1	11
Response to some portion of AC survey (DNR)	13	3	16

The data for the 50 states ("Crash Forms" 2006) were supplemented with accident report forms from two provinces (British Columbia and Northwest Territories) (Appendix C), and the four responses from other Canadian provinces (Alberta, Manitoba, Newfoundland, and Nova Scotia) to the applicable portions of the survey.

Data Analysis

In some cases there was more than one respondent for an individual DOT or DNR. In such instances, the answers for these respondents were combined into one response, which resulted in a maximum of two responses for each state or province; one for a DOT and one for a DNR.

The responses were summarized by calculating the number and/or percentage of respondents that selected the different options or categories for their responses. The percentages were calculated as the number of responses in each category divided by the total number of respondents to that question. For these calculations, the maximum number of respondents was two for each state or province (one for the DOT and one for the DNR). In the text, percentages refer only to the respondents and responses relevant to specific questions. For example, there were 25 DOT respondents to the AVC survey. If 15 marked "yes" to a question, 8 marked "no," and 2 did not respond, the percentage "yes" is 65% (15/23), and the percentage "no" is 35% (8/23). Thus, it is important to realize that the percentages for different questions are based on different totals if the number of respondents differed. Finally, several questions permitted multiple responses, in which case the sum of the percentages in the categories could add up to more than 100%.

In certain cases, chi-square tests were run to determine whether responses differed by agency type (DOT vs. DNR) or nation (United States vs. Canada). In this synthesis report the term "significant" was reserved for P-values ≤ 0.05. These statistical tests were only conducted when the expected sample sizes in each cell were ≥ 5, as chi-square tests with expected frequencies <5 generate unreliable results.

Data Summary Tables

The summary tables of the responses are included in the appendices (Appendixes E, F, and G). The percentages in the summary tables are calculated differently than in the text. These percentages were based on the number of agencies that responded to the survey as a whole, so that nonresponse to certain questions could be assessed. Using the previous example with the 25 DOTs responding to the AVC survey, with 15 answering "yes" to a question, 8 answering "no," and 2 not responding, in the survey tables these percentages appear as "yes" = 60% (15/25), "no" = 32% (8/25), and no response = 8% (2/25).

RESULTS

Respondents

For DOTs and DNRs combined the response rate was 88.9% (56 of 63 states and provinces) (Table 2). DOTs (63%) had a slightly higher response rate than DNRs (57%) (Table 2, Figures 1 and 2). Therefore, DOTs and DNRs were similarly represented in the responses to the survey. (Note: some agencies did not answer all the questions, or all parts of one question, causing variable sample sizes within and between individual questions.)

The response rate for the AVC portion was higher than for the AC portion of the survey (Table 2). Note that DOTs and DNRs only responded to these portions of the survey if they actually collected AVC or AC data.

Data Types (Introduction Survey and Crash Forms)

Based on the responses to the introductory questions from the survey, AVC data are collected or managed by more DOTs than DNRs (Figure 3). AC data are collected or managed by more responding DNRs than DOTs (Figure 3).

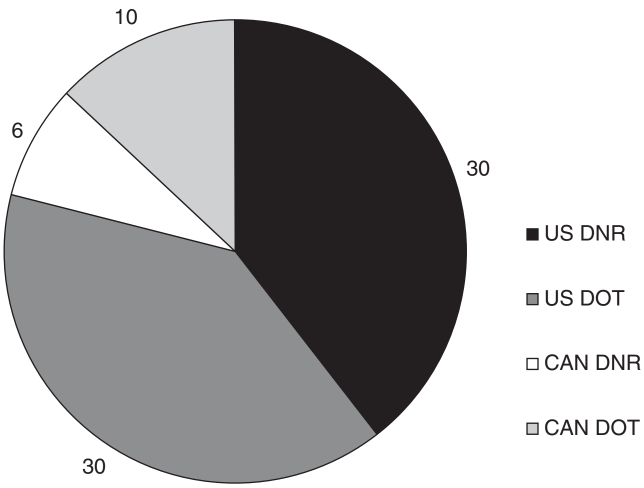

FIGURE 1 Respondents to surveys by nation and agency.

Based on a review of the crash forms, all responding states and provinces record animal–vehicle collisions as at least a checkbox or code on the crash form, except for one state.

Absence of Animal–Vehicle Collision and Animal Carcass Data Collection Programs (Introduction Survey)

This section relates only to the DOTs and DNRs that reported that they do not collect AVC or AC data. Results from agencies that collect either AVC or AC data or both data types were excluded from this section. For DOTs, the most common reason for not collecting AVC or AC data is equally that they were not interested ($n = 4$; 29%) or that "someone else" collects such data ($n = 4$; 29%), with two responses each for the expense, time involved, and "other" responses including "no demonstrated problem" and "AC pick-ups might be logged by road foremen but no one collects that data." Responses by DNRs differed somewhat. The most common reason DNRs do not collect AVC or AC data is that "someone else" collects such data

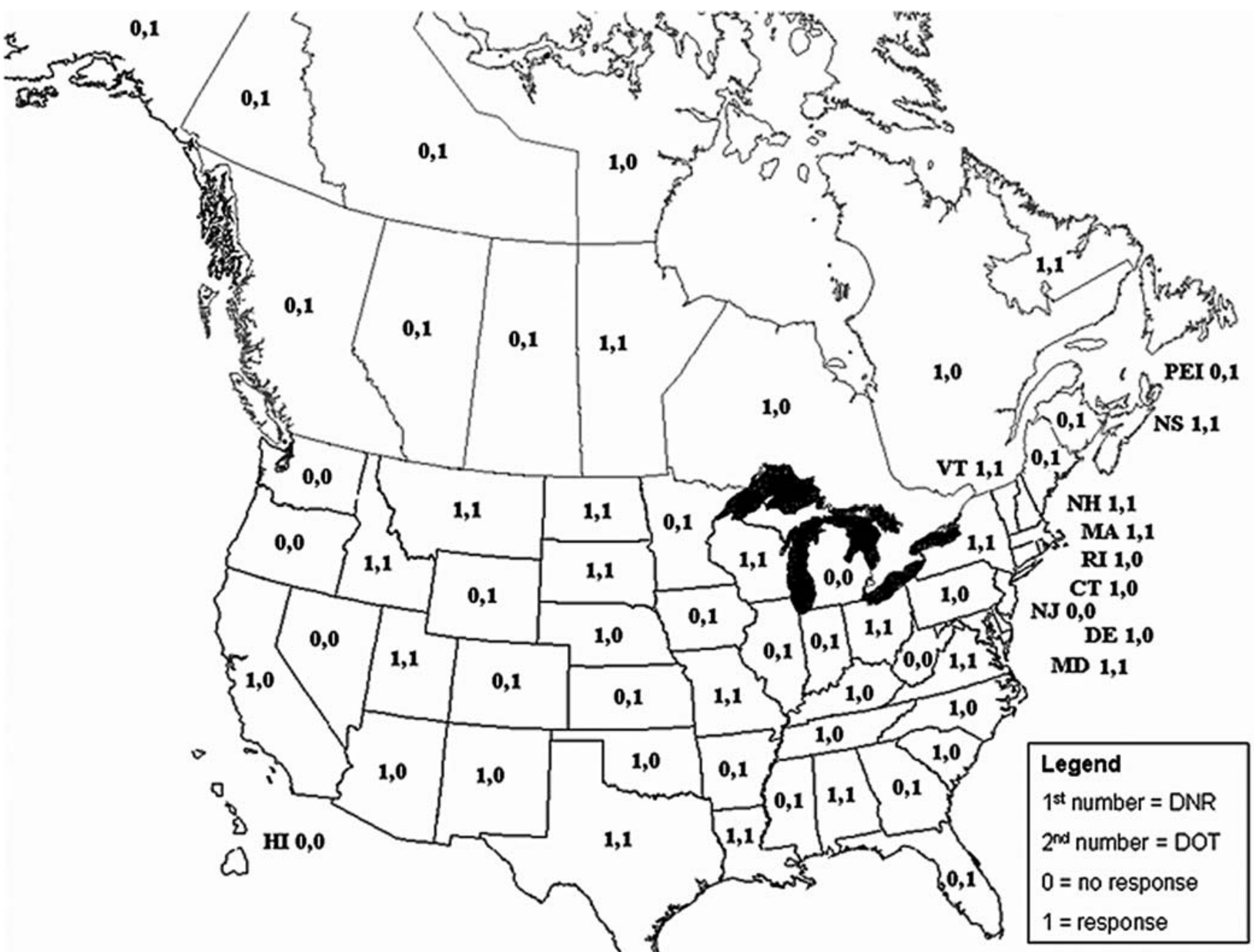

FIGURE 2 Study area and respondents by state and province.

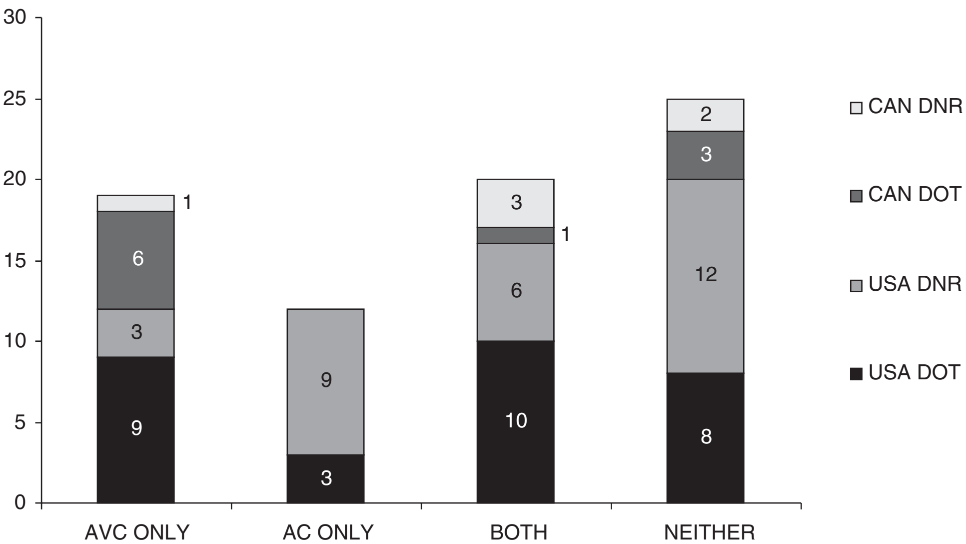

FIGURE 3 Number of agencies from the United States and Canada that collect AVC and/or AC data.

(*n* = 8; 53%), followed by the expense (*n* = 4; 27%) and the amount of time associated with data collection (*n* = 2; 13%).

DOT respondents had varying opinions on whether, in their professional opinion, their agency should begin to collect AVC or AC data. Of the eight respondents, three (38%) answered "yes," whereas two answered "no" (25%) and three were undecided (38%). Most of the DNR respondents (*n* = 8; 80%) believed that, in their professional opinion, their agency should not begin to collect AVC or AC data.

Next, the agencies were asked what changes would need to be made before their agency would begin collecting AVC or AC data. Most DOTs (*n* = 7; 39%) responded that a need had to be demonstrated first. Other changes included more funding (*n* = 4; 22%), better training (*n* = 3; 17%), and more personnel (*n* = 2; 11%). One DOT indicated that the development of a mechanism for field data entry would be required before their department would begin collecting AC or AVC data. Most of the responding DNRs (*n* = 8; 40%) also stated that a demonstrated need would be required. Other required changes included more funding (*n* = 5; 25%) and more personnel (*n* = 4; 20%).

AVC Survey

The AVC survey form can be found in Appendix B, with the summary data contained in Appendix F.

Rationale for AVC Data Collection and Roads and/or Areas Included (*AVC Section 1*)

Agencies were asked why they collect or manage AVC data by ranking reasons in order of importance, with 1 being most important. Most DOTs indicated that public safety was the primary reason for collecting AVC data (*n* = 20; 83%), with wildlife management or conservation the number two reason (*n* = 11; 58%) and accounting the third (*n* = 8; 57%; Figure 4). Other reasons given were that it is a legal requirement for them to report AVCs that result in property damage of $1,000 or greater (*n* = 2; Manitoba and South Dakota), and that it allows for the identification of high-collision areas so that warning signs can be put in place (*n* = 2; Alberta and New Hampshire), which is closely linked to public safety as well.

DNR respondents were almost equally divided between public safety and wildlife management/conservation as the primary reasons they collect or manage AVC data, with accounting reasons the next most important reason (Figure 4). Other reasons why DNRs collect or manage AVC data included tracking diseases such as chronic wasting disease and rabies (*n* = 2).

On average, DNRs have collected AVC data for longer than DOTs, with 20.9 years of collecting for the average DOT (95% C.I. = 15.49, 26.40; *n* = 18), as compared with an average of 31.4 years of collecting for DNRs (95% C.I. = 20.91, 41.95; *n* = 7). However, this difference was not significant when tested with a two-sided, two-sample *t*-test; $t = 1.734$, $P = 0.115$. Ohio and Nebraska DNRs have recorded AVC data since the 1950s, the longest recording period of all respondents. Note that some answers were unquantifiable, including "many years ago" and "for ever," could not be used in the calculations. Similar percentages of responding DOTs and DNRs reported that collection of AVC data was mandatory (*n* = 18; 75% and *n* = 6; 67%; $P = 0.986$).

Of the 25 responding DOTs, 24 (96%) collect data on Interstates, 24 (96%) collect data on arterial roads, 19 (76%) collect data on collector roads, and 13 (52%) collect data on

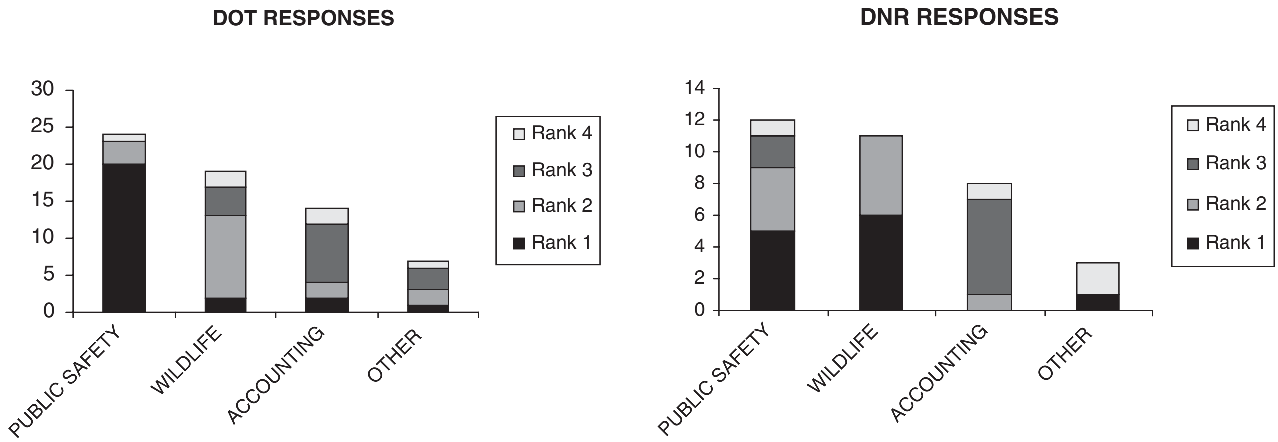

FIGURE 4 Ranked reasons why DOTs and DNRs collect AVC data.

local roads. One of these DOTs collects data on Interstates only, and the Northwest Territories DOT collects data on all roads except for Interstates because it has none. All 10 DNRs that responded to the question collect data on Interstates and arterial roads, 6 (60%) also collect data on collector roads, and 8 (80%) also collect data on local roads.

The geographic limits of the reporting area for DOTs included all roads in the state or province (n = 10; 43%), all state or federal lands (n = 7; 30%), and all public lands in their state or province (n = 4; 17%). The Alaska DOT reports on all areas where state police crash reports are completed and the Manitoba DOT reports on all areas under provincial jurisdiction, excluding municipal roads. The geographic limits of the reporting area for the 11 responding DNRs contained all areas in the state or province (n = 5; 45%) or all state and/or federal lands (n = 3; 27%). Two respondents report on all roads on public lands in the state or province, and one reports on all areas with certain exceptions, such as military bases, certain federal lands, forest access roads, and tribal lands.

Overwhelmingly, all agencies responded that the landscape surrounding the areas where they collect AVC data are both rural and urban (n = 32; 94%), with only New Hampshire and Vermont DOTs indicating the landscape is predominantly rural.

When asked what other organizations or individuals collect AVC data on the road systems that are covered, most agencies indicated that some branch of law enforcement is involved (n = 13). Other responses included other governmental branches (i.e., city or county; n = 4) and private organizations or individuals (i.e., nongovernmental organizations, interested members of the public; n = 4).

Correspondingly, when asked what other organizations or individuals collect AVC data on the road systems that are *not* covered, the agencies indicated that no organizations or individuals collect AVC data in these areas (n = 5) or that another government agency (i.e., city or county) was in charge of these data (n = 5).

AVC Parameters Recorded and Reporting Thresholds (*AVC Section 2, Crash Forms*)

Respondents were asked, "What organization(s) does the actual animal–vehicle data collection on the ground?" Multiple agencies collect AVC data; however, most frequently, the Highway Patrol or other law enforcement agencies were selected, with 25 responses (45%) indicating their participation. DOTs and DNRs were roughly equal, with 13 and 11 responses (24% and 20%), respectively. Other answers included local contractors and private citizens.

Data are often reported to DOTs and DNRs by drivers (n = 25; 48%) or by other agencies (n = 17; 34%). Other responses included local law enforcement (n = 6; 12%) and interested individuals (n = 2; 4%).

Based on the survey responses most DOTs have reporting thresholds for AVCs (n = 16; 64%), whereas only a few DNRs do (n = 4; 33%). This difference was significant (P = 0.040). These thresholds generally involved a combination of human injury, property damage, and involvement of a certain species. Twelve respondents indicated that property damage generally needs to be in excess of $1,000 U.S. or Canadian, whereas two respondents noted that in excess of $500 in property damage would be required to report the collision, and one respondent stated that any amount of "reportable vehicle damage" would be sufficient to record the collision, but it was unclear what that threshold was. Nine DOTs and DNRs indicated that their thresholds depend on what animal species or groups of species were involved in the collision (e.g., deer, bear, and moose).

Based on a review of the crash forms, all 50 states and 5 of the 6 responding provinces have thresholds under which vehicle collisions are not recorded (Figure 5). The most common threshold is a minimum estimated damage of $1,000 (22 states and 4 provinces), although many states have damage thresholds in the range of $500–$750 (19 states). Four states have reporting thresholds under $500, and two states (Alaska and Delaware) have reporting thresholds of more than

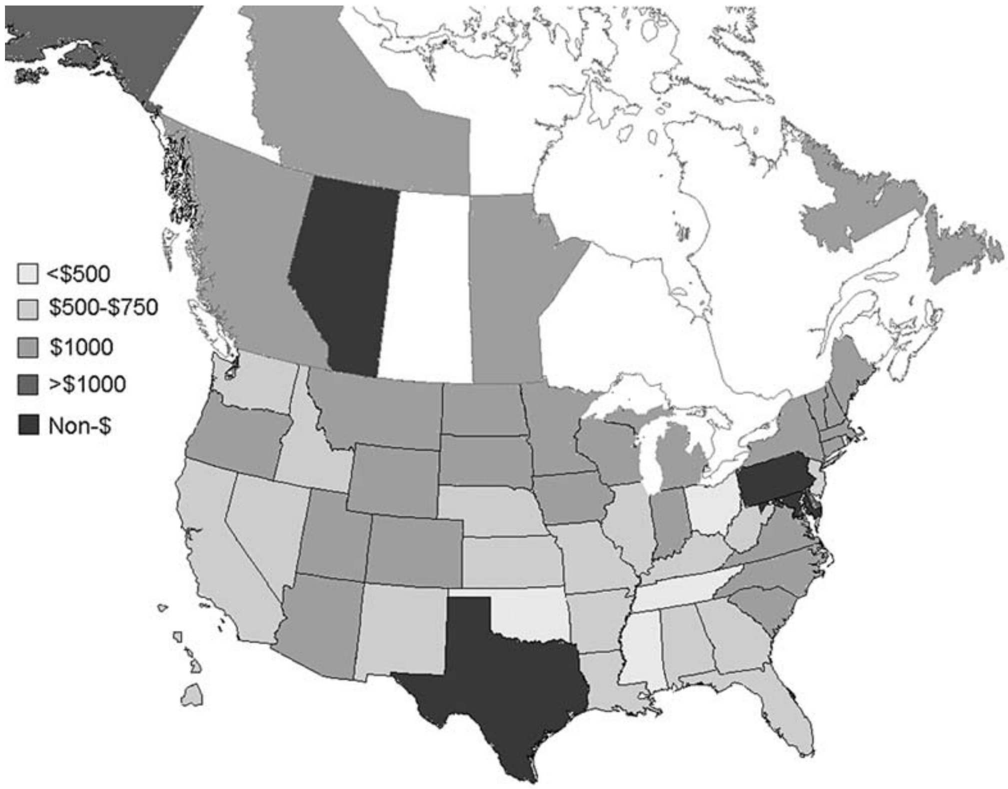

FIGURE 5 Minimum reporting threshold for a collision based on a review of the crash forms (United States, British Columbia, and Northwest Territories) and the survey responses (Canada). No information was available for the provinces shown without shading.

$1,000. Alberta, Connecticut, Maryland, and Texas have nonmonetary thresholds, including all reported crashes or crashes where the vehicle is towed. Note that five states will report collisions with less damage than the threshold if there is a human injury or fatality involved.

DOTs and DNRs described the search and reporting efforts as both "incidental" (DOT—$n = 6$, 29%; DNR—$n = 3$, 25%) and "monitoring" (DOT—$n = 8$, 38%; DNR—$n = 5$, 42%), with $P = 0.838$. Ten of 11 of the "other" respondents clarified their answers by noting the importance of accident collision reporting in the data and how the AVC data may underestimate the true number of collisions.

DOTs and DNRs ($n = 11$; 37%) stated that surveys or checks for AVCs largely occur as these collisions are reported or seen, whereas seven respondents (23%) indicated that checks occur daily (4 DOTs and 3 DNRs), 4 (13%) indicated they occur weekly (3 DOTs and 1 DNR), 1 DNR checks for AVCs monthly, and 2 DOTs check annually. "Other" responses from DOTs included a review of countywide routes every 2–3 years, and that checks occur at lower frequencies for lower classification highways.

DOTs and DNRs were asked which parameters they record as a part of AVC reporting. Nineteen DOTs responded to all or parts of the question. Most of the responding DOTs always record the date ($n = 19$; 100%), time ($n = 13$; 76%), district or unit ($n = 15$; 79%), the name of the observer ($n = 12$; 71%), road or route identification (ID) ($n = 18$; 95%), collision location ($n = 14$; 78%), the occurrence of human fatalities ($n = 14$; 82%), human injuries ($n = 12$; 71%), and property damage ($n = 12$; 71%) (Table 3). Most DOTs ($n = 7$; 47%) never record the type of human injuries, the sex ($n = 9$; 53%), or age ($n = 11$; 65%) of the animal concerned, or whether or not the animal carcass was removed ($n = 9$; 53%). Some DOTs always record the amount of property damage ($n = 6$; 38%), whereas others never do so ($n = 5$; 33%). The same applies to the species of the animal (seven DOTs always record the species name, five usually, and three sometimes). DNR responses primarily differed from DOT responses in that the majority of DOT responses were either "always" or "never," whereas DNR responses also included the other categories (usually, sometimes, rarely; see Table 3). Interestingly, most DNRs ($n = 7$; 78%) always record the species name and always or usually include the sex ($n = 6$; 67%) of the animal involved.

Based on a review of the crash forms, the most common method of documenting AVCs is a checkbox or a code for the object of collision referring to "animal" only (19 states and 1 province) (Figure 6). In these cases, if a species name is to be recorded, it would have to be in the crash narrative or the comments at the discretion of the recording official, and the information may not be accessible in the final crash database. The next most common method of entering AVCs is a checkbox or a code for "deer" and a checkbox or a code for "animal other than deer" (12 states). Eight states and two

TABLE 3
ANIMAL–VEHICLE COLLISION PARAMETERS RECORDED BY DNRs AND DOTs (all in percentages)

	DNR						DOT					
Recorded Parameters	Always	Usually	Sometimes	Rarely	Never	No Response	Always	Usually	Sometimes	Rarely	Never	No Response
Date	38	23	8	0	0	31	76	0	0	0	0	24
Time	23	8	15	15	8	31	52	8	4	0	4	32
District/unit	38	15	8	0	0	38	60	8	0	4	4	24
Name of observer	31	23	8	8	0	31	48	8	0	8	4	32
Road/route identification	31	15	15	0	0	38	72	4	0	0	0	24
Collision location	23	38	8	0	8	23	56	12	0	0	4	28
Human fatalities	38	8	8	0	8	38	56	0	0	0	12	32
Human injuries	31	8	15	0	8	38	48	4	4	0	12	32
Type of injury	8	23	0	15	15	38	24	0	4	4	28	40
Property damage	15	8	15	8	15	38	48	8	0	0	12	32
Amount ($) of property damage	8	8	15	8	23	38	24	8	4	8	20	36
Species of animal	54	15	0	0	0	31	28	20	12	0	8	32
Sex of animal	23	23	8	8	8	31	8	0	16	8	36	32
Age of animal	15	15	15	8	15	31	4	0	12	8	44	32
Removal of animal	31	15	15	0	0	38	16	0	8	8	36	32

Note: Shaded areas mark category with the most frequent response.

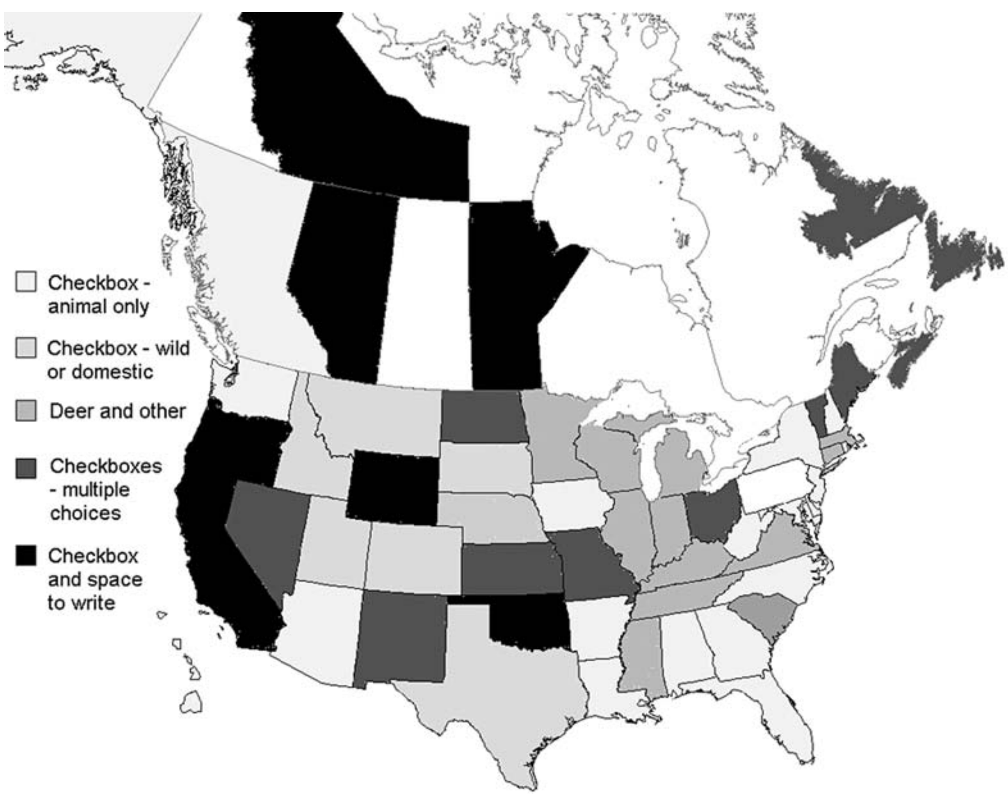

FIGURE 6 How AVCs are indicated on crash forms. Provinces or states without shading did not collect AVC data on crash forms or they represent states and provinces with missing data.

provinces allow multiple choices for wild species and/or domestic species. These states use checkboxes with species involved in collisions (e.g., Nevada has checkboxes for dog/coyote, burro, cattle, horse, deer, bear, antelope, big horn sheep, elk, and other animal). Kansas has similar codes (deer, other wild animal, cow, horse, other domestic animal), but also allows the species name to be written in a space. Six states only have checkboxes for "wild animal" and "domestic animal," with no space for specific comments unless the officer records that type of information in the crash narrative. Four states and three provinces use checkboxes for "animal" adjacent to a line where the species of animal can be written.

AVC Location Recording and Spatial Resolution (AVC Section 2—Continued)

Based on the survey responses most DOTs (n = 11; 58%) always use reference posts (miles or kilometers) to identify the location of a collision (Table 4). Most DOTs never use a GPS (n = 11; 69%) or map (n = 7; 44%) to record the location of the AVC. Some DOTs always use road sections to record the location of the AVC (n = 7; 39%), whereas others never do so (n = 4; 22%). The methods used by DNRs are more variable, with one DNR reporting collision data by house number or road intersection.

The precision of the spatial location of the AVC data is variable for both DOTs and DNRs. For most DOTs the location is rarely or never within 1 yard or meter (DOTs—n = 10, 77%; DNRs—n = 6, 86%), 15 yards or meters (DOTs—n = 8, 67%; DNRs—n = 5, 83%) or 30 yards or meters (DOTs—n = 7, 58%; DNRs—n = 4, 57%). The AVC data from DOTs are always or usually accurate to 0.1 mile or kilometer (n = 13; 68%) or 1 mile or kilometer (n = 6; 50%), whereas the data from DNRs are rarely or never accurate to 0.1 mile or kilometer (n = 4; 58%). However, the data from DNRs are always or usually accurate to 1 mile or kilometer (n = 5; 63%). One DNR always reports locations within one yard or meter, whereas one DOT usually and two DOTs sometimes report locations with this resolution. One DNR sometimes reports locations within 15 yards or meters, whereas the Mississippi DOT always reports collisions at this resolution, and the Iowa, Kansas, and Minnesota DOTs sometimes report collisions at this resolution. The Connecticut DNR usually and the Rhode Island and Vermont DNRs sometimes report collision data to 30 yards or meters, and the Kansas DOT usually and the Colorado, Iowa, Maryland, and Minnesota DOTs sometimes report collisions at this resolution. Four DNRs noted that location resolution is variable depending on the survey route and what references are available.

For DOTs the reference posts (miles or kilometers) used in describing animal–vehicle collision locations were mostly 1 mile or 1 kilometer apart (n = 7; 44%), whereas only one DNR uses reference posts at this distance. Two DNRs and two DOTs use reference posts 0.1 mile apart. Two DOTs have reference posts 0.2 mile apart, and one DOT reports reference posts that are 500 ft apart. One DOT and one DNR use references based on roadway or geographic features causing variable spatial resolution. Another DNR reports that major routes have reference posts every 2, 4, or 5 km, whereas minor routes have no reference posts. One DOT uses reference posts 2 km apart.

Based on a review of the crash forms, the most common method of locating a collision is based on distance from a roadway feature, such as an intersecting road, bridge, mile post, or other reference post (29 states and 4 provinces) (Figure 7). Twenty states record latitude and longitude or another coordinate-based system. We cross-checked the information from the crash forms, the instruction manuals accompanying the crash forms (if provided), and the survey data gathered to determine whether these coordinate locations are based on map coordinates or GPS. We found that 14 states do use GPS units when available. Note that many of these states do not require the use of a GPS and that several states and provinces use maps to derive the coordinates of crash locations.

Species and Species Groups Recorded for AVCs (AVC Section 2—Continued)

Amphibians are generally never recorded by DOTs and DNRs (Table 5). However, two DOTs do record amphibians

TABLE 4
HOW ANIMAL–VEHICLE COLLISION LOCATION DATA ARE REPORTED BY DNRs AND DOTs (all in percentages)

	DNR						DOT					
Recorded Parameters	Always	Usually	Sometimes	Rarely	Never	No Response	Always	Usually	Sometimes	Rarely	Never	No Response
GPS coordinates	0	8	15	8	23	46	4	0	4	12	44	36
Map coordinates	15	8	23	8	15	31	4	8	24	0	28	36
Miles/kilometers post	0	8	31	0	15	46	44	16	8	4	4	24
Road section	0	23	23	0	8	46	28	24	4	0	16	28
Other	0	8	0	0	0	92	0	0	0	0	16	84

Note: Shaded areas mark category with the most frequent response.

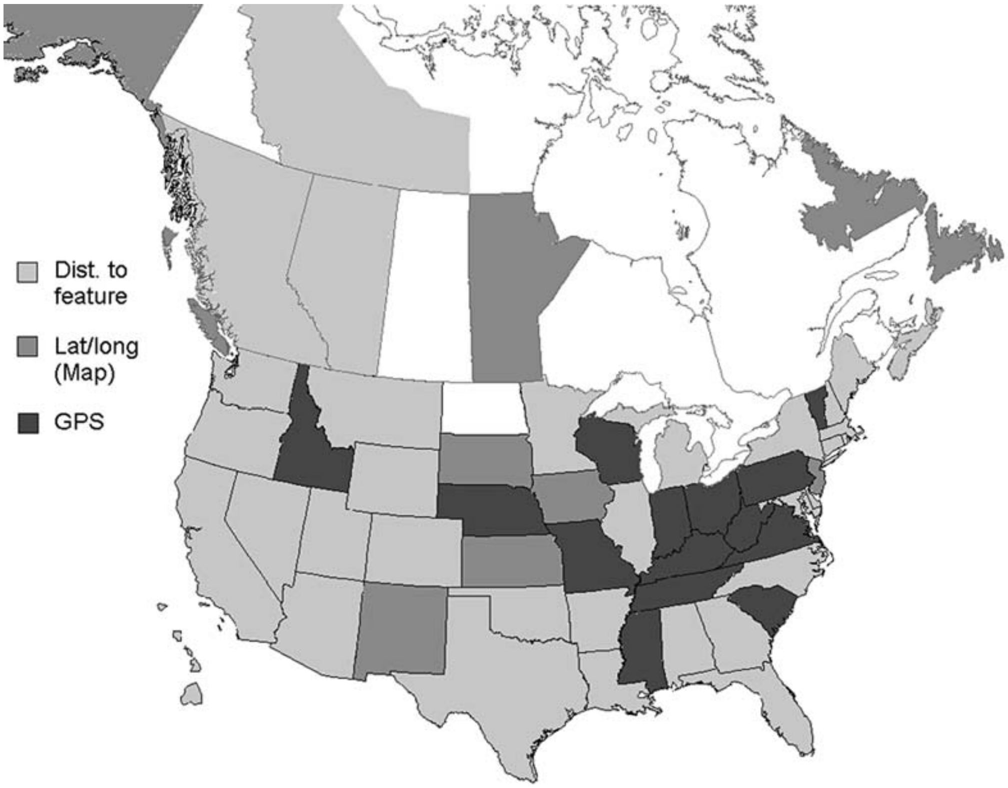

FIGURE 7 Location system used by each state or province based on a review of the crash forms. If it was uncertain as to whether GPS or maps were used to derive coordinates for location, the state was assigned to the category for map coordinates. Unshaded states, provinces, and territories did not have information available.

to the species (Vermont and Northwest Territories). The Kansas DOT records amphibians as "other wild animal." The Vermont DNR records amphibians to "order." In all, two DOTs and one DNR noted that they record all amphibian groups, endangered and otherwise (Vermont DOT and DNR and Northwest Territories DOT).

Reptiles are generally never identified by DOTs and DNRs (see Table 5). However, two DOTs record reptiles to genus (Mississippi and Northwest Territories), and the Vermont DNR records reptiles to the order. The Vermont DOT records endangered reptiles only, whereas the Northwest Territories DOT records all reptile groups.

Birds are recorded by some DOTs and DNRs (see Table 5). Five DOTs never report birds and five noted that only large birds are generally reported, or that it is based on the vehicle-operator's description, which varies in detail. Of the DOTs,

TABLE 5
SPECIES GROUPS RECORDED BY DNRs AND DOTs IN ANIMAL–VEHICLE COLLISION DATA COLLECTION PROGRAMS (all in percentages)

	DNR								DOT							
Recorded Parameters	Species	Genus	Family	Order	Class	Never	Other	No Response	Species	Genus	Family	Order	Class	Never	Other	No Response
Amphibians	0	0	0	8	0	62	15	15	8	0	0	0	0	52	12	28
Reptiles	0	0	0	8	0	46	23	23	0	8	0	0	0	56	4	32
Birds	15	0	0	8	0	31	23	23	4	12	0	8	8	20	20	28
Large wild mammals	69	8	0	8	0	0	15	0	12	44	0	0	0	4	12	28
Small wild mammals	31	0	8	0	0	8	23	31	8	12	4	8	0	28	8	32
Domestic animals	15	X	X	X	0	23	38	23	40	X	X	X	0	12	20	28

Notes: Shaded areas mark category with the most frequent response. X = not an option for responses.

Vermont records birds to species; Mississippi, Northwest Territories, and Wyoming record birds to genus; Colorado and South Dakota record birds to order; and Iowa and Manitoba record birds to class. Of the 10 responding DNRs, two report birds to species (Delaware and Kentucky), one reports birds to order (Vermont), four never report birds, and three report birds sporadically. Bird groups of interest to responding DOTs included all bird groups (n = 2; 13%), endangered species (n = 2; 13%), game birds (n = 1; 7%), and raptors (n = 3; 20%). Four DOTs (27%) noted that typically only large birds are recorded, because some DOTs have a damage threshold. The Colorado DOT records birds occasionally, based on time and knowledge of their crews. Of the DNRs that report birds (n = 12; 75%), groups of interest include endangered species (n = 3; 25%), game birds (n = 3; 25%), and raptors (n = 3; 25%).

Large wild mammals (deer and larger) are recorded by most DOTs and DNRs (see Table 5). Most DOTs record large wild mammals to the genus, whereas most DNRs identify large wild mammals to the species. One DOT noted that, although they record large mammals to genus, they are recorded only as comments on the police AVC records, and their names are not entered into the database. One DNR (Nova Scotia) records only black bear, white-tailed deer, and moose (no other bear or deer species in their area), and one DNR records white-tailed deer only (Rhode Island). One DNR reports furbearers (Ohio). Large mammal groups of interest to DOTs include ungulates (n = 8), game species (n = 7), carnivores (n = 4), all species (n = 5), and endangered species (n = 2). DNRs mostly indicated interest in ungulates (n = 8), with the next highest response for game species (n = 5), carnivores (n = 3), all species (n = 2), endangered species and non-natives (Newfoundland).

Small wild mammals (smaller than deer) are only recorded by some DOTs and DNRs (see Table 5). Of the 17 responding DOTs, 7 never report small mammals, and of the 9 responding DNRs, 4 report small mammals to species. Some DOTs identify small mammals to the genus or species (n = 5). Two other DOTs record small mammals as "other wild animals" if they are involved in crashes that meet the reporting thresholds, and one DOT noted that small wild mammals are recorded at the discretion of the field personnel and these observations are entered into the database. Groups of special interest to DOTs include all small mammals (n = 3), carnivores (n = 2), and one response each for endangered species and game mammals. Small mammal groups of interest to DNRs include carnivores (n = 4), game species (n = 3), and one response each for all small mammals, endangered species, and non-native species. One DNR reported that species are recorded depending on the interest of specific projects underway.

Domestic animals are identified by some DOTs and DNRs (see Table 5). Of the 18 responding DOTs, 10 report domestic animals to species, 3 never report domestic animals, and 1 of the 5 "other" responses stated that domestic animals are described as "all other animals" if they were involved in a crash that meets reporting thresholds. Five DOTs record all domestic animals (although some record only if reporting thresholds are met) and three record large species only. Three DNRs record large species only.

Portions of carcasses are frequently kept for further analysis by both DOTs (n = 9; 50%) and DNRs (n = 7; 54%). Further analyses include disease testing and a means to gather more information about population dynamics. Chronic wasting disease was the most frequently mentioned disease (n = 4; Connecticut, Kentucky, Rhode Island, and Virginia), followed by rabies (n = 2; Kentucky and Mississippi), and West-Nile Virus (n = 1; Connecticut). Samples to investigate the reproductive state (Nova Scotia DNR) and age (Missouri DNR) of the animal concerned are also gathered from carcasses. One DOT noted that the DNR in the same state collects specific information from black bear carcasses; however, it is unclear what parameter and for what purpose.

Training and Instruction for AVC Data Collectors (AVC Section 3)

Although AVC data are typically collected by law enforcement personnel, these organizations were not approached for this synthesis; the synthesis was restricted to DOTs and DNRs. Given that limitation, more responding DOTs (n = 9; 69%) than DNRs (n = 1; 11%) train their employees in AVC data collection (P = 0.093). The DOTs have variable training regimens. Four DOTs train employees once, one trains them every year, one trains them on the job, one trains them bi-yearly, and one trains them "periodically." DOTs employ different training techniques, including literature (n = 3; 18%), on-the-job training (n = 8; 47%), seminars (n = 3; 18%), new employee training classes (n = 1; 6%), and police training academies (n = 1; 6%). The 11 responding DOTs train employees in filling out forms (n = 10; 91%), the purpose and importance of data collection (n = 9; 82%), and the importance of collecting accurate data (n = 6; 56%). DOTs do not always train employees regarding which AVCs to record (n = 5; 45%), how to identify species (n = 3; 27%), how to age carcasses (n = 1; 9%), how to use a GPS (n = 1; 9%), or how to enter and manage data (n = 1; 9%). None of the responding DOTs train their employees in carcass sexing or necropsy. Three DOTs provide their employees with data sheets or forms, and one provides aides to familiarize employees with the road system and related reporting software. One DOT (Mississippi) provides employees with species identification guides and GPS units to document AVC location information. Only one responding DNR trains its employees. The training takes place in the field with experienced personnel and with a seminar. The DNR trains its people in the purpose of data collection, the importance of collecting accurate data, how to fill out data collection forms, what collisions and carcasses should be recorded, how to identify species, how to age and sex carcasses, how to use a GPS, how to obtain accurate location information, and supplements this with training by veterinarians to investigate potential diseases of the animals. However, the DNR does not train its employees in how to perform a necropsy nor how to enter and manage data. The DNR provides its employees with data sheets or forms, but no other tools or materials.

AVC Data Analyses and Data Sharing
(*AVC Section 4*)

Significantly more DOTs share AVC data with other organizations than DNRs ($P = 0.024$). Nineteen of 22 DOTs (86%) share their data, compared with 6 of 12 DNRs (50%). DOTs most frequently share data with DNRs ($n = 7$), followed by information released to the public ($n = 4$). Information is also shared with law enforcement agencies ($n = 3$), research groups ($n = 2$), auto insurers ($n = 2$), and any other organization that may be interested ($n = 4$). DNRs that share data most frequently do so internally or with other natural resource agencies ($n = 2$), whereas one shares information with the public, one shares information with stakeholders or "whomever requests it," and one shares with DOTs.

Most responding DOTs ($n = 17$; 77%) and DNRs ($n = 11$; 91%) analyze AVC data. The differences between DOTs and DNRs were not significant ($P = 0.561$). DOTs noted that data analysis is also done by local DNRs ($n = 2$) or by law enforcement ($n = 3$); however, most responding DOTs noted that their data are analyzed by their own personnel (i.e., crash analysts, traffic engineers, highway technical staff, etc.; $n = 12$; 71%). Most responding DNRs noted that data are analyzed by a wildlife biologist ($n = 8$; 73%). The one DNR that does not analyze its own data reported that a research biologist for a deer project does the analysis.

Data are analyzed annually by most responding DOTs ($n = 8$; 40%), although many also analyze data as needed or on request ($n = 5$; 25%). Two DOTs analyze data as often as specific projects require, and two analyze data at periods of longer than 1 year. Three DOTs analyze data more frequently than annually (i.e., continuously or quarterly). Similarly, most DNRs analyze data annually ($n = 8$; 67%), with three DNRs analyzing data as needed or on request and one analyzing as often as specific projects require.

Respondents were asked to describe the purpose(s) of data analysis. The 19 responding DOTs overwhelmingly responded that the identification of problem areas is the primary function of data analysis ($n = 17$; 89%), whereas only 2 (11%) of the DOT respondents included monitoring wildlife trends, diseases ($n = 1$; 5%), other wildlife or ecological concerns ($n = 2$; 11%), and other transportation concerns ($n = 3$; 16%). DOTs reported ancillary purposes, including to investigate the frequency of deer–vehicle collisions, track shifts in populations of certain species and the spread of non-native species, provide data to a DNR, budget for future projects and identify areas where maintenance needs to focus, and receive reimbursement from the DNR for each deer removed. The 12 responding DNRs frequently described a dual purpose of monitoring wildlife trends ($n = 8$; 67%) and identification of problem areas ($n = 7$; 58%), whereas other DNRs indicated disease monitoring ($n = 1$; 8%), other wildlife or ecological concerns ($n = 3$; 25%), or other transportation concerns ($n = 2$; 17%). Other wildlife or ecological concerns include estimating age and sex composition, rates of reproduction, effects of winter severity, and collecting data on endangered species. Other concerns include determining what kind of mitigation measures may be needed and where they may be installed and investigating times of day, weather, and road conditions that may be associated with accidents. DNRs reported ancillary purposes that include public relations, documentation of invasive or expanding species populations, and providing a basis for population goals.

DNRs and DOTs were asked which of the following data processing tools are used in data analysis: computer databases, frequency graphs, statistical cluster analysis, statistical analysis for trends, and GIS. All but 1 of the 19 responding DOTs use computer databases ($n = 18$; 95%), most use frequency graphs for kills along certain road sections ($n = 13$; 68%), and almost half use statistical cluster analysis ($n = 9$; 47%). Fewer than half of the respondents use statistical analysis for trends ($n = 6$; 32%) or GIS ($n = 8$; 42%). All but one of the responding DNRs use computer databases ($n = 10$; 91%); most perform statistical analysis for trends ($n = 7$; 64%) and GIS ($n = 6$; 55%). Less than half the DNR respondents use frequency graphs ($n = 5$; 45%) or statistical cluster analysis ($n = 4$; 36%).

Data are entered into one database by most states and provinces (75%). However, the DOT respondent from one province noted that data are put in a province-wide database; however, the DNR respondent from that same province noted that they are not, suggesting that the DNR may not be aware of the database. Most responding DOTs and DNRs enter data in the centralized database on at least a monthly basis ($n = 7$, 39%; $n = 4$, 36%) or from 1 to 6 months after receiving the data ($n = 3$, 17%; $n = 6$, 55%). One DNR and two DOTs enter the data more than 6 months after data collection, and one DNR and two DOTs noted that the time between data collection and data entry varies widely.

The results of data collection and analysis are published annually by DOTs and DNRs ($n = 8$; 47% and $n = 7$; 54%), with four DOTs (Maryland, New Hampshire, Ohio, and Wyoming) and two DNRs (Newfoundland and Nova Scotia) publishing as needed or on request. One DOT and one DNR publish at intervals of longer than 1 year, and one DOT (Colorado) and one DNR (Manitoba) publish at intervals shorter than 1 year (i.e., monthly and quarterly). Three DOTs and two DNRs do not publish the results of their data for external review. Both DOTs (n = 13; 72%) and DNRs (n = 10; 83%) share results with the personnel that collects the data.

Data publication is often in electronic form, and the reports are either distributed though e-mail or posted on the Internet, with seven responding DOTs (46%) and five responding DNRs (45%) preferring this method. Two DNRs and two DOTs publish in different media depending on the request. One DNR and three DOTs send media to other agencies, and one DOT relies on public media (television). Other publication media include booklets, mail, and presentations. Most responding DOTs (n = 16; 89%) share results with other organizations or individuals, including DNRs, local law enforcement, non-profit groups, research groups, and the general public. All responding DNRs (n = 11; 100%) also share results with other organizations or individuals, including local agencies, hunters, trappers, and the general public.

All DOTs (n = 18; 100%) believe that the collection and analysis of AVC data leads to on-the-ground mitigation measures, whereas 82% of the DNRs (n = 9) responded similarly. Two DNRs indicated that the data do not lead to mitigation measures. Thirteen DOTs responded with examples of mitigation measures deployed based on AVC data. These include the use of warning signs (n = 13; 100%), crossing structures (including underpasses, multi-use bridges, and wildlife overpasses; n = 4, 31%), fencing (n = 5; 38%), alteration of vegetation along the right-of-way (n = 3; 23%), striping and rip-rap (n = 1; 8%), and lighting of problem areas (n = 1; 8%). Six DNRs responded with comments regarding what kinds of mitigation measures are employed. These include warning signs (n = 6; 100%), speed limits (n = 2; 33%), and changes to the habitat along the right-of-way.

Most responding DOTs (n = 14; 82%) indicated that the mitigation measures are put in place because of the DOT alone, although one DOT indicated that mitigation results from cooperation between DNRs and DOTs. Three DOTs noted that other parties were involved, including planners, Transportation Management System Coordinators, transportation district management, local individuals, field personnel, and analysts. Similarly, five of the responding DNRs (55%) indicated that DOTs do the mitigation, with two respondents indicating that mitigation occurs through cooperation between DNRs and DOTs. One respondent noted that it depends on if the mitigation is requested by a town, municipality, or DOT, and one believed the question was not applicable.

Potential Obstacles to Implementing or Improving AVC Programs (*AVC Section 5*)

According to the 17 responding DOTs, the most commonly reported problem with AVC programs is that AVCs are underreported (n = 7; 41%), whereas data quality (consistency, accuracy, and/or completeness) was identified as a problem by four DOTs, and the lack of spatial accuracy was also identified as a problem by four DOTs. One DOT believed that automated tools in the database could simplify data analysis, whereas another commented that changes to the database entry software would result in (partially) incompatible data. One DOT reported that the publication of yearly reports is often behind schedule. Two DOTs reported no problems with data collection.

Sixteen DOTs elaborated on how AVC data collection can be improved. The most frequent suggestion was to improve data quality in terms of consistency, accuracy, and completeness (n = 6; 38%). Improving spatial accuracy is important to 25% of respondents, increasing accuracy of species identification is important to 19%, and increased resources (such as personnel time and training) are important to 13%. One DOT indicated that improving the consistency of data reporting on a state-wide level would be beneficial. Another DOT indicated that public recognition of the value in collecting these data would be important, whereas yet another indicated that expanding and improving AVC data collection and integrating it with carcass removal data would be helpful. Two DOTs did not believe that their data collection methods needed improvement.

Of the eight responding DNRs, four (50%) have concerns with data quality (i.e., inconsistency, inaccuracy, and/or incompleteness). Spatial accuracy concerns two (25%) of respondents, one DNR mentioned underreporting, and yet another DNR has problems with incompatible methods used by data collectors and data analyzers. Two DNRs have problems with the interval between data collection, feedback, and analysis. Only one DNR reported no problems with data collection.

Of the nine responding DNRs, most (n = 6; 67%) believe that AVC data collection methods could be improved through increasing spatial accuracy, especially through incorporating GPS technology in the data collection procedures. Three DNRs (33%) also believe that improving data quality (making the data more consistent, accurate, and/or complete) is important. One DNR indicated that improving species identification would be helpful, whereas another DNR indicated enhanced timeliness in filing reports would be helpful. Increased resources for data collection were important to two DNRs. One DNR believed that AVC data collection methods did not need to be improved.

The procedures for AVC data analyses are thought to have similar problems. Eleven DOTs indicated one or more problems with AVC data analyses, whereas five indicated *no* problems with existing data analyses. The most common data analysis concern for DOTs is the quality (consistency, accuracy, and completeness) of the data (45%), followed by spatial accuracy (27%). Three DOTs indicated that underreporting of AVCs causes problems in data analysis. Four of eight responding DNRs (50%) indicated that poor data quality was problematic. Spatial accuracy was problematic to three (38%) of responding DNRs. Three other DNRs (38%) indicated no problems with data analysis.

Thirteen DOTs offered ideas on how to improve AVC data analysis methods. Improving spatial accuracy (e.g., through the use of GPS technology) and improved spatial analyses (e.g., through the use of GIS) is important to five (38%) (Alaska, Alberta, Maryland, Utah, and Wyoming). Three DOTs (Minnesota, New Hampshire, and Wyoming) (23%) indicated that improving data quality (consistency, accuracy, and completeness) is important. Five DOTs (British Columbia, Maine, Manitoba, Maryland, and Wyoming) (38%) also indicated that improving the timeliness of data entry would facilitate data analysis. British Columbia added that more reporting from rural areas would be helpful. Similarly, most DNRs that responded with suggestions on how to improve AVC data analysis methods believe that the use of GIS and improving the spatial accuracy of the data (e.g., through the use of GPS technology) is beneficial to the data analyses (43%; Ohio, Ontario, and Rhode Island). Ontario, Rhode Island, and Vermont DNRs (43%) indicated that timeliness with data entry would facilitate data analyses, and the Newfoundland DNR noted that data analysis for AVCs could be improved through changes in the database and data entry process. Ontario and Rhode Island indicated that including cluster analyses would be beneficial.

Data dissemination is not regarded as a problem by DOTs ($n = 11$; 73%) or DNRs ($n = 9$; 100%). Other comments reiterated that the use of GPS technology and GIS facilities is needed (one DOT), that there is little support for reducing AVCs and improving AVC data collection programs because AVCs form only a small portion (<1%) of the total number of collisions that result in human injuries or fatalities (one DOT), that not all engineers cared about the subject and that traffic planners needed to be involved with AVC data earlier in the planning process (one DOT), that coordinating data collection and dissemination with other state agencies could be problematic (one DOT), that making information available through the Internet may be beneficial (one DOT), and that a more formal annual report would aid in data dissemination (one DOT).

AC Survey

The AC survey can be found in Appendix B, with the summary data contained in Appendix G.

Rationale for AC Data Collection and Roads and/or Areas Included (*AC Section 1*)

Survey participants were asked why they collect or manage AC data, ranking responses in order of importance, with 1 being most important and 4 being least important. Responding DOTs ranked public safety (n = 5; 50%) and accounting (n = 4; 50%) as the top reasons to collect or manage AC data (rank 1), with wildlife management or conservation ranked as second most important (rank 2; $n = 5$; 50%) (Figure 8 *upper*). Other reasons DOTs collect or manage AC data include requests by the public and "research." DNRs mostly ranked wildlife management or conservation as the most important reason ($n = 9$; 75%) with public safety ranking second ($n = 5$; 45%) (Figure 8 *lower*). Other reasons why DNRs collect or manage AC data include disease monitoring.

On average, DNRs have collected AC data longer than DOTs, with 22 years of collecting AC data for the average DNR (95% C.I. = 15.2, 28.9; n = 10), and 12.2 years of collecting AC data for the average DOT (95% C.I. = 2.0, 22.4; $n = 6$), but differences were not significant when tested with a two-sided, two-sample t-test ($P = 0.153$). The earliest collections of AC data were undertaken in 1966 by the Newfoundland DNR, 1978 by the Ohio and British Columbia DOTs, and 1979 by the Nova Scotia DNR.

Half of the responding DOTs reported that AC collection is mandatory (n = 5), and the other half reported it is either voluntary or semi-voluntary (n = 1 and 4). Of responding DNRs, 64% reported that the collection of AC data is mandatory (n = 7), whereas 36% reported it is voluntary or semi-voluntary (n = 1 and 3). These percentages were not statistically different ($P = 0.850$).

Of the nine DOTs that responded, all collect data on Interstates (100%), eight (89%) collect data on arterial roads, five (55%) collect data on collector roads, and one (11%) collects data on local roads. Of the 12 DNRs that responded, 11 (92%) collect data on Interstates, 11 (92%) collect data on arterial roads, 10 (83%) collect data on collector roads, and 7 (58%) collect data on local roads. The Idaho DNR does not collect data on Interstates or arterial roads.

The geographic limits of the reporting area for the 10 responding DOTs primarily included all areas (or roads) under their jurisdiction, without further specification ($n = 5$; 50%). Two DOTs report on all roads in all areas within their states, and one DOT reports on "many of the main freeways and major arterials, especially in rural areas where collisions with animals are a concern." The British Columbia DOT records data on all numbered highways under the agency's jurisdiction, except for those maintained by the federal government, and the Maryland DOT records data statewide for all state-maintained roads including Interstates. Another DOT noted that their geographic limits vary. The geographic limits of the reporting area for the 12 responding DNRs included all roads in the entire state or province ($n = 5$; 31%), all roads in the state or province with the exception of some federal lands (Kentucky), forest roads (Newfoundland), and tribal lands (Wisconsin). The North Dakota DNR reports on all Interstate, state, and county highways in all areas, and the

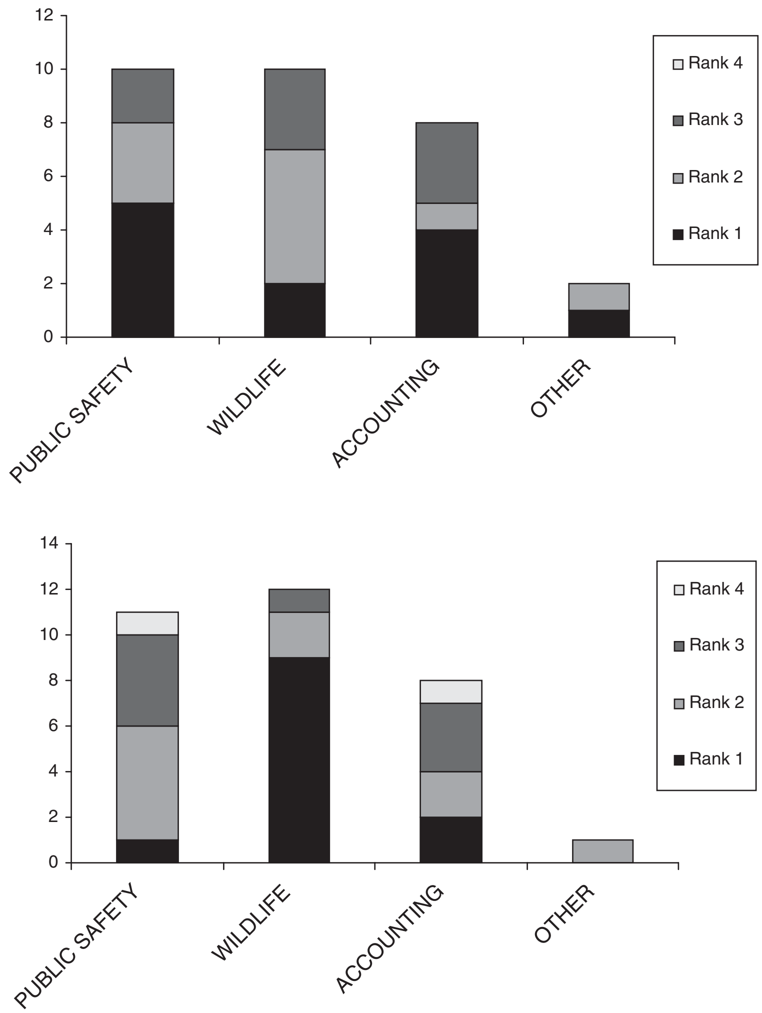

FIGURE 8 Ranked reasons why DOTs (*upper*) and DNRs (*lower*) collect AC data.

North Carolina DNR reports on all highways in the state. Two DNRs did not report geographic boundaries.

Responding agencies indicated that the landscape surrounding the areas where they collect AC data are both rural and urban (*n* = 18; 82%), with four respondents indicating that the surrounding landscape is predominantly rural (North Dakota DNR, Oklahoma DNR, Utah DOT, and Virginia DOT).

When asked which other organizations or individuals collect AC data on the road systems that are covered by their agencies, most respondents indicated that no other agency or organization works these roads (*n* = 7; 32%), with several respondents indicating that a branch of law enforcement also covers these roads (*n* = 6; 27%). Other responses included other governmental branches (i.e., city or county; *n* = 3; 14%) and private organizations or individuals (i.e., nongovernmental organizations, interested individuals, *n* = 4; 18%). Correspondingly, when asked what other organizations or individuals collect AC data on the roads *not* covered by their agency, most agencies did not respond (*n* = 14; 52%) or responded with "unknown" (*n* = 6; 22%). Other responses included DOT, DNR, law enforcement, other governmental agencies (i.e., city or county, *n* = 2) and that no other entities gather data on these roads (*n* = 1).

AC Parameters Recorded and Reporting Thresholds (*AC Section 2*)

Respondents were asked "Who reports the carcass to the agency or data collector?" Twenty-four agencies responded to this question, with 14 indicating that multiple agencies collect these data. The most frequent source of carcass data is DOTs (*n* = 16; 67%), followed by DNRs (*n* = 15; 63%) and highway patrols or other law enforcement agencies (*n* = 11; 46%). Other answers included private companies or the general public (*n* = 6; 25%).

Typically (other) agencies (*n* = 10; 100%) report the presence of a carcass to a DOT; although drivers report data to many DOTs as well (*n* = 6; 60%). Other sources of carcass data include law enforcement and contractors ($n = 2$ each). Agencies ($n = 11$; 79%) and drivers ($n = 12$; 86%) are the most frequent data sources for animal carcasses for DNRs. Roughly equal proportions of DOTs ($n = 7$; 70%) and DNRs ($n = 8$; 57%) have reporting thresholds for animal carcasses ($P = 0.831$). For DOTs, these thresholds usually involve a combination of carcass location and species involved. Most responding DOTs reported a threshold of whether the carcass was in the road ($n = 5$; 56%); in the right-of-way, even if not visible to drivers ($n = 6$; 67%); and if the carcass was in the right-of-way and visible to drivers ($n = 6$; 67%). Five DOTs responded that certain species must be involved for the carcass to be reported (56%). For DNRs, these thresholds usually involve certain species only ($n = 7$; 58%). The species of interest to both DOTs and DNRs were deer ($n = 12$); moose ($n = 3$); bear ($n = 4$); certain medium- and large-sized mammals, including livestock, furbearers, carnivores, and other ungulates; and birds ($n = 8$).

Search and reporting efforts for ACs were described as monitoring by most responding DOTs ($n = 6$; 75%), but as incidental by most responding DNRs ($n = 10$; 71%). These differences were not quite significant ($P = 0.060$). The Montana and Utah DOTs indicated that both monitoring and incidental reporting occur, depending on the routes.

The frequency of checks for ACs is variable. Five DOTs (38%) search daily, two (15%) search weekly, two (15%) search daily and weekly (depending on road type and classification), and one (8%) reported that the frequency of surveys varied. DNRs often record ACs as they are encountered or reported ($n = 6$; 46%), although some DNRs perform daily searches ($n = 2$, with one additional DNR search daily over a 1-month span), and other DNRs searching for ACs weekly ($n = 1$), daily and weekly ($n = 1$), monthly ($n = 1$), another reporting ACs incidentally, and two others reported only that the frequency of the checks varied.

Agencies were asked which parameters they regularly record as a part of AC reporting (Table 6). Ten DOTs responded to all or parts of this question. Most responding DOTs either always or usually record the date ($n = 10$; 100%), district or unit ($n = 8$; 80%), road or route ID ($n = 10$; 100%), carcass location ($n = 8$; 80%), and species of the animal concerned ($n = 8$; 88%). Most DOTs record the observer's name either always or usually, and the sex of the animal sometimes. Most DOTs never record time, the age of the animal, or whether the carcass was removed ($n = 5$; 50%). Human fatalities, human injuries, types of injuries, presence of property damage, or estimated amount of property damage are never recorded by the responding DOTs.

Of the 16 DNRs that took the AC survey, 5 (31%) did not respond to this question. Most responding DNRs always or usually record date ($n = 10$; 91%), district or unit ($n = 10$; 91%), the name of the observer ($n = 7$; 64%), road or route ID ($n = 8$; 73%), carcass location ($n = 7$; 64%), species of animal ($n = 11$; 100%), and whether the carcass was removed ($n = 6$; 55%). Most DNRs always or usually record the sex ($n = 7$; 64%) and age of the animal carcass ($n = 6$; 55%). Most DNRs ($n = 8$; 73%) never record the presence of human fatalities, human injuries, types of injuries, or amount of property damage sustained as a result of this carcass. Another 64% never record whether property damage occurred.

TABLE 6
ANIMAL CARCASS PARAMETERS AND FREQUENCY OF RECORDING THESE PARAMETERS BY DNRs AND DOTs (all in percentages)

	DNR						DOT					
Recorded Parameters	Always	Usually	Sometimes	Rarely	Never	No Response	Always	Usually	Sometimes	Rarely	Never	No Response
Date	50	13	6	0	0	31	82	9	0	0	0	9
Time	19	6	13	13	19	31	9	18	18	0	45	9
District/unit	50	13	6	0	0	31	64	9	0	0	18	9
Name of observer	31	13	25	0	0	31	27	27	18	0	18	9
Road/route identification	31	19	13	0	6	31	73	18	0	0	0	9
Carcass location	25	19	13	6	6	31	55	18	9	0	9	9
Human fatalities	6	6	0	6	50	31	0	0	0	0	91	9
Human injuries	6	0	0	13	50	31	0	0	0	0	91	9
Type of injury	0	6	0	13	50	31	0	0	0	0	91	9
Property damage	6	0	0	19	44	31	0	0	0	0	91	9
Amount ($) of property damage	0	6	0	13	50	31	0	0	0	0	91	9
Species of animal	50	19	0	0	0	31	64	9	0	0	9	18
Sex of animal	25	19	13	6	6	31	9	18	36	9	18	9
Age of animal	13	25	0	25	6	31	0	9	27	18	36	9
Removal of carcass	31	6	13	0	19	31	36	9	0	0	45	9

Note: Shaded areas mark category with the most frequent response.

TABLE 7
HOW ANIMAL CARCASS LOCATION DATA ARE REPORTED BY DNRs AND DOTs
(all in percentages)

	DNR						DOT					
Recorded Parameters	Always	Usually	Sometimes	Rarely	Never	No Response	Always	Usually	Sometimes	Rarely	Never	No Response
GPS coordinates	0	6	19	13	25	38	0	0	0	9	73	18
Map coordinates	6	6	19	19	19	31	0	0	18	9	55	18
Mile/kilometer post	6	6	31	13	6	38	55	27	9	0	0	9
Road section	6	25	19	0	6	44	36	36	0	0	18	9
Other	13	6	6	0	0	75	0	0	0	0	9	91

Note: Shaded areas mark category with the most frequent response.

AC Location Recording and Spatial Resolution
(*AC Section 2—continued*)

Animal carcass location recording varied between DOTs and DNRs (Table 7). Most DOTs never use GPS technology ($n = 8$; 89%) or maps to derive coordinates ($n = 6$; 67%). Most DOTs always or usually use mile or kilometer reference posts ($n = 9$; 90%) and/or road sections ($n = 8$; 80%). Of the responding DNRs, most rarely or never make use of GPS technology ($n = 6$; 60%) or maps to derive coordinates ($n = 6$; 55%). DNRs sometimes use mile or kilometer reference posts ($n = 5$; 50%) and usually or sometimes record the road sections ($n = 7$; 78%). Other responses included the use of landmarks (e.g., 1 mile north of Swift River), zoogeographic region, or county name.

The accuracy for AC locations is generally at or more than 0.1 mile or kilometer, with only one of the nine DOTs using more accurate descriptions. The British Columbia DOT noted that it usually records ACs at 1 yard or meter, although it noted that location accuracy precision is only theoretically at the 1-meter level; in reality the locations are described less accurately. The Maryland DOT also rarely records carcass positions at 1 meter or yard and at 15 meters or yards, although it sometimes records carcasses at 30 yards or meters. Carcasses are always or usually recorded at the 0.1 mile or kilometer ($n = 6$; 67%) or 1 mile or kilometer level ($n = 4$; 57%).

Location accuracy of ACs is rarely under 0.1 mile or kilometer for DNRs, with the Kentucky DNR reporting that it always records ACs within 1 yard or meter. Idaho rarely records ACs within 1 yard or meter and 15 yards or meters, Idaho and South Dakota rarely record ACs within 30 yards or meters, and Vermont sometimes records ACs to 30 yards or meters. Two DNRs reported that they always record within 0.1 mile or kilometer (Nova Scotia and South Dakota), one DNR usually (Vermont), one DNR sometimes (Wyoming), one DNR rarely (Wisconsin), and four DNRs never report to this level of accuracy. Four DNRs usually record AC locations to 1 mile or kilometer, whereas two others sometimes, one rarely, and one never record at this accuracy level. Other DNR responses included the use of geographic references, county name, or zoogeographic region.

Reference and mile posts used in determining location descriptions for ACs are usually 1 mile apart on roads that DOTs ($n = 5$) and DNRs ($n = 4$) collect data on, and fewer are located at 0.1-mile intervals (DNR = 1; DOT = 3). The Maryland DOT uses reference posts located 500 ft apart.

Species and Species Groups Recorded for ACs
(*AC Section 2—continued*)

Amphibians are generally not recorded by DOTs or DNRs (Table 8). Of the 10 DOTs responding, 9 (90%) never record amphibians, whereas one DOT almost never records amphibians. Of the 12 DNRs responding, only 1 (8%) reported amphibians to species level, although this DNR only incidentally reports amphibians. Other DNR responses included "our agency does not have jurisdiction over amphibians," that the question was not applicable to their area (Nova Scotia), and that amphibians are rarely reported (Kentucky).

Reptiles are also rarely recorded by DOTs and DNRs (see Table 8). Of the nine responding DOTs, eight never record reptiles, and one almost never records reptiles. Of the 11 DNRs responding, only 1 DNR records reptiles to the species level, although reptiles are only incidentally reported. One DNR records all reptile groups to order (Kentucky), eight DNRs never record them, and one DNR noted that its agency does not have jurisdiction over reptiles.

Birds are generally recorded in more detail than reptiles or amphibians (see Table 8). Of the eight responding DOTs, the Wyoming DOT records all raptors to genus; British Columbia DOT reports birds at the discretion of its personnel; Idaho DOT records raptors and other "large birds"; Virginia identifies hawks and turkeys; and Maryland identifies turkeys, owls, and eagles. Four DOTs (50%) never record birds, and one DOT rarely records them. The Arizona DNR records game birds and turkeys to species, but noted that all birds except wild turkeys are incidentally reported. The Kentucky DNR records all birds to species, New Hampshire DNR records endangered birds to

TABLE 8
SPECIES GROUPS RECORDED BY DNRs AND DOTs IN ANIMAL CARCASS DATA COLLECTION PROGRAMS (all in percentages)

	DNR								DOT							
Recorded Parameters	Species	Genus	Family	Order	Class	Never	Other	No Response	Species	Genus	Family	Order	Class	Never	Other	No Response
Amphibians	6	0	0	6	0	44	25	25	0	0	0	0	0	64	9	27
Reptiles	6	0	0	6	0	50	6	31	0	0	0	0	0	73	9	18
Birds	25	0	0	0	0	31	13	31	0	9	0	18	9	36	9	18
Large wild mammals	69	0	6	0	0	6	0	19	64	27	0	0	0	0	0	9
Small wild mammals	25	0	0	0	0	25	13	38	18	0	18	0	0	36	18	9
Domestic animals	13	X	X	X	0	6	38	44	55	X	X	X	0	9	27	9

Notes: Shaded areas mark the category with the most frequent response. X = not an option for responses

species, and Pennsylvania DNR records endangered birds to species but rarely collects them. The Idaho DNR noted that birds are rarely recorded; usually only for specific projects. Eight DNRs never record birds (62%).

Large wild mammals (deer size and greater) are the most often recorded animal group, with all responding DOTs recording large mammals ($n = 7$, 70%, classify to species, and $n = 3$, 30%, classify to genus) (see Table 8). Large mammal groups of special interest to DOTs include all large wild mammals ($n = 5$; 50%) and game species ($n = 5$; 50%). Three DOTs record ungulates (Idaho, Iowa, and Utah), two record carnivores (Idaho and Utah), one records endangered species (Idaho), and one records non-native species (Idaho). All but one of the responding DNRs record large wild mammals ($n = 12$; 92%), with 11 classifying them by species and Arizona recording them to family. Ungulates were the large mammal group of highest interest to responding DNRs ($n = 7$; 54%). Other large mammal groups recorded by DNRs include all species ($n = 2$; Kentucky and Newfoundland), endangered species ($n = 4$; 31%), game species ($n = 4$; 31%), carnivores ($n = 4$; 31%), and non-native species (South Dakota).

Small mammals are classified to the species level by two responding DOTs (20%), to family by two DOTs (20%), are never recorded by four DOTs (40%), and are rarely recorded by two DOTs (20%) (see Table 8). The New York State DOT noted that the larger small mammals (i.e., coyotes or beaver) are regularly recorded. Small mammal groups of interest to DOTs included all species ($n = 2$), and larger small mammal species where identification is possible ($n = 2$). The British Columbia DOT records small wild mammal groups at the discretion of the maintenance contractors. Small mammals are identified to species by four responding DNRs (40%), whereas four respondents (40%) never and two respondents (20%) rarely record small mammals. Small mammal groups of interest to DNRs include all small mammals, endangered species, carnivores, and non-native species ($n = 1$ each). One DNR was interested in furbearer species only.

More DOTs ($n = 6$; 60%) than DNRs ($n = 2$; 22%) record domesticated animals to the species level (see Table 8). Five DOTs record large species only (45%), whereas two DOTs responded with "other," and elaborated that small species are occasionally recorded ($n = 1$) and that "dogs and cats etc." are recorded ($n = 1$). Domesticated animals are usually identified to species by only two of the nine responding DNRs, with one DNR never recording domestic animals. Six responding DNRs (67%) marked "other," but did not elaborate. When asked which groups of domestic animals are recorded, three DNRs noted large species only.

Both DNRs ($n = 9$; 69%) and DOTs ($n = 6$; 60%) keep portions of carcasses for further analysis. One DOT answered "yes" to this question, but noted that the DNR is the agency that collects data on black bears for further analysis. Further analyses included disease testing for chronic wasting disease (Arizona, Iowa, Kentucky, New York, South Dakota, and Wisconsin), West Nile Virus (New York, British Columbia, and Wisconsin), and rabies (Kentucky). Reproductive data are also gathered from the carcasses (Missouri).

Training and Instruction for AC Data Collectors (AC Section 3)

Section 3 was designed to investigate what training, instruction, and other aides are provided to AC collectors. More DOTs ($n = 5$; 50%) than DNRs ($n = 2$; 14%) train their AC data collectors; however, to obtain the appropriate sample size for the chi-square test (five or more expected sample size in each cell), the "don't know" answers ($n = 2$ for both DNR and DOT) were pooled with the "no" answers. With this stipulation, the differences were not significant ($P = 0.149$). Of the responding DOTs, two train their data collectors just once, one trains them yearly, one trains them annually or more frequently, and one selected "other" but did not specify further. One DOT uses literature combined with on-the-job training for its data collectors, whereas three train them on the job and one uses a seminar. The two DNRs that train their AC data collectors noted that their training was not specific to AC data collection, but that the information dissemination and general training could be applied to AC data collection. One

DNR answered subsequent questions, implying that an additional DNR trains its data collectors.

Five DOTs responded to how they train their data collectors (Idaho, Montana, New York, Ohio, and Wyoming). All train their employees in the purpose of collecting the data, four train their data collectors in the importance of recording accurate information, four train in filling out forms (Idaho, Montana, Ohio, and Wyoming), three train in which ACs to record (Idaho, Ohio, and Wyoming), two train in species identification (Idaho and Wyoming), one trains in determining the age of a carcass (Wyoming), two train in obtaining accurate information (Idaho and Montana), and one trains in handling carcasses potentially infected with chronic wasting disease, West Nile virus, and in carcass composting (New York). None of the DOTs train their data collectors in carcass sexing, necropsy, the use of GPS technology, or data entry or management. Only one DOT responded to the question asking what tools and materials are provided to AC data collectors. This DOT provides worker safety materials.

The three DNRs that train their data collectors train them in different aspects of data collection. One DNR trains them in filling out forms only. Two DNRs train their employees in the purpose of data collection and the importance of recording accurate information, filling out forms, which ACs to record, and in taking accurate location information. One of these two DNRs also trains its data collectors in species identification, carcass aging, carcass sexing, necropsy, and use of GPS technology. None of the DNRs trains its employees in data entry or management. Two DNRs responded to the question regarding the materials and tools provided to assist with AC data collection. The Newfoundland DNR provides its data collectors with specially designed data books. Arizona Game and Fish Department provides workers with species identification guides, GPS units, and necropsy kits.

AC Data Analyses and Data Sharing (*AC Section 4*)

A higher percentage of DOTs ($n = 9$; 90%) than DNRs ($n = 8$; 53%) share AC data with other organizations, although this difference was not significant ($P = 0.197$). The DOTs that share their data do so with DNRs ($n = 4$; 44%), interdepartmentally ($n = 5$; 56%), with consultants and academic institutions ($n = 1$; 11%), whomever requests the data ($n = 1$; 11%), and one DOT shares data through GeoData Services data linkage efforts. Of the eight responding DNRs, three (38%) share their data with DOTs, the general public ($n = 4$; 50%), interdepartmentally ($n = 2$; 25%), and with researchers ($n = 1$; 13%).

Most responding DOTs ($n = 7$; 78%) and DNRs ($n = 11$; 73%) analyze AC data. One DOT responded that data are analyzed by a DNR, and one DOT noted that the data are analyzed by "various entities." DOTs indicated that data analyses were mainly performed by personnel within the DOT ($n = 7$; 78%), including highway safety technicians, TMS coordinators, planners, etc., with two DOTs (22%) sending data to wildlife biologists at DNRs. The three DNRs that do not analyze their own data remarked that they are analyzed by a biologist, other conservation agency, or that they are only in the process of beginning data analysis. Data analyses for DNRs are all performed by wildlife biologists ($n = 10$ out of 10 respondents).

Four DOTs analyze data annually (44%), three others analyze data annually and on request or depending on specific needs (33%), and three analyze data as needed only (33%). One DOT noted that data analysis frequency varies, and another DOT noted that data analysis occurs as time permits on a case-by-case basis. Data are analyzed annually by seven responding DNRs (64%), whereas one analyzes either annually or on request, one analyzes data only as needed or on request, and two reported that analysis frequency varies.

Respondents were asked to describe the purpose(s) of the data analyses. DOTs overwhelmingly responded that the identification of problem areas is the primary function of the data ($n = 8$; 80%), with only two DOTs (20%) stating that wildlife and/or ecological reasons is the primary function of the analyses. Wildlife conservation and other ecological reasons were overwhelmingly selected as a secondary purpose in data collection from the six responding DOTs ($n = 4$; 67%). The 11 responding DNRs also indicated that identification of problem areas is a purpose of data analysis ($n = 7$; 64%), but monitoring wildlife population trends received five responses (45%), and other wildlife and/or ecological reasons received four responses (36%). When identifying other purposes that the data serve, three DNRs noted wildlife population monitoring or general wildlife/ecological reasons. One DNR also noted public relations and one the importance of non-native species monitoring.

The agencies were asked which data processing tools are used in AC data analysis: computer databases, frequency graphs, statistical cluster analysis, statistical analysis for trends, and GIS. All but one of the responding DOTs use computer databases ($n = 8$; 89%). DOTs also use frequency graphs for road sections ($n = 4$, 44%; British Columbia, Iowa, Utah, and Wyoming) and GIS facilities ($n = 4$, 44%; Idaho, Iowa, Maryland, and New York), and, although less frequently, statistical cluster analyses (Iowa and Wyoming) and statistical analysis for trends (Iowa). All but two of the responding DNRs use computer databases ($n = 9$; 82%), and most use statistical analysis for trends ($n = 6$; 55%), but fewer use frequency graphs for road sections (North Dakota and South Dakota), statistical cluster analyses (Connecticut and Missouri), or a GIS (Arizona, Nova Scotia, and South Dakota).

Data are entered into one centralized database for most states and provinces (12 of 17 responding states and 2 of 3 responding provinces). Most responding DOTs ($n = 4$; 44%) and DNRs ($n = 4$; 40%) noted that data entry into the centralized database occurs monthly or more frequently. The

Iowa, Maryland, and Ohio DOTs noted that data entry would occur over 1 to 2 business days. One DOT estimated the time interval at 3 months, whereas another DOT noted it could take 1 to 6 months to have the data entered, and one DNR mentioned it could take 1 to 2 months. Three DNR respondents noted that data entry could take more than 6 months. Three DNR respondents and two DOT respondents noted that turnover between data collection and entry varies greatly.

DOTs commonly publish AC data at intervals of less than 1 year (n = 4; 40%) or on request (n = 2; 20%), with one agency publishing at a frequency of more than 1 year. The Maryland DOT publishes the data on an intranet server concurrent with data entry. Responding DOTs publish in different manners depending on request (n = 3), use the data internally or share it with other agencies and stakeholders (n = 3), use public media (n = 1), or vary in their publication methods. All responding DOTs (n = 9) share their results internally and with other organizations and individuals, including DNRs, and the general public.

DNRs (n = 7; 64%) generally publish their data yearly, with two respondents (18%) publishing data only in internal reports and two (18%) not publishing data currently. Data are published in a manner as requested by three DNRs, in a booklet or report by three others, and web-based by one. Eight of the responding DNRs (80%) share their results with other organizations or individuals, including DOTs, other local agencies, the Audubon Society, the general public, and/or whoever requests the data.

Most DOTs (n = 8; 88%) believe that collection and analysis of AC data leads to on-the-ground mitigation measures, but only 50% (n = 5) of responding DNRs agreed. One DOT believes that the data do not lead to mitigation measures. These differences were not significant (P = 0.185), although sample sizes were relatively low.

Eight DOTs responded with examples of mitigation measures that were put in place based on AC data. These included warning signs (n = 7), fencing (n = 5), and crossing structures (n = 3). One DOT indicated that it was working toward deploying mitigation in response to AC data. Five DNRs responded with comments regarding what kinds of mitigation measures are employed. The measures include warning signs (n = 4), wildlife fencing and under- or overpasses (n = 1), and one DNR respondent noted that mitigation is planned but has not yet been implemented. These mitigation efforts are mostly attributed to DOTs (n = 11) and secondarily to DNRs (n = 3), law enforcement (n = 1), and other agencies (n = 1).

Potential Obstacles to Implementing or Improving AC Programs (*AC Section 5*)

The most common problem experienced by both DOTs (n = 6; 60%) and DNRs (n = 9; 64%) in data collection procedures is the lack of consistency. Reasons for lack of consistency include personnel problems (i.e., getting all personnel to do equal levels of data collection, changing personnel, personnel not completing data sheets, personnel recording information inconsistently) and consistency in reporting locations. Two DOTs noted that districts differ in data collection procedures within the state, which hampers data synthesis efforts. Other problems include a lack of a state-wide database and inadequate follow-up procedures to verify certain data, inadequate staff time to collect data for animals other than deer and other large mammals, the state of the animal carcass when it is encountered or removed, that data collection is not mandatory, and that observations of some species are too low for "statistical reliability." Three DOTs and one DNR reported no problems with AC data collection.

Most responding DNRs and DOTs believe AC data collection methods can be improved by making data collection more consistent and/or improving the spatial accuracy of AC locations, especially through the use of GPS technology. Eight responding DOTs mentioned the need for increased data quality (i.e., consistency, accuracy, and completeness; n = 4; 50%), increased spatial accuracy (n = 4; 50%), and additional resources (n = 2; 20%), such as personnel and training. Four responding DNRs (40%) indicated that improving consistency in data collection is important, five (50%) mentioned improvements in the spatial accuracy of the data, whereas two other DNRs mentioned a need for a centralized database, one DNR noted that considerable training and funding is useful, and another DNR indicated the need for more tools (such as GPS units) to allow for more spatially accurate data collection. Five of the 18 respondents (28%) specifically mentioned coordinates obtained through GPS or maps, the use of GIS facilities, and the need for field computers integrated with a GPS unit that allows for digital data entry in the field and precise and consistent locations.

Data analyses have problems similar to data collection. Of the nine DOTs that responded, six (67%) believe data quality (i.e., consistency, accuracy, and completeness) is problematic for analysis, two DOTs believe that a lack of resources makes analyses more difficult, one DOT believes that the lack of spatial accuracy presents difficulty with the analyses, and that the inadequate data on "small animals" is also problematic. One DOT believes there are no problems with AC data analyses. Of the nine DNRs responding to this question, five (56%) believe that a lack of consistency in data collection is problematic for analysis, one DOT believes that a lack of spatial accuracy is problematic, and two DOTs believe felt that inadequate resources makes AC data analyses more difficult. Two DOTs believe there are no problems with data analyses.

Of the five responding DOTs, four believe integration with GIS will improve analysis, four believe that faster and/or automated data entry will improve analysis, whereas two believe that more consistent data entry and collection will improve data analysis. One other DOT suggested cluster analyses. The eight responding DNRs believe that data analyses can be improved through integration with GIS (two DNRs), faster data entry (one DNR), more consistent data entry (one DNR), making reporting mandatory (one DNR), and obtaining better data (one DNR). Three DNRs believe data analyses did not need to be improved.

Most responding DOTs ($n = 4$; 57%) and DNRs ($n = 8$; 80%) believe there are no problems with AC data dissemination. The remaining responses included a need for more resources (two DOTs and one DNR) and that a lack of the consistency or compatibility of the data and reporting procedures makes dissemination of data difficult (two DOTs and one DNR). Suggestions to improve AC data dissemination include:

- Dedicating personnel to this activity.
- Enhancing communication between DOTs and DNRs.
- Disseminating data electronically instead of on paper.
- Entering the data into a centralized database.

CHAPTER FOUR

SUCCESSFUL EXAMPLES

INTRODUCTION

This chapter gives examples of successful practices for the collection, analysis, reporting, and application of AVC and AC data. For the purpose of this chapter, success was defined as a practice that has the support of the people that collect, analyze, report, and use the AVC and AC information, resulting in long-term dedication to the collection, analyses and reporting of AVC and AC data, and the execution of mitigation measures aimed at reducing animal–vehicle collisions.

DATA COLLECTION

For successful animal–vehicle collision data collection it is critical to have crash forms that have a checkbox for collisions with wild animals and additional checkboxes for the most common species involved in crashes and/or a space to write the name of such species. For a crash form to be filled out the crash has first to be reported (often to law enforcement personnel) and minimum thresholds often apply. Therefore, by definition AVC data only report a fraction of the total number of animal–vehicle collisions. Nonetheless, if the reporting efforts are consistent, the data can be compared in space and time making it a valuable tool.

For successful AC data collection it is critical to have motivated and trained personnel that understands the importance of the data collection program and that knows how to fill out the forms. Two successful AC programs [Wildlife Accident Reporting System (WARS) in British Columbia and Large Animal Accident Removal Reporting System in Maryland (L. Sielecki, personal communication, British Columbia DOT, July 2006; W. Branch, personal communication, Maryland DOT, July 2006; Henke et al. 2002; Sielecki 2003a,b, 2004, 2005] were both implemented with a top-down approach that guaranteed standardized procedures. Nonetheless, it is advisable to encourage existing or future data collectors to participate in the design of the program and the associated procedures. It is also important to document the procedures in great detail as a reference for everyone involved with the program. In Maryland, the AC reporting form was integrated with an already existing form that facilitated acceptance of the program and procedures because it is fully integrated with daily practices and in order to receive salary, the forms have to be completed and submitted (W. Branch, personal communication, Maryland DOT, July 2006). Follow-up procedures and the associated resources to check up on errors or missing or unusual data are essential for the data quality, and it also shows the personnel that collects the data that the data are seriously reviewed and that they are considered important (L. Sielecki, personal communication, British Columbia DOT, July 2006). In British Columbia, the data collection is done by contractors who have a contractual obligation to collect data on road-killed animals and the forms are submitted on a monthly basis. In Maryland, the forms are submitted on a daily basis.

In general, user-friendly forms and a precise referencing system (e.g., through the use of a GPS) are helpful for the implementation of a successful program (L. Sielecki, personal communication, British Columbia DOT, July 2006). Increased spatial accuracy combined with user friendliness can be obtained through the use of a hand-held field computer that is integrated with a GPS (e.g., Huijser 2006b). Species identification can be improved through training and, for example, a field guide with distribution maps that helps identify the most commonly found road killed species (L. Sielecki, personal communication, British Columbia DOT, July 2006; Ministerie van Verkeer en Waterstaat 1995; Sielecki 2004).

Experience with an AC data collection program in The Netherlands suggests that it is wise to restrict the species recorded to those of interest to either human safety and/or conservation (A. Piepers, personal communication, Public Works and Water Management, Dutch Ministry of Transportation, July 2006). Furthermore, the species should be easily identifiable by the personnel collecting the data, but that training may be justified to recognize rare, threatened, or endangered species (L. Sielecki, personal communication, British Columbia DOT, July 2006). Species that are not a concern to human safety or natural resource conservation and species that are abundant and/or not easily identifiable should generally not be included in the program, because it may result in inconsistent and wrong reporting. It is also important to ask data collectors for suggestions for improvements to the program, to send them the reports on the data, and to show them how the data can lead to mitigation measures, if applicable (L. Sielecki, personal communication, British Columbia DOT, July 2006). Perhaps it is most important to demonstrate the need for a data collection program.

DATA ANALYSES

Great care should be given to the design of the data collection program as the parameters collected and the procedures used to collect those parameters dictate what can and cannot be done with the data. In general, regular and timely data entry and/or data quality checks are essential to correct errors, retrieve missing data, and verify any unusual data. The use of a hand-held field computer that is integrated with a GPS (Huijser 2006b) may help such timely checks, because there are no hardcopy data forms waiting to be entered in a database; the data are entered once in the field at the time of the observation.

It is not unusual that AVC data from crash forms are excluded from safety data analyses (M. Pawlovich, personal communication, Iowa Department of Transportation, July 2006). However, animal–vehicle collisions are not necessarily random and they can be mitigated. Furthermore, by excluding AVC data other road characteristics that may have been a factor in such collisions may go undetected (M. Pawlovich, personal communication, Iowa Department of Transportation, July 2006). In general, AVC data should be included in safety data analyses.

It is important to dedicate sufficient resources to the analyses of the data. The resources should not only allow for employees for data entry (if applicable), follow-up, and analyses, but also for computers and software (e.g., GIS and statistical software for cluster analyses) (M. Pawlovich, personal communication, Iowa Department of Transportation, July 2006; L. Sielecki, personal communication, British Columbia DOT, July 2006). Finally, standardized procedures should be in place for data analyses that may include the use of GIS and statistical software to identify and prioritize the locations that may require mitigation measures. These procedures can be based on standardized research questions, but should also allow for new or innovative approaches if different questions arise.

REPORTING

AVC data may be reported in combination with other data derived from crash forms, whereas AC data are typically analyzed on their own (e.g., Henke et al. 2002; Sielecki 2004; Maine Department of Transportation 2005; Urbitran Associates et al. 2005). The reports may be organized according to standard research questions, but they should also allow for different analyses if required. The use of maps (e.g., the output of procedures with a GIS) is recommended (D. Brunell, personal communication, Maine Department of Transportation). The report should be made available to decision makers who may need to act on the results of the report, the personnel that collects the data, and, if appropriate, also to peers in other states or provinces, especially DOTs and DNRs, and the general public. Internet publication of the report allows for wide availability at low cost.

APPLICATIONS

Chapter two lists the most common applications of AVC and AC data, including:

- Estimating the magnitude of the animal–vehicle collisions (e.g., Kline and Swann 1998; Garrett and Conway 1999).
- Identifying animal–vehicle collision and road-mortality hotspots (e.g., Clevenger et al. 2003; Huijser et al. 2006a).
- Identifying road, traffic, human, and environmental factors that contribute to animal–vehicle collisions (e.g., Caro et al. 2000; Clevenger et al. 2003; Huijser et al. 2006a).
- Developing predictive models to determine where animal–vehicle collisions and animal carcasses are most likely to occur (e.g., Finder et al. 1999; Malo et al. 2004; Seiler 2005).
- Prioritizing mitigation efforts and assessing animal–vehicle collision mitigation methods (e.g., Barnum 2003; Bertwistle 2003; Dodd et al. 2004).
- Creating an index of population size for selected wildlife species (e.g., Dickerson 1939; Case 1978; Baker et al. 2004).

Although AVC and AC data can be used to evaluate the effectiveness of potential mitigation measures (e.g., Reeve and Anderson 1993; Clevenger et al. 2001; 2002a; Mosler-Berger and Romer 2003), it is important to include maintained or improved habitat connectivity in the evaluation of mitigation measures because AVC and AC data serve human safety as well as natural resource conservation goals. Furthermore, AVC and AC data can be used to modify the mitigation measure at that particular location and/or conduct mitigation measures on other sites based on the lessons learned.

Other uses of AVC and AC data include cost monitoring and accountability. Cost monitoring helps illustrate the economic impact of collisions with wild animals and potential changes over time. Yet another use of the data is for public outreach and education to inform the public about the potential for collisions with wildlife, sometimes at specific locations in specific seasons (e.g., fall). Examples of such campaigns are the "Don't veer for deer" campaign [e.g., Iowa Department of Public Safety (2003)] and the driver education, video, brochure, newspaper articles, television broadcasts, and posters on deer and moose collisions distributed in Maine (Maine Department of Transportation) (Figure 9).

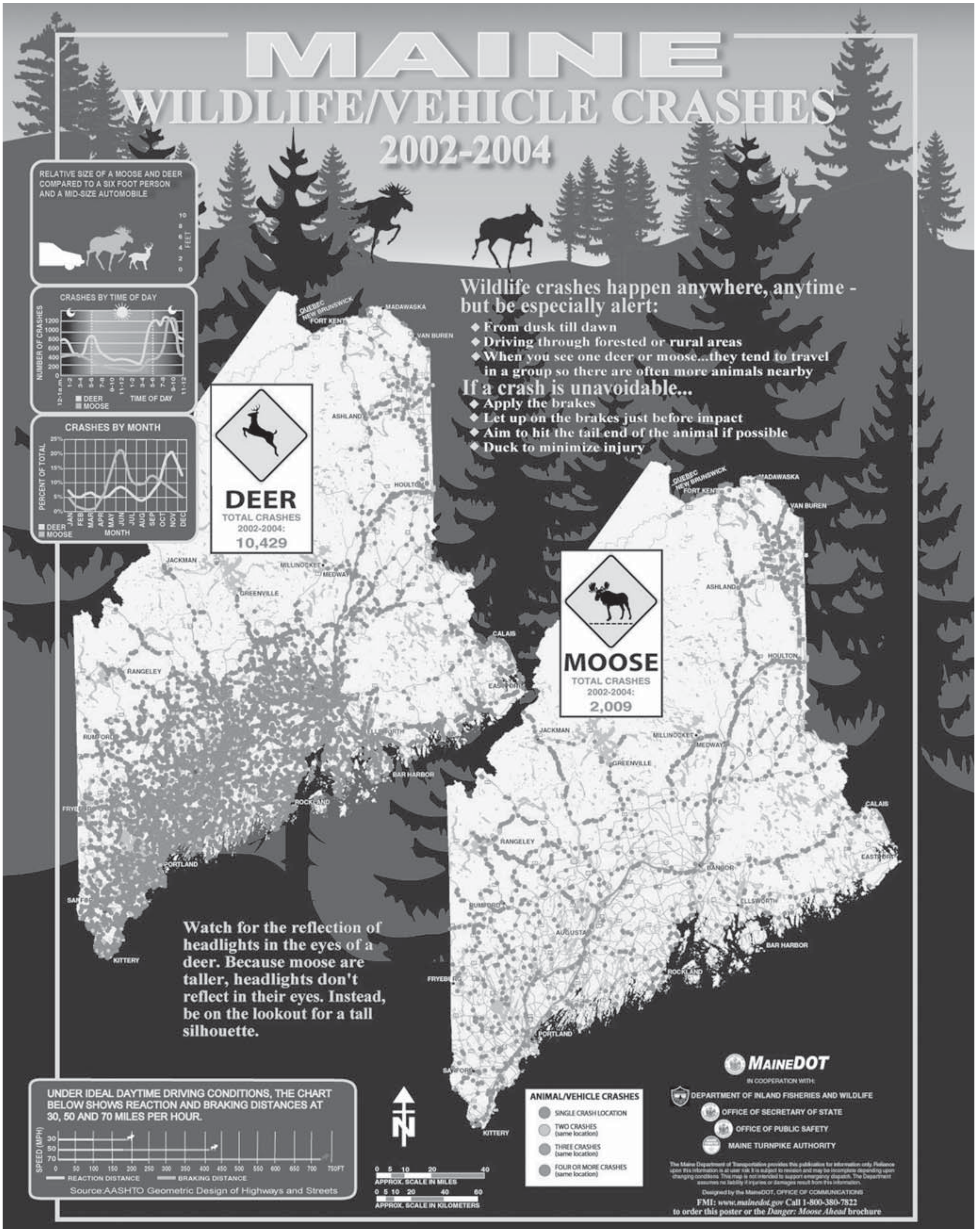

FIGURE 9 Deer and moose collisions in Maine. Poster distributed by the Maine DOT (reprinted with permission from the Maine Department of Transportation).

CHAPTER FIVE

CONCLUSIONS

Most of the responding departments of transportation (DOTs) (65%) and some departments of natural resources (DNRs) (36%) collect animal–vehicle collision (AVC) data. However, a review of the crash forms showed that 49 of 50 states (98%) and all of the provinces that sent in their crash forms allow for the recording of animal–vehicle collisions on their crash forms in one way or the other. Nonetheless, the species name of the animal involved cannot be entered on all forms, and most states and provinces have reporting thresholds. The location of the crash is usually described based on the distance to certain road or landscape features (typically 0.1 mi/km accuracy, sometimes with even less precision), and relatively few states and provinces use coordinates [obtained through either a global positioning system (GPS) or a map]. Adding additional animal-related parameters on crash forms, such as details on the sex and age of the animal concerned is not preferred because AVC data are mostly collected for safety reasons, and not so much for natural resource conservation. Furthermore, reporting thresholds may be standardized, but underreporting can never be eliminated because the data collection largely depends on accidents that are reported to law enforcement agencies; the search and reporting effort is not fully controlled by the personnel collecting the data. Nonetheless, allowing for checkboxes for the most commonly hit species and/or a space to write in the species name is essential to make the AVC data more useful.

Half of the responding DNRs and some DOTs (37%) collect animal carcass (AC) data. The date of the observation, name and contact details of the observer, road or route name or number, the location of the carcass, the species name of the animal concerned, and whether the carcass was removed can all be considered essential parameters. AC data are collected for safety reasons as well as natural resource conservation and to a lesser extent for accounting reasons. Although the sex and age of the animal concerned are useful and often recorded, especially by DNRs, these and other animal-related parameters can be considered to have a lower priority.

Many DOTs and DNRs enter the locations in a geographical information system (GIS) for spatial analyses. Depending on the type and purpose of the analysis this may introduce the notion that the data are more precise than they actually are, which can have serious consequences (e.g., when the location for potential mitigation measures has to be pinpointed). Many DOTs and DNRs are aware of this issue and stress the importance of increased spatial accuracy for the location of AVCs and ACs and other accident types. Almost all organizations have their data entered in a centralized computer database. However, the time period between recording the data and data entry was shown to vary greatly (from several business days up to more than 6 months). DOTs primarily have engineers analyze the AVC and AC data using frequency and cluster analyses to identify animal–vehicle collision hotspots. DNRs typically have the AVC and AC data analyzed by biologists. DNRs were also interested in identifying hotspots; however, they also use the data to detect wildlife population trends and typically use trend analyses.

DOTs and DNRs identified the lack of a demonstrated need, underreporting, poor data quality (consistency, accuracy—especially spatial accuracy—and/or completeness), and delays in data entry as the main obstacles to implementing or improving AVC or AC data collection and analysis. Using more rigid and standardized procedures, including centralized databases, GPS technology, and the use of GIS, were specifically mentioned to address some of these problems and improve the data collection and data analyses procedures. In addition, based on the results of the survey, the coordination between DOTs and DNRs, who share invested interest in the data, and data sharing can be much improved.

Before an AVC or AC program is initiated or expanded, it is important to illustrate the needs and benefits of such data collection. The most important needs and benefits are:

- With a standardized AVC/AC data collection program the occurrence of incidents that affect human safety, natural resource conservation, and monetary losses are documented.
- With a standardized AVC/AC data collection program changes in animal–vehicle collisions in time or space can be documented.
- With a standardized AVC/AC data collection program locations that may require mitigation can be identified and prioritized, allowing for an effective use of resources.
- With a standardized AVC/AC data collection program the effectiveness of mitigation measures in reducing collisions can be evaluated. This allows for modifications (if needed) and the application of the lessons learned at other locations, again allowing for an effective use of resources.

Based on the results of this survey one may consider the following points when initiating new or improving existing

AVC or AC data collection programs (also partially based on Knapp and Witte 2006):

- Include animal–vehicle collisions as a checkbox on all crash forms (AVC data) and allow for checkboxes and/or free space to write down the name of the species.
- Coordinate with the other data collection program (AVC or AC) (if applicable) in the state or province and coordinate within and between agencies (especially DOTs and DNRs in the same state or province). This may expand into coordination with insurance companies and municipalities that manage smaller roads.
- Standardize the parameters and procedures, not just at the state or provincial level, but preferably at a national or even international level (United States and Canada). Such standardization could include "priority" and "non-priority" variables. The latter group would allow for the collection of specific variables in certain states or provinces or by certain organizations, and not in or by others.
- Increase the spatial accuracy for the crash location (e.g., through the use of GPS).
- For AC data, focus on large species that are a concern to human safety and species that are a conservation concern and that can be readily identified by the personnel collecting the data. Do not focus on species that are neither a safety or conservation concern, especially if these species are very frequently hit by vehicles or if the species cannot be readily identified by personnel collecting the data.
- Establish a central database starting at the state or provincial level, and eventually at a national level.
- Consider direct data entry in a digital database through the use of hand-held field computers, eliminating manual data entry in the offices.
- Have a follow-up procedure in place to identify errors, retrieve missing data, and verify unusual data.
- Train personnel in data collection, especially with regard to species identification and an accurate description of the location of the crash. Such efforts will also help reduce underreporting for AC data. Training for DOT personnel may have to place more emphasis on animal-related parameters, especially species identification, whereas training for DNR personnel may have to be initiated altogether.
- Provide resources for data management and analyses, including GIS facilities.
- Share the (raw) data and reports, especially within and between agencies (e.g., DOTs and DNRs).
- At a minimum, use the data to:
  - Illustrate the magnitude of the problem and analyze trends and
  - Identify and prioritize road sections that may require mitigation measures and evaluate their effectiveness in reducing collisions.
- Evaluate the status and performance of the program on a regular basis and make adjustments where necessary.

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GLOSSARY

Animal-vehicle collision (AVC) data: accident reports (e.g., data on property damage and potential human injuries and fatalities), with or without corresponding animal carcass data (see next definition). These data are often collected by personnel from law enforcement agencies and submitted to the state or provincial transportation agency for further analyses.

Animal carcass (AC) data: data on animal carcasses observed and/or removed on or along the road, with or without corresponding accident reports (see previous definition). These data are often collected by road maintenance personnel from the state or provincial transportation agency or by personnel from natural resource management agencies that may or may not submit these data to the state or provincial transportation agency for further analyses.

Departments of natural resources (DNRs): all natural resource management agencies at the state or provincial level, despite the fact that some of them have slightly different or different names.

Departments of transportation (DOTs): all transportation agencies at the state or provincial level, despite the fact that some of them have slightly different or different names.

GIS (geographical information system): a collection of computer hardware, software, and data with a spatial component to capture, manage, analyze, and display all forms of geographically referenced information.

GPS (global positioning system): a navigational system that uses satellites to determine the latitude and longitude of a receiver on earth.

Necropsy: examination and dissection of a dead body (e.g., a road-killed white-tailed deer) to determine cause of death or the changes produced by disease.

Provinces: the 10 provinces and 3 territories (Northwest Territories, Nunavut, and Yukon Territory) of Canada.

Raptor: birds of prey.

States: the 50 states of the United States of America, excluding the District of Columbia (Washington, D.C.).

Taxon (plural **Taxa**)**:** a group of organisms of any taxonomic rank (e.g., class, order, family, genus or species). An example of these taxa (for white-tailed deer) is given below:

Class: mammal
Order: herbivore
Family: Cervid (Cervidae)
Genus: deer (*Odocoileus sp.*)
Species: white-tailed deer (*Odocoileus virginianus*)
Ungulates: hoofed animals.

APPENDIX A

List of Papers Using Animal–Vehicle Collision or Animal Carcass Data

This appendix provides a list of papers utilizing AC or AVC data. This list is not meant to be exhaustive, but provides examples of papers using the data to accomplish the different purposes discussed in the text. The listed parameters are those explicitly reported by the synthesis authors in the methods section or implicitly reported in the results. Additional parameters may have been collected but not reported.

		Collision/Carcass Parameters								Traffic/Road Parameters				Landscape Parameters			Other Parameters		
Reference	Purpose*	Date	Time	Location (resolution)	Species	Sex	Age	Property damage	Injuries	Speed	Volume	Road type	Road condition	Vegetation landcover	Topography	Fencing	Animal fate	Number of animals	Mitigation status
Adams and Geis (1983)	1b			(1.0 mi)	Small mammals														
Allen and McCullough (1976)	3	x	x	(0.16 km)	Deer only	x		x	x	x	x	x		x			x	x	
Aresco (2005)	1b				Four reptiles	x													
Baker et al. (2004)	6	x		$(1.0\ mi^2)$	Fox														
Bashore et al. (1985)	2,3,4				Deer only					x			x	x	x	x			
British Columbia Traffic Collision Stats (2003)	1a																		
Bellis and Graves (1971)	1b,3	x		(200 ft)	Deer only	x	x												
Bertwistle (2003)	5		x	(0.1 km)	Two large ungulates														
Biggs (2004)	1a,2,3	x	x	x	Deer and elk			x	x	x			x	x	x	x	x		
Bissonette and Hammer (2000)	5	x		(1.0 mi)	Deer only	x	x												
Boarman and Sazaki (1996)	1b,5			x	x														
Caro et al. (2000)	3	x		x	x									x					
Case (1978)	1b,6	x		(milepost)	x					x	x								
Clevenger et al. (2003)	1b,2,3			(5–10 m)	x	x	x												
Conn (2004)	1a																		
Conover et al. (1995)	1a																		
Dodd et al. (2004)	5	x		(100 m)	x														
Farrell et al. (1996)	1a,3	x		x	Moose only														
Feldhamer et al. (1986)	3	x		(0.16 km)	Deer only	x						x		x	x				
Finder et al. (1999)	2,4				Deer only									x	x				
Foster and Humphrey (1995)	5				x														
Garrett and Conway (1999)	2,3	x	x	(0.1 km)	Moose only								x						
Gibbs and Shriver (2002)	1b,4				Turtles														
Gibbs and Shriver (2005)	1b,4				Amphibians														
Gunson et al. (2003)	1b,3	x		(0.1 mi, 5–10 m)	Elk/large mammals	x	x				x							x	
Gunther et al. (1998)	1b,3	x		(odometer)	x	x	x			x				x					
Hedlund et al. (2003)	1a				Deer only														
Huijser et al. (2006)	1a	x	x	(0.1 mi)	x	x	x			x	x	x	x	x	x	x			

		Collision/Carcass Parameters								Traffic/Road Parameters				Landscape Parameters			Other Parameters		
Reference	Purpose*	Date	Time	Location (resolution)	Species	Sex	Age	Property damage	Injuries	Speed	Volume	Road type	Road condition	Vegetation landcover	Topography	Fencing	Animal fate	Number animals	Mitigation status
Kassar and Bissonette (2005)	2	x		x	Deer only														
Khattak (2003)	1a				No species														
Kline and Swann (1998)	1b	x		x	x							x							
Kline et al. (2003)	1b,4																		
Lehnert and Bissonette (1997)	5	x		(161 m)	Deer only														
Lehnert et al. (1998)	1b,4				Deer only	x	x												
Malo et al. (2004)	2,3	x	x	(0.1 km)	x														
McCaffrey (1973)	6	x		x	Deer only	x	x				x						x		
Meyer and Ahmed (2004)	4				Deer only					x	x		x		x	x			
Mumme et al. (2000)	1b				Florida scrub jays														
Oxley et al. (1974)					Small animals	x	x												
Perrin and Disegni (2003)	1a,2	x	x	(1.0 mi)	x														
Pojar et al. (1975)	5		x	x	Deer only	x	x			x									
Puglisi et al. (1974)	1b,3	x		(1.0 mi)	Deer only	x								x	x	x			
Ramakrishnan and Williams (2005)	1b,3			x	Deer only	x							x	x	x				
Reed (1981)	5			x	Deer only					x									
Reeve and Anderson (1993)	5			(161 m)	Deer only	x	x												
Rogers (2004)	2,3,5	x	x	x	Deer only									x					
Rolley and Lehman (1992)	6	x		(district)	Raccoons	x	x			x	x								
Roof and Wooding (1996)	5	x		x	Squirrel and larger														
Schafer and Penland (1985)	5		x	(milepost)	Deer only														x
Smith and Voigt (2005)	1b	x		x	x	x						x							
Tardif (2003)	1a,1b				x			x	x										
Thomas (1995)	1,2			(1/100 mi)	Moose only														
Williams and Wells (2005)	1a,3		x		x			x	x	x		x							
Wood and Wolfe (1988)	5	x		x	Deer only	x	x	x	x	x		x							

*1a, magnitude of problem for human safety.
1b, magnitude of problem for wildlife populations.
2, identification of hotspots.
3, identification of factors resulting in hotspots.
4, development of predictive models.
5, prioritize mitigation efforts and assess effectiveness.
6, index of population size.

APPENDIX B

Survey Forms

Introduction Letter

SURVEY OF STATE AND PROVINCIAL TRANSPORTATION AND NATURAL RESOURCE MANAGEMENT AGENCIES (USA AND CANADA)

NCHRP Project 20-05/Topic 37-12
Animal-vehicle collision data collection

Dear Sir or Madam:

RE: Animal–Vehicle Collision Data Collection Survey

Animal–vehicle collisions are a substantial problem across North America. Each year, hundreds of people are killed and many thousands are injured. In addition, countless animals are killed and injured, with some species facing possible local or regional extinction. Finally, animal–vehicle collisions are estimated to result in more than $1 billion in property damages annually.

To better understand this situation, the Transportation Research Board of the National Academies has sponsored a study by the Western Transportation Institute of how departments of transportation and natural resource management agencies across North America collect and manage information on animal–vehicle collisions and animal carcasses found along the road.

You have been identified as your organization's most knowledgeable person with regard to this issue. Please take a few minutes to answer the attached survey. Please note that it may take about 30 minutes to complete the survey. However, you can click the "save data" button and continue later if you cannot finish the questionnaire in one session. You will be sent a link through e-mail that will allow you to return to where you left off. Furthermore, you may skip many of the questions depending on the type of data that your organization collects. Also, note that this survey is completely voluntary. Your responses will help the Transportation Research Board document current policies and practices for the collection, analysis, and use of animal–vehicle collision and animal carcass data, and make recommendations for the future.

If you think someone else is better suited to complete this survey for your state or province, please let me know, or forward this survey to them. Your participation in this survey is greatly appreciated. If you have any questions regarding this survey, please let me know.

Sincerely,

Kind regards,

Marcel Huijser

Marcel P. Huijser, PhD
Research Ecologist
Western Transportation Institute
Montana State University (WTI–MSU)
PO Box 174250
Bozeman, MT 59717-4250
USA
Phone: 406-543-2377
Fax: 406-994-1697
E-mail: mhuijser@coe.montana.edu

Introduction Survey

Please complete the following so that we can send you a copy of the report with the results of this survey. We may also contact you for follow-up information.

Name: ______
Department or agency: ______
Position: ______
How long in that position: ______
Address: ______
City: ______
State or province/zip code: ______
Country (USA or Canada): ______
Telephone: ______
Fax: ______
E-mail: ______

INSTRUCTIONS

Unless specified otherwise, please select only one answer for each question.

Please note that this survey distinguishes between TWO TYPES OF DATA:

a. Animal–vehicle collision (AVC) data: accident reports (e.g., data on property damage and potential human injuries and fatalities), WITH or WITHOUT corresponding animal carcass data (see next definition).

b. Animal carcass (AC) data: data on animal carcasses observed and/or removed on or along the road, WITH or WITHOUT corresponding accident reports (see previous definition).

SECTION 1

1. What type of data does your agency collect or manage?
   - ☐ AVC data (please fill out the AVC form)
   - ☐ AC data (please fill out the AC form)
   - ☐ AVC and AC data (please fill out both the AVC and AC forms)
   - ☐ None (go to SECTION 2)

SECTION 2

2. If you selected “no” on Question 1, why not?
   - ☐ Too expensive
   - ☐ Too time consuming
   - ☐ Too difficult
   - ☐ Not interested
   - ☐ Someone else collects (Who? _______________)
   - ☐ Other: ______________

3. In your professional opinion, should your department/agency begin collecting AVC or AC data?
   ☐ Yes ☐ No ☐ Don’t know

4. What changes need to be made before your department/agency will begin collecting AVC or AC data?
   - ☐ More money
   - ☐ More personnel
   - ☐ Better training

☐ Demonstrated need
☐ Other: _______________
☐ Don't know
☐ Nothing will make us collect AVC or AC data

5. Is there anything else you think we should know that has not already been addressed? Are there any other comments you wish to make? ____

Thank you for your time. We appreciate it!

Animal–Vehicle Collision Data Survey

INSTRUCTIONS

1. Unless specified otherwise, please select only one answer for each question.
2. For the "choose one" options, click on the box and a drop down menu will appear from which you can select the appropriate response.
3. Please note that this survey is designed for animal–vehicle collision (AVC) data only: accident reports (e.g., data on property damage and potential human injuries and fatalities), WITH or WITHOUT corresponding animal carcass data.

It is not for animal carcass (AC) data: data on animal carcasses observed and/or removed on or along the road, WITH or WITHOUT corresponding accident reports.

SECTION 1: The questions in this section are designed to determine why and how long your agency has been collecting/managing AVC data, and to determine the road type or geographical area for which your agency collects/manages AVC data.

1. Why does your agency collect/manage AVC data? Please rank the following options in order of importance with 1 being the most important.

_____ Public (human) safety
_____ Wildlife management/conservation
_____ Accounting (e.g., time/effort report for carcass removal)
_____ Other: ____

2. When did your agency start collecting AVC data? ___________

3. On what basis does your agency collect AVC data?

☐ Voluntary (not requested at all)
☐ Semi-voluntary (requested, but not integrated into daily practices, nobody asks for the data if they are not delivered)
☐ Mandatory (integrated into daily practices, somebody asks for the data if they are not delivered)

4. Please describe the road types for which your agency collects or manages AVC data (check all that apply).

☐ Interstates or other limited access highways (typically ≥ 2 lanes for each direction)
☐ Arterial roads (typically ≥ 1 lane for each direction, designed for through traffic)
☐ Collector roads (for access to land/buildings and to deliver traffic to arterial roads and limited access highways
☐ Local roads (for access to land/buildings, not designed for through traffic)

5. Please describe the geographic limits of the reporting area. For example, all roads within your state or province; all highways under your agency's jurisdiction, including national parks, federal lands, Native American/first nations lands; only where your agency does maintenance; certain geographical areas within your state or province only; etc.
____
____

6. How would you characterize the landscape surrounding these areas?

☐ Rural
☐ Urban
☐ Both rural and urban

7. What other organizations or individuals collect AVC data on the roads and areas your agency reports on?
____

8. If your agency does not cover all road types and areas, what other organizations or individuals are responsible for collecting AVC data on those other roads and areas? _______________________

SECTION 2: The questions in this section are designed to determine the details of and reporting thresholds for individual AVC reports.

9. What organization(s) does the actual animal–vehicle collision data collection on the ground? (Check all that apply.)

☐ Transportation organization
☐ Natural resource management organization
☐ Highway patrol/law enforcement agency
☐ Other: _______________________

10. Who reports the AVC to the agency or data collector? (Check all that apply.)

☐ Driver or other witnesses of the collision
☐ Agency personnel pass by the location of the collision
☐ Other: _______________________

11. Does your agency have a reporting threshold for animal–vehicle collisions? ☐ Yes ☐ No

12. If yes, what is the reporting threshold? (Select all that apply.)

☐ Presence of human injuries or fatalities
☐ A certain minimum amount of property damage (minimum estimated damage $ ________)
☐ Certain animal species only (what animal species or species groups?) ________________
☐ Other: _______________________

If you think your answer needs additional clarification, please comment here: _______________________
____

13. How would you characterize the search and reporting effort for animal–vehicle collisions?

☐ Incidental observations
☐ Monitoring (consistent search and reporting effort, but this does not necessarily mean that all collisions are reported)
☐ Other: _______________________

14. What is the frequency of surveys/checks for AVCs on a given road section?

☐ Daily
☐ Weekly
☐ Monthly
☐ Other: _______________________

15. Do you record one or more of the following parameters?

    Date: __________
    Time: __________
    District or unit: __________
    Name observer: __________
    Road/route identification: __________
    Collision location: __________
    Occurrence of human fatalities: __________
    Occurrence of human injuries: __________
    Type of injury: __________
    Occurrence of property damage: __________
    Estimated amount of property damage: __________
    Species name of the animal involved: __________
    Sex of animal: __________
    Age of animal: __________
    Whether the animal carcass was removed or not: __________

16. How is collision location recorded?

    Coordinates through GPS: __________
    Coordinates through map: __________
    Reference or mi/km post: __________
    Road section: __________
    Other: __________________________

17. How precise is the collision location information?

    Within 1 yard or 1 m: __________
    Within 15 yard or 15 m: __________
    Within 30 yard or 30 m: __________
    Within 0.1 mi/km based on reference or mi/km post: __________
    Within 1.0 mi/km based on reference or mi/km post: __________
    Other: ____

18. If reference or mi/km posts are used for the location description, how far apart are these signs usually?
    ____

19. Amphibians are usually identified to: __________. If you chose other, please describe: ______________________________
    ____

20. Amphibian groups recorded include (check all that apply):

    - ☐ All
    - ☐ Endangered species
    - ☐ Other: ____________________
    - ☐ Amphibians are never recorded

21. Reptiles are usually identified to: __________ . If you chose other, please describe: ______________________________
    ____

22. Reptile groups recorded include (check all that apply):
    - ☐ All
    - ☐ Endangered species
    - ☐ Other: ________________
    - ☐ Reptiles are never recorded

23. Birds are usually identified to: __________. If you chose other, please describe: ________________________________
    ____

24. Bird groups recorded include (check all that apply):

    - ☐ All
    - ☐ Endangered species
    - ☐ Game birds (species that are hunted)
    - ☐ Raptors
    - ☐ Songbirds
    - ☐ Other: ______________________
    - ☐ Birds are never recorded

25. Large wild mammals (deer and larger) are usually identified to: __________. If you chose other, please describe:
    ____

26. Large wild mammal groups recorded include (check all that apply):

    - ☐ All
    - ☐ Endangered species
    - ☐ Game species (species that are hunted)
    - ☐ Ungulates (hoofed animals; e.g., deer, elk, mountain goats)
    - ☐ Carnivores
    - ☐ Non-native species
    - ☐ Other: _________________________
    - ☐ Large wild mammals are never recorded

27. Small wild mammals (smaller than deer) are usually identified to: __________. If you chose other, please describe:
    ____

28. Small wild mammal groups recorded include (check all that apply):

    - ☐ All
    - ☐ Endangered species
    - ☐ Game species (species that are hunted)
    - ☐ Carnivores
    - ☐ Non-native species
    - ☐ Other: __________________________
    - ☐ Small wild mammals are never recorded

29. Domestic animals are usually identified to: __________. If you chose other, please describe: _______________________
    ____

30. Domestic animal groups recorded include (check all that apply):

    - ☐ All
    - ☐ Large species only
    - ☐ Other: _______________________
    - ☐ Domestic animals are never recorded

31. Are the animal carcasses or parts thereof collected for further analyses (e.g., chronic wasting disease, West Nile virus)?
☐ Yes (please describe: ___________________________) ☐ No

PLEASE SEND US A COPY OF YOUR AVC DATA COLLECTION SHEET IF POSSIBLE (E-MAIL, FAX, OR MAIL)

SECTION 3: The questions in this section are designed to determine what training, instruction, or other help is provided for AVC data collectors.

32. Do AVC data collectors receive training?

☐ Yes ☐ No (Skip to SECTION 4, Question 37) ☐ Don't know (Skip to SECTION 4, Question 37)

33. How often does training occur?

☐ Once
☐ Monthly
☐ Yearly
☐ Other: ____________

34. What are data collectors trained in? (Check all that apply.)

☐ Purpose of data collection
☐ Importance of collecting accurate data
☐ How to fill out forms
☐ Which collisions/carcasses should be recorded
☐ Species identification
☐ Carcass sexing
☐ Carcass aging
☐ Necropsy
☐ GPS use
☐ Obtaining accurate location information
☐ Data entry and management (for analyzing data)
☐ Other: _________________________________

35. How is training conducted? (Check all that apply.)

☐ Literature
☐ On the job
☐ Seminar
☐ Other: __________

36. What tools and materials are provided to assist with AVC data collection? (Check all that apply.)

☐ Species identification guides
☐ GPS units
☐ Necropsy kit
☐ Other: __________

SECTION 4: The questions in this section are designed to determine the method of data analysis used for AVC data, who uses the information, and how the results are disseminated.

37. Are the raw data shared with other organizations or individuals?

☐ Yes (with whom? __________) ☐ No ☐ Don't know

38. Are the data analyzed by your agency?

☐ Yes ☐ No (skip to SECTION 5, Question 54) ☐ Don't know (skip to SECTION 5, Question 54)

39. If the data are not analyzed by your agency, then who does the analysis? ____________________

40. What is the purpose of the data analyses (e.g., identification and prioritization of problem areas)?
____

41. What other purposes do the data serve (e.g., documentation of presence and spread of non-native species)?
____

42. Please describe the data analyses procedures: ____________________
____

43. Which of the following data processing tools are used? (Check all that apply.)

☐ Data entered in database on computer
☐ Data presented in frequency graphs for certain road sections
☐ Statistical analyses to identify clusters
☐ Statistical analyses to identify changes over time
☐ Data entered in a GIS

44. Are the data integrated in one database for the entire state or province? ☐ Yes ☐ No

45. How much time passes between data collection and data entry in a centralized database? ____________________

46. Who performs the analysis? ___________

47. How often are the data analyzed? ___________

48. How often are the results published? ___________

49. How are the data and results disseminated? ___________

50. Are the results shared with the people who collect the data? ☐ Yes ☐ No

51. Are the results (analyzed, discussed) shared with other organizations or individuals?

☐ Yes (with whom? _______________) ☐ No

52. Do the data lead to on the ground mitigation measures (e.g., warning signs, wildlife fencing, wildlife crossing structures, change in route for new road, changes in rights-of-way or land management)?

☐ Yes (please describe: _____________) ☐ No

53. By whom? _____________

SECTION 5: The questions in this section are designed to identify the potential obstacles to implementing, advancing, or improving data collection and analyses.

54. What problems have you experienced in AVC data collection? ____________________

55. How can AVC data collection methods be improved (e.g., species identification, spatial precision, data consistency)?
____

56. What problems have you experienced with AVC data analyses? ______________________________

57. How can AVC data analyses methods be improved (e.g., faster data entry and analyses and feedback, data integration, cluster analyses, GIS)? ______________________________

58. What problems have you experienced with disseminating the results of AVC data analyses? ______________________________
____

59. How can AVC data dissemination be improved? ______________________________

60. Do you know of any particularly successful AVC data collection, analyses, and use program within your state or province?
☐ Yes (please describe: ________________) ☐ No

61. Do you know of any particularly successful AVC data collection, analyses, and use program outside of your state or province? ☐ Yes (please describe:________________) ☐ No

62. Is there anything else you think we should know that has not already been addressed? Are there any other comments you wish to make? ______________________________
____
____

REMINDER: IF YOU DO COLLECT/MANAGE AVC DATA, PLEASE SEND US A COPY OF AN AVC DATA COLLECTION SHEET IF POSSIBLE (E-MAIL, FAX, OR MAIL)

Thank you for your time. We appreciate it!

Animal Carcass Data Survey

INSTRUCTIONS

1. Unless specified otherwise, please select only one answer for each question.
2. For the "choose one" options, click on the box and a drop down menu will appear from which you can select the appropriate response.
3. Please note that this survey is designed for animal carcass (AC) data only: data on animal carcasses observed and/or removed on or along the road, WITH or WITHOUT corresponding accident reports.

It is not for animal–vehicle collision (AVC) data: accident reports (e.g., data on property damage and potential human injuries and fatalities), WITH or WITHOUT corresponding animal carcass data.

SECTION 1: The questions in this section are designed to determine why and how long your agency has been collecting/managing AC data, and to determine the road type or geographical area for which your agency collects/manages AC data.

1. Why does your agency collect/manage AC data? Please rank the following options in order of importance with 1 being the most important.

   _____ Public (human) safety
   _____ Wildlife management/conservation
   _____ Accounting (e.g., time/effort report for carcass removal)
   _____ Other: ______________________________

2. When did your agency start collecting AC data? ____________

3. On what basis does your agency collect AC data?

☐ Voluntary (not requested at all)
☐ Semi-voluntary (requested, but not integrated into daily practices; nobody asks for the data if they are not delivered)
☐ Mandatory (integrated into daily practices, somebody asks for the data if they are not delivered)

4. Please describe the road types for which your agency collects or manages AC data (check all that apply):

☐ Interstates or other limited access highways (typically ≥ 2 lanes for each direction)
☐ Arterial roads (typically ≥ 1 lane for each direction, designed for through traffic)
☐ Collector roads (for access to land/buildings and to deliver traffic to arterial roads and limited access highways
☐ Local roads (for access to land/buildings, not designed for through traffic)

5. Please describe the geographic limits of the reporting area. For example, all roads within your state or province; all highways under your agency's jurisdiction, including national parks, federal lands, Native American/first nations lands; only where your agency does maintenance; certain geographical areas within your state or province only; etc.
____
____

6. How would you characterize the landscape in this area?

☐ Rural
☐ Urban
☐ Both rural and urban

7. What other organizations or individuals collect AC data on the roads or areas your agency reports on?
____

8. If your agency does not cover all road types or geographic areas, what other organizations or individuals are responsible for collecting AC data on those other roads and areas? ____________________________________

SECTION 2: The questions in this section are designed to determine the details of and reporting thresholds for individual AC reports.

9. Who reports the carcass to the agency or data collector? (Check all that apply.)

☐ Transportation organization
☐ Natural resource management organization
☐ Contracted out to private company
☐ Highway patrol/law enforcement agency
☐ Other: ______________________

10. How is your agency or the data collector typically notified of an animal carcass? (Check all that apply.)

☐ Driver or other witnesses of the carcass
☐ Agency personnel pass by the location of the carcass
☐ Other: ____________________________

11. Does your agency have a reporting threshold for animal carcasses? ☐ Yes ☐ No

12. If "yes," what is the reporting threshold? (Select all that apply.)

☐ Carcasses that lie on the roadway between the solid white lines
☐ All carcasses that lie in the right-of-way beyond the solid white lines, regardless of whether the carcasses are highly visible to drivers
☐ All carcasses that lie in the right-of-way beyond the solid white lines only if they are highly visible to drivers
☐ Certain animal species or groups (What animal species or groups? _______________)
☐ Other: ______________________________

13. How would you characterize the search and reporting effort for animal carcasses?

☐ Incidental observations
☐ Monitoring (consistent search and reporting effort, but this does not necessarily mean that all carcasses are reported)
☐ Other: ______________________________

14. What is the frequency of surveys/checks for ACs on a given road section?

☐ Daily
☐ Weekly
☐ Monthly
☐ Other: ______________________________

15. Do you record one or more of the following parameters?

Date: __________
Time: __________
District or unit: __________
Name observer: __________
Road/route identification: __________
Carcass location: __________
Occurrence of human fatalities: __________
Occurrence of human injuries: __________
Type of injury: __________
Occurrence of property damage: __________
Estimated amount of property damage: __________
Species name of the animal involved: __________
Sex of animal: __________
Age of animal: __________
Whether animal carcass was removed or not: __________

16. How is carcass location recorded?

Coordinates through GPS: __________
Coordinates through map: __________
Reference or mi/km post: __________
Road section: __________
Other: __________

17. How precise is the carcass location information?
Within 1 yard or 1 m: __________
Within 15 yards or 15 m: __________
Within 30 yards or 30 m: __________
Within 0.1 mi/km based on reference or mi/km post: __________
Within 1.0 mi/km based on reference or mi/km post: __________
Other: __________

18. If reference or mi/km posts are used for the location description, how far apart are these signs usually?
____

19. Amphibians are usually identified to: ___________. If you chose other, please describe: ________________________________
____

20. Amphibian groups recorded include (check all that apply):

☐ All
☐ Endangered species
☐ Other: ______________________
☐ Amphibians are never recorded

21. Reptiles are usually identified to: ___________ . If you chose other, please describe: __________________________________
____

22. Reptile groups recorded include (check all that apply):

☐ All
☐ Endangered species
☐ Other: _________________
☐ Reptiles are never recorded

23. Birds are usually identified to: ___________. If you chose other, please describe: ____________________________________
____

24. Bird groups recorded include (check all that apply):

☐ All
☐ Endangered species
☐ Game birds (species that are hunted)
☐ Raptors
☐ Songbirds
☐ Other: _______________
☐ Birds are never recorded

25. Large wild mammals (deer and larger) are usually identified to: ___________. If you chose other, please describe:
____

26. Large wild mammal groups recorded include (check all that apply):

☐ All
☐ Endangered species
☐ Game species (species that are hunted)
☐ Ungulates (hoofed animals; e.g., deer, elk, mountain goats)
☐ Carnivores
☐ Non-native species
☐ Other: ____________________________
☐ Large wild mammals are never recorded

27. Small wild mammals (smaller than deer) are usually identified to: ___________. If you chose other, please describe:
____

28. Small wild mammal groups recorded include (check all that apply):

- ☐ All
- ☐ Endangered species
- ☐ Game species (species that are hunted)
- ☐ Carnivores
- ☐ Non-native species
- ☐ Other: ___________________________
- ☐ Small wild mammals are never recorded

29. Domestic animals are usually identified to: ___________. If you chose other, please describe: _________________________
____

30. Domestic animal groups recorded include (check all that apply):

- ☐ All
- ☐ Large species only
- ☐ Other: _________________________
- ☐ Domestic animals are never recorded

31. Are the animal carcasses or parts thereof collected for further analyses (e.g., chronic wasting disease, West Nile virus)?
☐ Yes (please describe: ________________) ☐ No

PLEASE SEND US A COPY OF YOUR AC DATA COLLECTION SHEET IF POSSIBLE (E-MAIL, FAX, OR MAIL)

SECTION 3: The questions in this section are designed to determine what training, instruction, or other help is provided for AC data collectors.

32. Do AC data collectors receive training?

☐ Yes ☐ No (Skip to SECTION 4, Question 37) ☐ Don't know (Skip to SECTION 4, Question 37)

33. How often does training occur?

- ☐ Once
- ☐ Monthly
- ☐ Yearly
- ☐ Other: __________

34. What are data collectors trained in? (Check all that apply.)

- ☐ Purpose of data collection
- ☐ Importance of collecting accurate data
- ☐ How to fill out forms
- ☐ Which carcasses should be recorded
- ☐ Species identification
- ☐ Carcass sexing
- ☐ Carcass aging
- ☐ Necropsy
- ☐ GPS use
- ☐ Obtaining accurate location information
- ☐ Data entry and management (for analyzing data)
- ☐ Other: __________________________________

35. How is training conducted? (Check all that apply.)

☐ Literature
☐ On the job
☐ Seminar
☐ Other: ___________

36. What tools and materials are provided to assist with AC data collection? (Check all that apply.)

☐ Species identification guides
☐ GPS units
☐ Necropsy kit
☐ Other: ________________

SECTION 4: The questions in this section are designed to determine the method of data analysis used for AC data, who uses the information, and how the results are disseminated.

37. Are the raw data shared with other organizations or individuals?

☐ Yes (with whom?_______________) ☐ No ☐ Don't know

38. Are the data analyzed?

☐ Yes ☐ No (skip to SECTION 5, Question 54) ☐ Don't know (skip to SECTION 5, Question 54)

39. If the data are not analyzed by your agency, then who does the analysis? ____

40. What is the purpose of the data analyses (e.g., identification and prioritization of problem areas)?
____

41. What other purposes do the data serve (e.g., documentation of presence and spread of non-native species)?
____

42. Please describe the data analyses procedures: ____

43. Are the following data processing tools used? (Check all that apply.)

☐ Data entered in database on computer
☐ Data presented in frequency graphs for certain road sections
☐ Statistical analyses to identify clusters
☐ Statistical analyses to identify changes over time
☐ Data entered in a GIS

44. Are the data integrated in one database for the entire state or province? ☐ Yes ☐ No

45. How much time passes between data collection and data entry in a centralized database? __________

46. Who performs the analysis? __________

47. How often are the data analyzed? __________

48. How often are the results published? __________

49. How are the data and results disseminated? __________

50. Are the results shared with the people who collect the data? ☐ Yes ☐ No

51. Are the results (analyzed, discussed) shared with other organizations or individuals?
☐ Yes (with whom? ________________)   ☐ No

52. Do the data lead to on the ground mitigation measures (e.g., warning signs, wildlife fencing, wildlife crossing structures, change in route for new road, changes in right-of-way or land management)?
☐ Yes (please describe: ________________)   ☐ No

53. By whom? __________

SECTION 5: The questions in this section are designed to identify the potential obstacles to implementing, advancing, or improving data collection and analyses.

54. What problems have you experienced in AC data collection? ____

55. How can AC data collection methods be improved (e.g., species identification, spatial precision, data consistency)?
____

56. What problems have you experienced with AC data analyses? ____

57. How can AC data analyses methods be improved (e.g., faster data entry and analyses and feedback, data integration, cluster analyses, GIS)? ____

58. What problems have you experienced with AC data dissemination? ____

59. How can AC data dissemination be improved? ____

60. Do you know of any particularly successful AC data collection, analyses, and use program within your state or province?
☐ Yes (please describe: _______________)   ☐ No

61. Do you know of any particularly successful AC data collection, analyses, and use program outside of your state or province
☐ Yes (please describe: ________________)   ☐ No

62. Is there anything else you think we should know that has not already been addressed? Are there any other comments you wish to make?____
____
____

REMINDER: IF YOU DO COLLECT/MANAGE AC DATA, PLEASE SEND US A COPY OF AN AC DATA COLLECTION SHEET IF POSSIBLE (E-MAIL, FAX, OR MAIL)

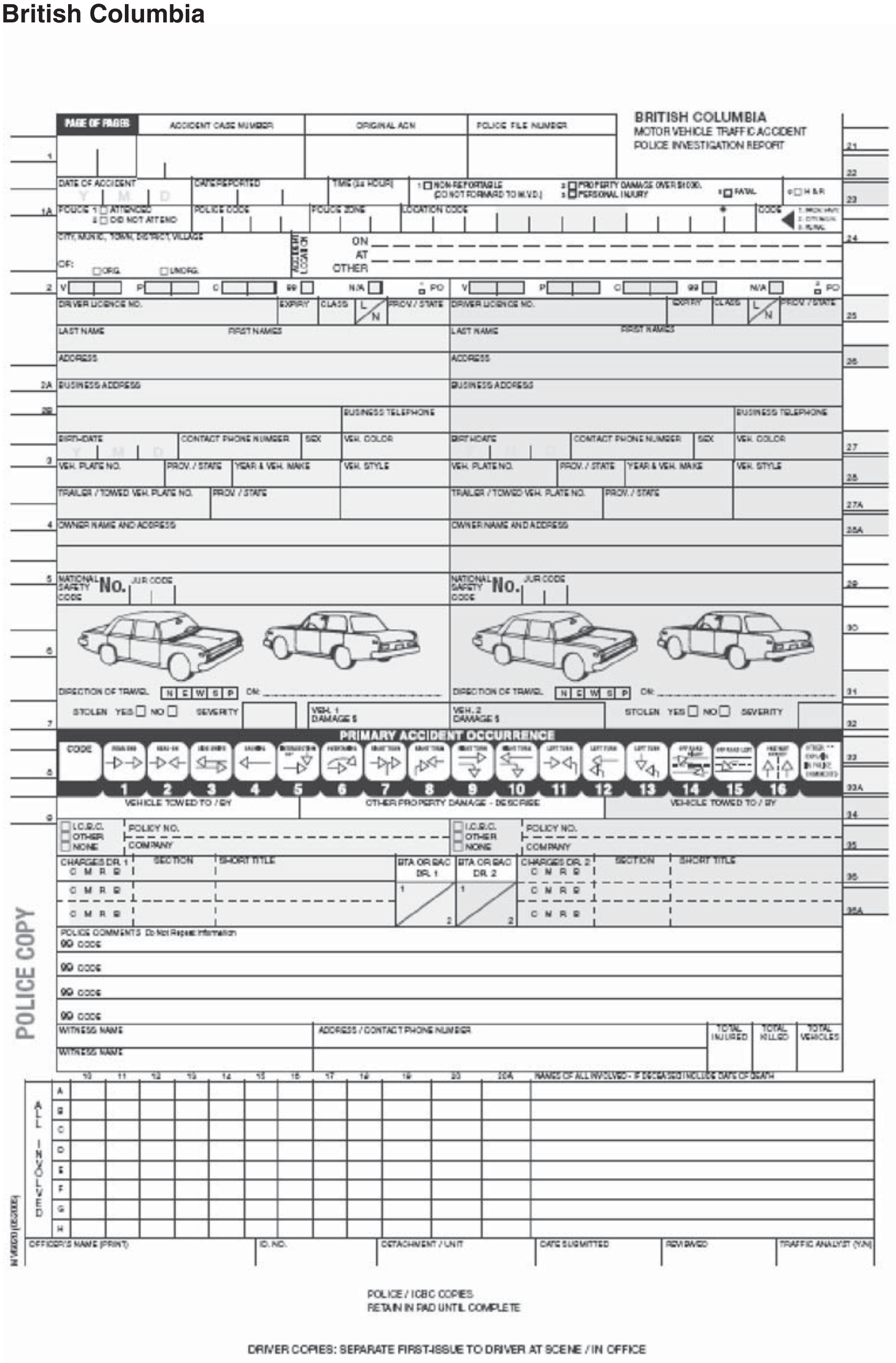
Thank you for your time. We appreciate it!

APPENDIX C

Examples of Animal–Vehicle Collision Data Collection Forms (Canada only)

Note: Crash forms for all 50 states of the United States are posted on the website for the National Center for Statistics and Analysis of the National Highway Traffic Safety Administration (NHTSA 2006).

British Columbia



BRITISH COLUMBIA
MOTOR VEHICLE TRAFFIC ACCIDENT
POLICE INVESTIGATION REPORT

PAGE OF PAGES | ACCIDENT CASE NUMBER | ORIGINAL ACN | POLICE FILE NUMBER

DATE OF ACCIDENT (Y M D) | DATE REPORTED | TIME (24 HOUR) | NON-REPORTABLE (DO NOT FORWARD TO M.V.D.) | PROPERTY DAMAGE OVER $1000. | PERSONAL INJURY | FATAL | H & R

POLICE: ATTENDED / DID NOT ATTEND | POLICE CODE | POLICE ZONE | LOCATION CODE | CODE

CITY, MUNIC., TOWN, DISTRICT, VILLAGE | OF: ORG. / UNORG. | ACCIDENT LOCATION: ON / AT / OTHER

DRIVER LICENCE NO. | EXPIRY | CLASS | L/N | PROV. / STATE

LAST NAME | FIRST NAMES

ADDRESS

BUSINESS ADDRESS

BUSINESS TELEPHONE

BIRTHDATE (Y M D) | CONTACT PHONE NUMBER | SEX | VEH. COLOR

VEH. PLATE NO. | PROV. / STATE | YEAR & VEH. MAKE | VEH. STYLE

TRAILER / TOWED VEH. PLATE NO. | PROV. / STATE

OWNER NAME AND ADDRESS

NATIONAL SAFETY CODE No. | JUR CODE

DIRECTION OF TRAVEL N E W S P | ON:

STOLEN YES / NO | SEVERITY | VEH. 1 DAMAGE $ | VEH. 2 DAMAGE $

PRIMARY ACCIDENT OCCURRENCE

CODE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

VEHICLE TOWED TO / BY | OTHER PROPERTY DAMAGE - DESCRIBE | VEHICLE TOWED TO / BY

I.C.B.C. / OTHER / NONE | POLICY NO. | COMPANY

CHARGES DR. 1 (C M R B) | SECTION | SHORT TITLE | BTA OR BAC DR. 1 | BTA OR BAC DR. 2 | CHARGES DR. 2 (C M R B) | SECTION | SHORT TITLE

POLICE COMMENTS Do Not Repeat Information
99 CODE
99 CODE
99 CODE
99 CODE

WITNESS NAME | ADDRESS / CONTACT PHONE NUMBER | TOTAL INJURED | TOTAL KILLED | TOTAL VEHICLES
WITNESS NAME

POLICE COPY

ALL INVOLVED: A B C D E F G H | 10 11 12 13 14 15 16 17 18 19 20 20A | NAMES OF ALL INVOLVED - IF DECEASED INCLUDE DATE OF DEATH

OFFICER'S NAME (PRINT) | ID. NO. | DETACHMENT / UNIT | DATE SUBMITTED | REVIEWED | TRAFFIC ANALYST (Y/N)

POLICE / ICBC COPIES
RETAIN IN PAD UNTIL COMPLETE

DRIVER COPIES: SEPARATE FIRST-ISSUE TO DRIVER AT SCENE / IN OFFICE

BRITISH COLUMBIA
MOTOR VEHICLE TRAFFIC ACCIDENT
POLICE INVESTIGATION REPORT

PAGE OF PAGES | ACCIDENT CASE NUMBER | ORIGINAL ACN | POLICE FILE NUMBER

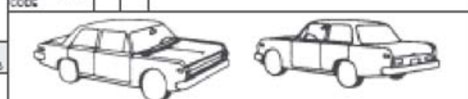
DATE OF ACCIDENT (Y M D) | DATE REPORTED | TIME (24 HOUR) | 1 ☐ NON-REPORTABLE (DO NOT FORWARD TO M.V.D.) | 2 ☐ PROPERTY DAMAGE OVER $1000. | 3 ☐ PERSONAL INJURY | 4 ☐ FATAL | 0 ☐ H & R

POLICE 1 ☐ ATTENDED 2 ☐ DID NOT ATTEND | POLICE CODE | POLICE ZONE | LOCATION CODE | CODE (1. PROV. HWY 2. CITY/MUN. 3. RURAL)

CITY, MUNIC., TOWN, DISTRICT, VILLAGE — OF: ☐ ORG. ☐ UNORG. | ACCIDENT LOCATION — ON / AT / OTHER

V | P | C | 99 | N/A | PO — V | P | C | 99 | N/A | PO

DRIVER LICENCE NO. / EXPIRY / CLASS / L/N / PROV. / STATE	DRIVER LICENCE NO. / EXPIRY / CLASS / L/N / PROV. / STATE
LAST NAME / FIRST NAMES	LAST NAME / FIRST NAMES
ADDRESS	ADDRESS
BUSINESS ADDRESS	BUSINESS ADDRESS
BUSINESS TELEPHONE	BUSINESS TELEPHONE
BIRTHDATE (Y M D) / CONTACT PHONE NUMBER / SEX / VEH. COLOR	BIRTHDATE (Y M D) / CONTACT PHONE NUMBER / SEX / VEH. COLOR
VEH. PLATE NO. / PROV. / STATE / YEAR & VEH. MAKE / VEH. STYLE	VEH. PLATE NO. / PROV. / STATE / YEAR & VEH. MAKE / VEH. STYLE
TRAILER / TOWED VEH. PLATE NO. / PROV. / STATE	TRAILER / TOWED VEH. PLATE NO. / PROV. / STATE
OWNER NAME AND ADDRESS	OWNER NAME AND ADDRESS
NATIONAL SAFETY CODE No. / JUR CODE	NATIONAL SAFETY CODE No. / JUR CODE



DIRECTION OF TRAVEL N E W S P ON: | DIRECTION OF TRAVEL N E W S P ON:

STOLEN YES ☐ NO ☐ SEVERITY | VEH. 1 DAMAGE $ | VEH. 2 DAMAGE $ | STOLEN YES ☐ NO ☐ SEVERITY

PRIMARY ACCIDENT OCCURRENCE

CODE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | OTHER

VEHICLE TOWED TO / BY | OTHER PROPERTY DAMAGE - DESCRIBE | VEHICLE TOWED TO / BY

☐ I.C.B.C. ☐ OTHER ☐ NONE — POLICY NO. / COMPANY | ☐ I.C.B.C. ☐ OTHER ☐ NONE — POLICY NO. / COMPANY

CHARGES DR. 1 (C M R B) | SECTION | SHORT TITLE | BTA OR BAC DR. 1 | BTA OR BAC DR. 2 | CHARGES DR. 2 (C M R B) | SECTION | SHORT TITLE

POLICE COMMENTS Do Not Repeat Information
99 CODE
99 CODE
99 CODE
99 CODE

WITNESS NAME | ADDRESS / CONTACT PHONE NUMBER | TOTAL INJURED | TOTAL KILLED | TOTAL VEHICLES
WITNESS NAME

ICBC COPY — FORWARD TO VICTORIA WITHIN 24 HOURS OF REPORT

ALL INVOLVED

	10	11	12	13	14	15	16	17	18	19	20	20A	NAMES OF ALL INVOLVED - IF DECEASED INCLUDE DATE OF DEATH
A													
B													
C													
D													
E													
F													
G													
H													

OFFICER'S NAME (PRINT) | ID. NO. | DETACHMENT / UNIT | DATE SUBMITTED | REVIEWED | TRAFFIC ANALYST (Y/N)

PAGE OF PAGES | ACCIDENT CASE NUMBER | ORIGINAL ACN | POLICE FILE NUMBER

BRITISH COLUMBIA
MOTOR VEHICLE TRAFFIC ACCIDENT
POLICE INVESTIGATION REPORT

1

DATE OF ACCIDENT Y M D | DATE REPORTED | TIME (24 HOUR) | 1 ☐ NON-REPORTABLE (DO NOT FORWARD TO M.V.D.) | 2 ☐ PROPERTY DAMAGE OVER $1000. 3 ☐ PERSONAL INJURY | 4 ☐ FATAL | 5 ☐ H & R

1A POLICE 1 ☐ ATTENDED 2 ☐ DID NOT ATTEND | POLICE CODE | POLICE ZONE | LOCATION CODE | CODE 1. PROV. HWY. 2. CITY/MUN. 3. RURAL

CITY, MUNIC., TOWN, DISTRICT, VILLAGE
OF: ☐ ORG. ☐ UNORG.
ACCIDENT LOCATION: ON / AT / OTHER

2 V P C 99 ☐ N/A ☐ PO | V P C 99 ☐ N/A ☐ PO

DRIVER LICENCE NO. | EXPIRY | CLASS | L / N | PROV. / STATE | DRIVER LICENCE NO. | EXPIRY | CLASS | L / N | PROV. / STATE

LAST NAME | FIRST NAMES | LAST NAME | FIRST NAMES

ADDRESS | ADDRESS

2A BUSINESS ADDRESS | [redacted]

2B BUSINESS TELEPHONE

BIRTH-DATE Y M D | CONTACT PHONE NUMBER | SEX | VEH. COLOR | SEX | VEH. COLOR

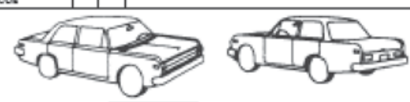
3 VEH. PLATE NO. | PROV. / STATE | YEAR & VEH. MAKE | VEH. STYLE | VEH. PLATE NO. | PROV. / STATE | YEAR & VEH. MAKE | VEH. STYLE

TRAILER / TOWED VEH. PLATE NO. | PROV. / STATE | TRAILER / TOWED VEH. PLATE NO. | PROV. / STATE

4 OWNER NAME AND ADDRESS | OWNER NAME AND ADDRESS

5 NATIONAL SAFETY CODE No. JUR CODE | NATIONAL SAFETY CODE No. JUR CODE

6



DIRECTION OF TRAVEL N E W S P ON: | DIRECTION OF TRAVEL N E W S P ON:

7 STOLEN YES ☐ NO ☐ SEVERITY | VEH. 1 DAMAGE $ | VEH. 2 DAMAGE $ | STOLEN YES ☐ NO ☐ SEVERITY

PRIMARY ACCIDENT OCCURRENCE

8 CODE

9 VEHICLE TOWED TO / BY | OTHER PROPERTY DAMAGE - DESCRIBE | VEHICLE TOWED TO / BY

☐ I.C.B.C. ☐ OTHER ☐ NONE | POLICY NO. COMPANY | ☐ I.C.B.C. ☐ OTHER ☐ NONE | POLICY NO. COMPANY

CHARGES DR. 1 C M R B | SECTION | SHORT TITLE | BTA OR BAC DR. 1 | 1 / 2 | [redacted]
C M R B
C M R B

[redacted]

WITNESS NAME | [redacted] | TOTAL INJURED | TOTAL KILLED | TOTAL VEHICLES
WITNESS NAME

DRIVER 1 COPY

21 22 23 24 25 26 27 28 27A 28A 29 30 31 32 33 33A 34 35 36 36A

ALL INVOLVED	10	11	12	13	14	15	16	17	18	19	20	20A	NAMES OF ALL INVOLVED - IF DECEASED INCLUDE DATE OF DEATH
A													
B													
C													
D													
E													
F													
G													
H													

OFFICER'S NAME (PRINT) | I.D. NO. | DETACHMENT / UNIT | DATE SUBMITTED | REVIEWED | TRAFFIC ANALYST (Y/N)

NOTE: A COPY OF THIS ACCIDENT REPORT, INCLUDING THE INFORMATION CONTAINED IN THE BLACKED OUT SECTIONS, MAY BE GIVEN TO YOUR INSURANCE COMPANY UPON THEIR REQUEST TO ASSIST THEM IN PROCESSING CLAIMS.

PAGE OF PAGES | ACCIDENT CASE NUMBER | ORIGINAL ACN | POLICE FILE NUMBER

BRITISH COLUMBIA
MOTOR VEHICLE TRAFFIC ACCIDENT
POLICE INVESTIGATION REPORT

1

DATE OF ACCIDENT Y M D | DATE REPORTED | TIME (24 HOUR) | 1 ☐ NON-REPORTABLE (DO NOT FORWARD TO M.V.D.) | 2 ☐ PROPERTY DAMAGE OVER $1000. | 3 ☐ PERSONAL INJURY | 4 ☐ FATAL | 5 ☐ H & R

1A POLICE 1 ☐ ATTENDED 2 ☐ DID NOT ATTEND | POLICE CODE | POLICE ZONE | LOCATION CODE | CODE ◀ 1. PROV. HWY. 2. CITY/MUN. 3. RURAL

CITY, MUNIC., TOWN, DISTRICT, VILLAGE
OF: ☐ ORG. ☐ UNORG.

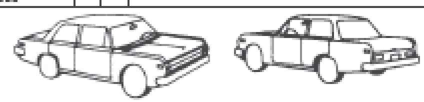
ACCIDENT LOCATION ON ___ AT ___ OTHER ___

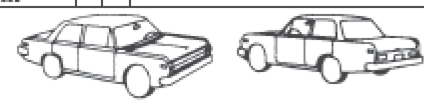
2 V P C 99 ☐ N/A ☐ 1 PO | V P C 99 ☐ N/A ☐ 2 PO

DRIVER LICENCE NO. / EXPIRY / CLASS / L/N / PROV / STATE	DRIVER LICENCE NO. / EXPIRY / CLASS / L/N / PROV / STATE
LAST NAME / FIRST NAMES	LAST NAME / FIRST NAMES
ADDRESS	ADDRESS
2A 2B [redacted]	BUSINESS ADDRESS
	BUSINESS TELEPHONE
SEX / VEH. COLOR	BIRTHDATE Y M D / CONTACT PHONE NUMBER / SEX / VEH. COLOR
3 VEH. PLATE NO. / PROV. / STATE / YEAR & VEH. MAKE / VEH. STYLE	VEH. PLATE NO. / PROV. / STATE / YEAR & VEH. MAKE / VEH. STYLE
TRAILER / TOWED VEH. PLATE NO. / PROV / STATE	TRAILER / TOWED VEH. PLATE NO. / PROV. / STATE
4 OWNER NAME AND ADDRESS	OWNER NAME AND ADDRESS
5 NATIONAL SAFETY CODE No. JUR CODE	NATIONAL SAFETY CODE No. JUR CODE

21 22 23 24 25 26 27 28 27A 28A 29 30

6





DIRECTION OF TRAVEL N E W S P ON: ___ | DIRECTION OF TRAVEL N E W S P ON: ___ 31

7 STOLEN YES ☐ NO ☐ SEVERITY | VEH. 1 DAMAGE $ | VEH. 2 DAMAGE $ | STOLEN YES ☐ NO ☐ SEVERITY 32

PRIMARY ACCIDENT OCCURRENCE

8 CODE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 OTHER - EXPLAIN IN POLICE COMMENTS 33 33A

9 VEHICLE TOWED TO / BY | OTHER PROPERTY DAMAGE - DESCRIBE | VEHICLE TOWED TO / BY 34

☐ I.C.B.C. ☐ OTHER ☐ NONE POLICY NO. COMPANY | ☐ I.C.B.C. ☐ OTHER ☐ NONE POLICY NO. COMPANY 35

[redacted] | BTA OR BAC DR. 2 (1 / 2) | CHARGES DR. 2 C M R B / C M R B / C M R B | SECTION | SHORT TITLE 36 36A

[redacted]

DRIVER 2 COPY

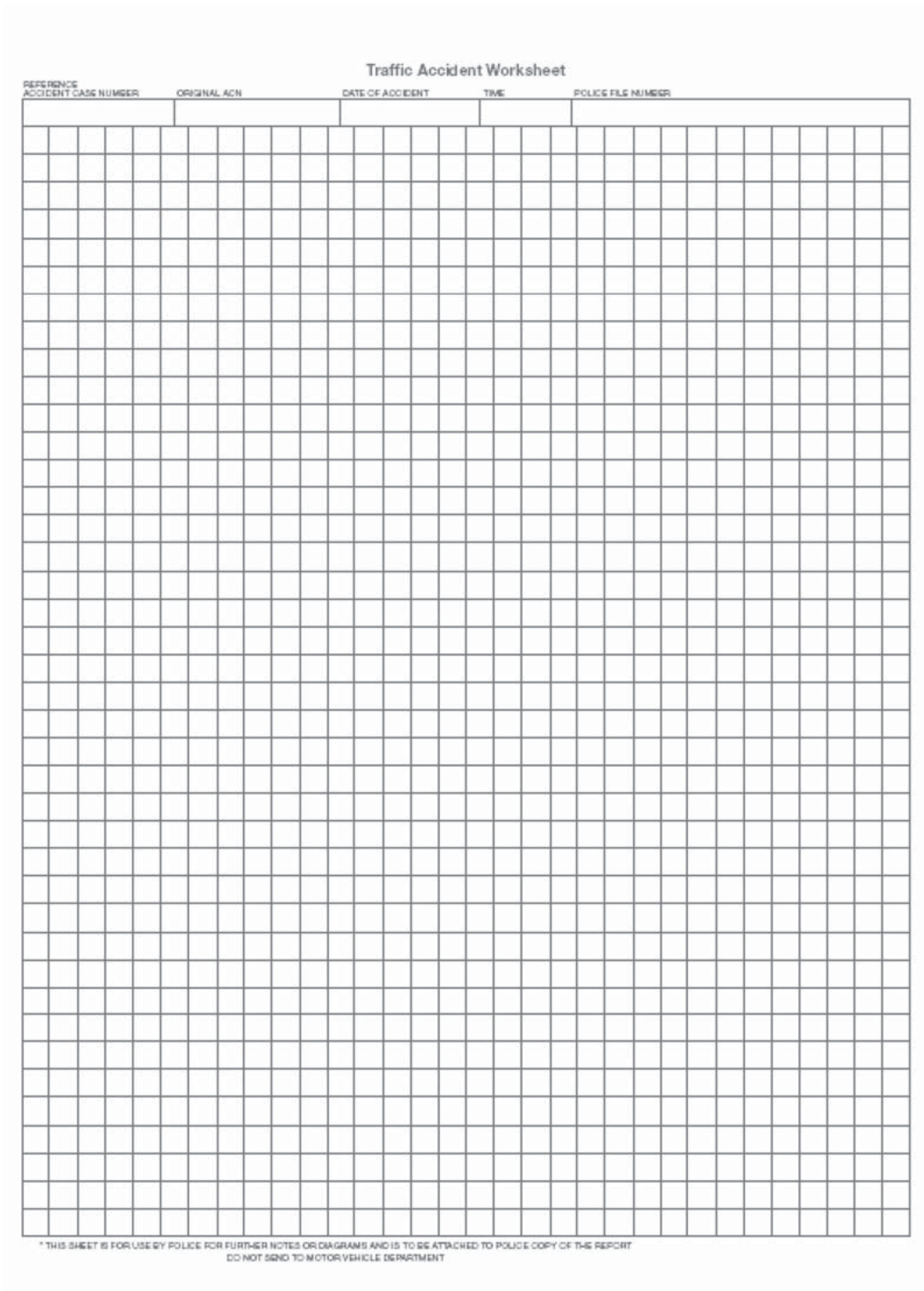
WITNESS NAME
WITNESS NAME
[redacted]
TOTAL INJURED | TOTAL KILLED | TOTAL VEHICLES

ALL INVOLVED

	10	11	12	13	14	15	16	17	18	19	20	20A	NAMES OF ALL INVOLVED - IF DECEASED INCLUDE DATE OF DEATH
A													
B													
C													
D													
E													
F													
G													
H													

OFFICER'S NAME (PRINT) | ID. NO. | DETACHMENT / UNIT | DATE SUBMITTED | REVIEWED | TRAFFIC ANALYST (Y/N)

NOTE: A COPY OF THIS ACCIDENT REPORT, INCLUDING THE INFORMATION CONTAINED IN THE BLACKED OUT SECTIONS, MAY BE GIVEN TO YOUR INSURANCE COMPANY UPON THEIR REQUEST TO ASSIST THEM IN PROCESSING CLAIMS.



Traffic Accident Worksheet

REFERENCE ACCIDENT CASE NUMBER	ORIGINAL ACN	DATE OF ACCIDENT	TIME	POLICE FILE NUMBER

* THIS SHEET IS FOR USE BY POLICE FOR FURTHER NOTES OR DIAGRAMS AND IS TO BE ATTACHED TO POLICE COPY OF THE REPORT
DO NOT SEND TO MOTOR VEHICLE DEPARTMENT

Northwest Territories

Northwest Territories ACCIDENT REPORT	02. POLICE DETACHMENT N T 1 0 0	03. CASE NUMBER	PAGE OF

LOCATION

1. In 2. Near	Community of		(Give Park, Special Area Etc.)	
On Km	Of Highway Number	Or	Street/Road/Avenue	
At Intersection With Km	Of Highway Number	Or	Street/Road/Avenue	
If Not At Intersection		metres km N S E W	of Street, Highway, Town, Etc.	
Special Reference	If Location Can Be Described More Precisely, Enter Here			

31. DIRECTION OF TRAVEL 1 N; 2; E 3; 4; S 5; 6; W 7; 8; 9. Parked; Q. Other; U. Unknown

REPORT TYPE 1. Original 2. Continuation 3. Amendment 4. Correction

REPORT STATUS 1. Complete 2. Incomplete

09. HOUR 00-23 UU. Unk.

13. NO. VEHICLES

04. SCENE ATTENDED 1. Yes 2. No

05. - 08. DATE OF COLLISION yy | mm | dd UU. Unknown

11. NO. KILLED

10. COLLISION SEVERITY 1. Fatal 2. Injury 3. Property Damage U. Unknown

15. HIT AND RUN 1. Yes 2. No

12. NO. INJURED

14 TYPE

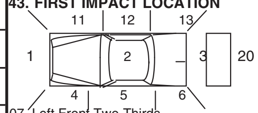
01. Hit Moving Object	03. Off Road Left	05. Rollover on Roadway	21. Rear End	23. Passing - Left Turn	25. Other Multi-Vehicle Same Direction	32. Sideswipe-Opposite Direction	34. Right Turn Including Conflict
02. Hit Stationary Object	04. Off Road Right	06. Other Single Vehicle	22. Sideswipe Same-Direction	24. Passing - Right Turn	31. Head-On	33. Left Turn Across Path	35. Right Angle

36. Other Multi-Vehicle Opposite Direction Type; 41. Hit Parked Vehicle; QQ. Other Collision; UU. Unknown Collision Type

DRIVER VEHICLE

Vehicle A	Vehicle B
29. VEH. SEQUENCE # 99. Ped. UU. Unk.	29. VEH. SEQUENCE # 99. Ped. UU. Unk.
30. TOTAL OCCUPANTS UU. Unknown	30. TOTAL OCCUPANTS UU. Unknown
LAST NAME / FIRST NAME(S)	LAST NAME / FIRST NAME(S)
ADDRESS	ADDRESS
ADDRESS	ADDRESS
DATE OF BIRTH / SEX / HOME PHONE / WORK PHONE	DATE OF BIRTH / SEX / HOME PHONE / WORK PHONE
DRIVER'S LICENCE # / 59. PROV /STATE / CLASS / 57. Years Licensed	DRIVER'S LICENCE # / 59. PROV /STATE / CLASS / 57. Years Licensed
58. STATUS 1. Valid 2. Incorrect 3. Not Licensed 4. Revoked/Suspended 5. Expired Q. Other N. Not Applicable U. Unknown	58. STATUS 1. Valid 2. Incorrect 3. Not Licensed 4. Revoked/Suspended 5. Expired Q. Other N. Not Applicable U. Unknown
34. YEAR UUUU. Unk. / MAKE/MODEL	34. YEAR UUUU. Unk. / MAKE/MODEL
LICENCE PLATE # / EXP / 32. PROV. / 33. VIN U. Unknown	LICENCE PLATE # / EXP / 32. PROV / 33. VIN U. Unknown

43. FIRST IMPACT LOCATION



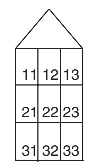
07. Left Front Two-Thirds
08. Left Rear Two-Thirds
09. Entire Left Side
10. Left Side - Unspecified
14. Right Front Two-Thirds
15. Right Rear Two-Thirds
16. Entire Right Side
17. Right Side Unspecified
18. Undercarriage
19. Interior
20. Attachment
99. No Apparent Damage
QC. Other UU. Unknown

42. DAMAGE SEVERITY
1. None
2. Minimal
3. Moderate
4. Severe
5. Demolished
Q. Other U. Unknown

OWNER

Vehicle A	Vehicle B
LAST NAME / FIRST NAME(S)	LAST NAME / FIRST NAME(S)
ADDRESS **SAME AS ABOVE**	ADDRESS **SAME AS ABOVE**
HOME PHONE / WORK PHONE	HOME PHONE / WORK PHONE
INSURANCE COMPANY / ADDRESS	INSURANCE COMPANY / ADDRESS
POLICY NUMBER / EXPIRY DATE	POLICY NUMBER / EXPIRY DATE

61. POSITION



96. Position Unknown
97. Sitting on Lap
98. Outside Passenger Compartment
99. Pedestrian
QQ. Other
UU. Unknown

62. EJECTION
1. Not Ejected
2. Partially Ejected
3. Fully Ejected
N. N/A Vehicle Type
Q. Other U. Unk.

64. MEDICAL TREATMENT REQUIRED
1. Not Injured/Unknown if Injured
2. Minimal
3. Minor
4. Major
5. Fatal
6. Death - Natural Causes
7. Injured - Extent Unknown

63. EJECTION LOCATION
1. Windshield
2. Adjacent Side Window
3. Opposite Side Window
4. Adjacent Side Door
5. Opposite Side Door
6. Rear Window or Gate
7. Sun Roof
8. Opened Convertible
N. Not Ejected
Q. Other U. Unknown

65. SAFETY EQUIPMENT
01. No Safety Device Used
02. Lap Belt Only Used
03. Shoulder Belt Only Used
04. Lap/Shoulder Belt Used
05. Front-Facing Child Restraint in Use
06. Rear-Facing Child Restraint in Use
07. Booster Seat
08. Child Restraint In Use - Unspecified
09. Helmet Worn
10. Reflective Clothing Worn
11. Helmet & Reflective Clothing Worn
12. Other Device Used
13. No Seat Belt Fitted for This Position
UU. Unknown

66. PROPER USE
1. Used Correctly
2. Used Incorrectly
3. No Seat Belt Fitted
N. No Safety Device Used
Q. Other U. Unknown

67. AIR BAG DEPLOYED
1. No Air Bag Fitted
2. Air Bag Fitted, No Deployment
3. Air Bag Fitted, Deployed
4. Air Bag Fitted, Deployment Unknown
N. Not Applicable Vehicle Type
Q. Other. U. Unknown

ALL INVOLVED

29. Veh Seq. #	54. Person Seq. #	55. Sex F. Female M. Male U. Unk.	56. Age 00 < 1 Yr. UU. Unk.	61. Position	62. Ejection	63. Ejection Location	64. Medical Treatment Required	65. Safety Equipment	66. Proper Use	67. Air Bag Deployed	NAMES AND ADDRESSES (IF DECEASED ALSO INCLUDE DATE & TIME OF DEATH)

Officer's Signature	Name	Rank	Date Reviewed	Reviewed By:

16. ROADWAY CONFIGURATION
1. Non-Intersection
2. Intersection 2 Roads
3. Intersection With Parking Lot/Driveway/Alley
4. Railroad Level Crossing
5. Bridge, Overpass, Viaduct
6. Tunnel Or Underpass
Q. Other
U. Unknown

17. WEATHER CONDITION
1. Clear and/or Sunny
2. Overcast, Cloudy - No Precipitation
3. Raining
4. Snowing, Not Including Drifting Snow
5. Freezing Rain, Sleet, Hail
6. Visibility Limitation (Eg. Fog, Smoke, Dust, Mist)
7. Strong Wind
Q. Other
U. Unknown

18. LIGHT CONDITION
1. Daylight
2. Dawn
3. Dusk
5. Darkness
U. Unknown

19. ARTIFICIAL LIGHT CONDITION
1. No Artificial Light
2. Artificial Light - On
3. Artificial Light - Off
U. Unknown

20. ROAD CLASSIFICATION I
1. Urban
2. Rural
U. Unknown

21. ROAD CLASSIFICATION II
2. Arterial
3. Collector
4. Local
Q. Other (Parking Lot)
U. Unknown

22. ROAD CLASSIFICATION III
1. One-Way, 2-Lane
2. One-Way, Multi-Lane
3. Undivided, 2-Way, 2-Lane
4. Undivided, 2-Way, Multi-Lane
5. Divided, With Barrier
6. Divided, With Median
7. Divided, Type Unspecified
Q. Other (Parking Lot)
U. Unknown

23. ROAD MATERIAL
1. Asphalt
2. Concrete
3. Gravel
4. Earth, Dirt
5. Chip-Seal
6. Brick/Cobblestone
7. Wood
8. Steel Deck
9. Ice Road
Q. Other
U. Unknown

24. ROAD SURFACE
1. Dry, Normal
2. Wet
3. Snow (Fresh/Loose)
4. Slush, Wet Snow
5. Icy
6. Sandy/Gravel/Dirt
7. Muddy
8. Oil
9. Flooded
Q. Other
U. Unknown

25. ROAD CONDITION
1. Good
2. Potholes, Bumps, Ruts
3. Under Construction, Repair
4. Uneven
5. Worn
6. Obscured/Faded Markings
Q. Other
U. Unknown

26. ROAD ALIGNMENT
1. Straight And Level
2. Straight With Grade
3. Curved And Level
4. Curved With Grade
5. Top Of Hill/Gradient
6. Bottom Of Hill/Gradient
Q. Other
U. Unknown

27. TRAFFIC CONTROL
01. Traffic Signals - Oper.
02. Traffic Signals - Flashing
03. Stop Sign
04. Yield Sign
05. Warning Sign
06. Pedestrian Crosswalk
07. Police Officer
08. School Guard, Flagman
09. School Crossing
10. Reduced Speed Zone
11. No Passing Zone Sign
12. Road Markings
13. School Bus Stopped/ Lights Flashing
14. School Bus Stopped/ Lights Not Flashing
15. Rail Crossing With Signals and/or Gates
16. Rail X-ing, Signs Only
17. Unspec. Control Device
18. No Control Present
QQ. Other
UU. Unknown

28. POSTED SPEED LIMIT
UUU. Unknown

35. VEHICLE TYPE
01. Passenger Car
02. Passenger Van
03. Light Utility Vehicle
04. Pickup Truck, To 4500 kg
05. Panel/Cargo Van, To 4500 kg
06. Other Truck, Van, To 4500 kg
07. Unit Truck, > 4500 kg
08. Road Tractor
09. School Bus
11. Urban Transit Bus
14. Intercity Bus
14. Motorcycle
15. Motorcycle - Speed Limited
16. Off-Road Vehicle
17. Bicycle
18. Purpose-Built Motor Home
19. Farm Equipment
20. Construction Equipment
22. Snowmobil
QQ. Other UU. Unknown

36. VEHICLE USE
01. Taxi
02. School Bus
03. Other Bus
04. Military
05. Police Cruiser
06. Other Police
07. Ambulance
08. Hearse
09. Tow Truck
10. Delivery Vehicle
11. Road Maintenance
12. Utilities Maintenance
13. Fire Response
99. No Special Use
QQ. Other
UU. Unknown

37. EMERGENCY USE
1. Yes
2. No
N. Not an Emergency Vehicle
U. Unknown

38. TRAILER TYPE
1. Recreational Trailer
2. Light Utility Trailer (Boat)
3. Commercial Full Trailer
4. One Semi-Trailer
5. Two Semi-Trailers, A-Train
6. Two Semi-Trailers, B-Train
7. Two Semi-Trailers, C-Train
8. Two Semi-Trailers, Connector Unknown
9. Three Semi-Trailers
N. No Trailers
Q. Other
U. Unknown

39. USE OF HEADLIGHTS
1. No Headlights On/Not Equipped
2. Daytime Running Lights On
3. Headlights On
4. Parking Lights Only On
5. Fog Or Auxiliary Lights On
Q. Other
U. Unknown

40. VEHICLE SPEED
000. Stopped in Traffic
NNN. Parked
UUU. Unknown

41. VEHICLE MANOEUVRE
01. Going Straight
02. Turning Left
03. Turning Right
04. Making U-Turn
05. Changing Lanes
06. Merging
07. Reversing
08. Overtaking
09. Negotiating Curve
10. Slowing, Stopping
11. Starting In Traffic
12. Leaving Roadside
13. Stopped/Parked Legally
14. Stopped/Parked Illegally
15. Swerving To Avoid Collision
16. Run-Away Or Roll Away Vehicle
21. Unspecified Manoeuvre
QQ. Other UU. Unknown

44 - 46. VEHICLE EVENTS
NON-COLLISION EVENTS:
01. Skidded Or Spun On Roadway
02. Ran Off Road
03. Overturned,Rollover
04. Jackknife Or Trailer Swing
05. Fire Or Explosion
06. Load Spill
07. Load Shift **EVT1**
08. Submersion
09. Other Non-Collision Event
HIT MOVING OBJECTS:
11. Hit Moving or Stopped Motor Vehicle
12. Hit Pedestrian
13. Hit Bicyclist **EVT2**
14. Hit Animal
15. Hit Train **EVT3**
19. Hit Another Moving Object
HIT NON-MOVING OBJECTS:
21. Hit Parked Vehicle
22. Hit Non-Fixed Object
23. Hit Building
24. Hit Ditch
25. Hit Embankment, Dirt Pile, Rock
26. Hit Culvert, Drainage Structure
27. Hit Tree/Bush/Hedge
28. Hit Light/Utility Pole
29. Hit Curb
30. Hit Post
31. Hit Traffic Barrier
32. Hit Other Fixed Object, Part Of Road Structure
33. Hit Other Fixed Object NOT Part Of Road Structure
39. Hit Other Type Fixed Object
NN. No 2nd or 3rd Event
QQ. Other UU. Unknown

47. DRIVER/PEDESTRIAN CONDITION
1. Fatigued/Fell Asleep
2. Inexperience
3. Under Influence - Alcohol
4. Under Influence - Drugs
5. Sudden Illness, Lost Conciousness
N. Apparently Normal
Q. Other U. Unknown

48. DRIVER ACTION
21. Following Too Closely
22. Distracted, Inattentive
23. Driving Too Fast For Conditions
24. Improper Turning Or Passing
25. Fail To Yield Right-Of-Way
26. Disobeyed Traffic Control Device/ Police Officer
27. Driving On Wrong Side Of Road
29. Backing Unsafely
30. Lost Control
NN. Driving Properly
QQ. Other UU. Unknown

49. VEHICLE FACTORS
41. Defective Brakes
42. Defective Steering
43. Defective Lights
44. Tire Blown Out
45. Unsecured Or Spilled Load
46. Oversized Load,Overload
47. Visibility Obstructed
48. Other Defective Parts
NN. No Defects
QQ. Other UU. Unknown

50. ENVIRONMENTAL FACTORS
51. Animal On Roadway
52. Road Surface Or Other Condition
53. Obstruction On Road
54. View Obstructed, Glare, Reflection
55. Weather Or Acts Of God
NN. No Environmental Factors
QQ. Other UU. Unknown

52. DANGEROUS GOODS CLASS
1. Explosives
2. Gases
3. Flammable Liquids
4. Flammable Solids, Spontaneous Combustibles
5. Oxidizers & Organic Peroxides
6. Poisonous & Infectious Substances
7. Radioactives
8. Corrosives
9. Misc. Dangerous Goods
N. Not a Commercial Vehicle
Q. Other U. Unknown

53. LOAD STATUS COMMERCIAL VEHICLES
1. Fully/Partially Loaded
2. Not Loaded
N. Not a Commercial Vehicle
Q. Other U. Unknown

60. BLOOD ALCOHOL CONCENTRATION
000-500 BAC (mg%) Of Driver /Pedestrian
600. Not Tested, Driver/Pedestrian Dead, Alcohol Use Suspected
610. Not Tested Due To Injury, Alcohol Use Suspected
620. Not Tested - Other Reasons, Alcohol Use Suspected
998. No Alcohol Suspected
NNN. Passenger UUU. Unknown

Driver 1 Driver 2
Ped 1 Ped 2
Ped 3 Ped 4

68. PEDESTRIAN ACTION
01. Crossing Intersection With ROW
02. Crossing Intersection Without ROW
04. In Crosswalk
05. Crossing Roadway At Midblock
06. Walking On Roadway Against Traffic
07. Walking On Roadway WithTraffic
08. On Sidewalk, Median, Safety Zone
11. Coming From Behind Parked Vehicle/Object
12. Coming From Behind Moving Vehicle
13. Running Into Roadway
14. Getting On/Off School Bus
15. Getting On/Off Vehicle
16. Pushing Vehicle Ped 1
17. Working On Vehicle
18. Playing On Road Ped 2
19. Working On Road
20. Lying On Road Ped 3
NN. Not a Pedestrian
QQ. Other UU. Unknown Ped 4

INDEPENDENT WITNESSES

Last Name	First Name
Address	
Home Phone	Work Phone
Last Name	First Name
Address	
Home Phone	Work Phone

ADDITIONAL WITNESSES ON FILE?
Yes ☐ No ☐

DESCRIPTION: Show Direction of Travel, Obstructions,Vehicle Movement,Travel Lane, Fixed Objects, Traffic Controls.

DIAGRAM Use Solid Direction Lines Before Impact and Broken Lines After

North

POLICE COMMENTS

DRIVER AT FAULT
Y. Driver Wholly/Partially At Fault
N. Driver Not At Fault
U. Unknown

CHARGES LAID
Y. Charges Laid Against Driver
N. Charges Not Laid
U. Unknown/Pending/Proposed

BRITISH COLUMBIA

Ministry of Transportation

MONTHLY WILDLIFE ACCIDENT REPORT

Enter the day of the month (e.g. 1, 2, 3, ... etc.) in the "Day" column below.

MONTH *(Please Circle)* **Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec** **YEAR** ________

REGION *(Please Circle)* **1 2 3 4 5 6** **DISTRICT**______________________ **DISTRICT NO.**______

Day	Time of Kill 1 = Dawn 2 = Day 3 = Dusk 4 = Dark	Location of Killed Animal RFI = Road Features Inventory (optional) **LKI = Landmark Kilometre Index (must be completed)**						Deer Sign within 100m	Deer Rflctr	# Killed	Animal Type Please Specify Sex (Male / Female / Unknown) Please Use "Y" to indicate if Yearling or Younger **(Other: Sheep, Caribou, Coyote, Porcupine, etc)**													Comments
		Hwy	RFI		LKI		Nearest				Deer			Moose			Elk			Bear			Other	
		No.	Landmark	Offset	Segment	Km	Town	Y/N	Y/N		M	F	U	M	F	U	M	F	U	M	F	U	(please specify)	

Please provide the following information to assist in report follow-ups:

______________________________ ______________
Maintenance Contractor Contact (Please Print) Telephone

______________________________ ______________
Ministry District Contact (Please Print) Telephone

Within 30 days of completion, please send this form to:

Leonard E. Sielecki, WARS Manager
Environmental Management Branch
BC Ministry of Transportation
4B - 940 Blanshard Street
P.O. Box 9850 STN PROV GOVT
Victoria, B.C. V8W 9T5 Phone: (250) 356-2255

Note: If you suspect that an animal has been the target of poachers, please contact your local Conservation Officer or call the ORR (Observe, Record, Report) Line at 1-800-663-9453.

H0107 (2001/06) Page_____of _____

Colorado DOT

COLLISION REPORT FORM

__Instructions:__ Please record any of the following species observed as roadkill: **Elk, deer, antelope fox, moose*, bighorn sheep*, mountain goat*, bear*, lion*, wolf*, lynx*, bobcat*.**

Each species box is meant to contain the specific information for each individual roadkill reported.

Region:	**Maintenance Super.:**	**Assistant Super.:**
Assistant Area Foreman:	**Area Foreman:**	**Patrols (M2):**

Species:		**Species:**		**Species:**		**Species:**	
Date		Date		Date		Date	
Highway		Highway		Highway		Highway	
Milepost (nearest 1/10th)		Milepost (nearest 1/10th)		Milepost (nearest 1/10th)		Milepost (nearest 1/10th)	
# Killed		# Killed		# Killed		# Killed	
Reported By		Reported By		Reported By		Reported By	
Removed?		Removed?		Removed?		Removed?	
Species:		**Species:**		**Species:**		**Species:**	
Date		Date		Date		Date	
Highway		Highway		Highway		Highway	
Milepost (nearest 1/10th)		Milepost (nearest 1/10th)		Milepost (nearest 1/10th)		Milepost (nearest 1/10th)	
# Killed		# Killed		# Killed		# Killed	
Reported By		Reported By		Reported By		Reported By	
Removed?		Removed?		Removed?		Removed?	

NOTE: Please report any species designated with a "*" to the Division of Wildlife. Northeast Region Service Center (303) 291-7227; Southeast Service Center (719) 277-5200; Northwest Service Center (970) 255-6100; Southwest Service Center (970) 247-0855.

Please return this form to your regional office:

Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
Deb Angulski 18500 E. Colfax Ave Aurora CO 80111	Philip Harrison 905 Erie Ave P.O Box 536 Pueblo CO 81002	Gary Spinuzzi 222 S. 6th St, G.J. CO 81501	Jim Eussen 1420 2nd St. Greeley CO 80631	Jon Holst 3803 N. Main Ave. Durango CO 81301	Jane Hann 2000 S. Holly St. Denver CO 80222

Monthly Road Kill Report Form - Please Return to Environmental Planner
This is an Excel computer fillable form with drop down automatic data entry boxes.
It can be saved and e-mailed or filled out by hand and sent in.

Idaho DOT

2006

Month ______________

Animal Information

M = Male, F = Female, U = Unknown

Please Use "Y" in the M, F, U boxes if the animal is a yearling or younger

Otherwise please use "X" for age other than yearling

Day	Location of Killed Animals			Deer			Elk			Moose			Bear			Other species (please specify)	**What done w/ animal?**	Initials of Observer	**Additional Comments**
	Route	Mile Point to 0.1 mile	How Many?	M	F	U	M	F	U	M	F	U	M	F	U		hauled to dump, roadside, G&F etc.		

Maryland DOT

Maryland Department of Transportation
State Highway Administration
Highway Maintenance Division
TEAM ACTIVITY CARD

Index #		Shop	
Date		Team Leader	

Work Order #s				

Agency Code 1	Description of Use
3490	Work Zone Traffic Control

PCA # Prefix	Description of Use
23---	Maintenance Work
27---	Reimbursable Incident * Must use Incident Tracking Number
28---	Non-Reimbursable Incident

	PCA # or Project #	Route #	Beginning Milepoint	Ending Milepoint	Direction /Ramp	Lane /Offset	WZTC #	WZTC Modified (Yes/No)	Hours On Site	Route Accomplishment in Unit of Measure
1										
2										
3										
4										
5										
6										
7										
8										

Labor

	Team Member	Code	CD	RT	OT	RT	OT	RT	OT	RT	OT
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
	Total Staff Hours (RT + OT)										

Equipment/Tools

	Tag #	Description	Used	On-Site	Used	On-Site	Used	On-Site	Used	On-Site	Ending Odometer
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											

Maryland DOT (continued)

Materials

PCA # or Project #	Agency Code 1 (if applicable)	Route #	Stock #	Description	Quantity Used	Unit of Measure

Large Wild Animals

(Deer, Bear, Coyote, Cougar)

Route #	Milepoint	Direction	Specific Location	Type of Animal	Sex of Animal (M, F, Unknown)

Reimbursable Incident Information

	Reimbursable Incident Tracking Number	Remarks
1	A	
2	A	
3	A	
4	A	
5	A	
6	A	
7	A	
8	A	

Remarks

Mississippi DOT (For Rabies Surveillance)

Date: ____________

Individuals Name: ______________________________

Address of individual: ______________________________

____

Phone Number: ______________________________

Location Specimen found: ______________________________
(Road, mile marker, city)

GPS Waypoints:______________ / ______________
(If Available)

Collection method: ☐ **Road kill** ☐ **Cage trap** ☐ **Shot**
☐ **Other** ______________________

Animal Species: ☐ **Raccoon** ☐ **Coyote** ☐ **Fox** ☐ **Dog**
☐ **Other** ______________________

Sex of Species: ☐ **Male** ☐ **Female**

Age: ☐ **Adult** ☐ **Juvenile**

Date Species Found: ______________________________

Comments: (can be written on back of this form)

Rabies Surveillance Program
USDA-APHIS
Wildlife Services
PO Drawer FW
MS State, MS 39762
(662) 325-3014

Montana DOT

Montana Department of Transportation

Animal Incident Report Form

Name and Section : ______________________________ **Observation Period:** ______________________

Date	Route	Milepost	Animal	Other Information – Comments
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown
† 1. Day † 2. Night † 3. Unk.		† 1. E † 4. S † 2. W † 5. Unk. † 3. N	† 1. Antelope † 6. Mule Deer † 11. Other (wild) † 2. Black Bear † 7. Moose † 12. Domestic † 3. Grizzly Bear † 8. Bighorn Sheep † 13. Deer unk. † 4. Elk † 9. Mountain Goat † 5. Whitetail Deer † 10. Mountain Lion	† 1. Male † 2. Female † 3. Yearling † 4. Unknown

Return this form to
Tom Hanek, Safety Management Section, Montana Department of Transportation
2701 Prospect Avenue, P.O. Box 201001, Helena, MT 59620

S:WORD97:ANIMAL:ANIMAL.doc

Revised 11/99

Northwest Territories DOT

NWT Wildlife - Vehicle Collision Report Form

Station:	RCMP File #:	Occurrence #:	Date:	Time:
Location of Incident (Hwy #):			Km Post:	
Latitude / Longitude (Use GPS & fill out on scene):			Officer Responding:	
Informant Name:		Phone #:	Address:	

Occupant Information

Name of Driver:	Licence #:		Age:	Sex:
Address:	Phone #:		Occupants: Y / N	Number of Occupants:
Occupant(s) Name:		Address:		Phone #:
Occupant(s) Name:		Address:		Phone #:
Describe any Injuries to Driver or Occupants:				

Vehicle / Weather Information

Vehicle Description (Licence Plate #):	Date:	Time of Accident (24h):
☐ Passenger Car ☐ Light or Heavy duty Truck ☐ Bus ☐ RV ☐ Semi-Trailer ☐ Other:		Ambient Temperature (°C):
Estimate of Damage: ☐ Minimal ☐ Extensive ☐ Wrecked	Light Conditions ☐ Dawn ☐ Day ☐ Dusk ☐ Night	
Road Surface Type: ☐ Asphalt ☐ Gravel ☐ Dirt	Surface Conditions: ☐ Dry ☐ Wet ☐ Icy ☐ Loose Snow ☐ Packed Snow	
Weather Conditions: ☐ Raining ☐ Cloudy ☐ Clear ☐ Snowing ☐ Fog ☐ Sunny ☐ Windy Other ☐		
Road Description: ☐ Turn ☐ Dip ☐ Rise ☐ Straight - Away	Photos of Vehicle Taken: Y / N	

Wildlife Information

Wildlife Species:		Was Animal(s) Killed on Impact: Y / N	Did Animal(s) Have To Be Destroyed: Y / N Number:	
Total Number of Animals Involved:		Males: _____ Calf _____ Yearling _____ Sub-Adult _____ Adult _____ Unknown Females: _____ Calf _____ Yearling _____ Sub-Adult _____ Adult _____ Unknown		
Dominant Vegetation along Roadside Right-of Way:				Photos taken: Y / N
Describe any Injuries to Wildlife:				
Method of Carcass Disposal:				
Hide Salvaged: Y /N	Skull Salvaged: Y /N	Meat Salvaged: Y /N	Biological Samples Collected: Y / N	Sample ID#
Lymph Nodes: Y /N	Fecal: Y /N	Teeth(Middle Incisors): Y / N	Ear(DNA): Y / N	Blood: Y / N
Full Girth (CM):	Half Girth (CM):	Nose - Tail Length (CM):		

Date:	Time:	Other Comments:

Oklahoma DNR

FURBEARER SIGHTING REPORT FORM
W-82-R, PROJECT 007
SPRING SURVEY

RETURN BY APRIL 5TH TO:

Wildlife Department-DICK HOAR
P.O. Box 1201.
Jenks, OK 74037

OBSERVER NAME ______________________________ IBM # ____________________

DATE	MILES DRIVEN	REGION *ONLY ONE PER DAY	NUMBER OF EACH SPECIES SEEN (NO DISTINCTION BETWEEN LIVING OR DEAD)							
			BOBCAT	RACCOON	GRAY FOX	RED FOX	COYOTE	SKUNK	OPOSSUM	OTHER
MAR 1										
MAR 2										
MAR 3										
MAR 4										
MAR 5										
MAR 6										
MAR 7										
MAR 8										
MAR 9										
MAR 10										
MAR 11										
MAR 12										
MAR 13										
MAR 14										
MAR 15										

***Region note. ONLY ONE REGION PER DAY ! Please indicate ONLY the region in which you drove the most miles that day.**

OTHERS INCLUDE: BEAVER, MINK, MUSKRAT, NUTRIA, RIVER OTTER, RINGTAIL, SPOTTED SKUNK, AND BADGER.

PLEASE INDICATE BY NAME ANY SPECIES SEEN.

ONLY COUNT ROADKILLS ONCE!

Utah DOT (Example 1)

Restoration Services

Driver Cody (Helper) Date 4-3-00

Check station Peerless P.O.C. Daniels

Signature Nancy Nisenger 50A53 A34

Highway	Mile Post #	Deer Doe	Deer Buck	Elk Buck	Elk Bull	Other Name	Other #
28	37	1					
28	28	1		1			
28	19	1					
28	15	1					
28	13	1					
28	8	1					
89	234	1					
89	239	1					
89	265	1					
89	266		1				
6	195	1					
6	205	1					
6	207	1					
6	229	1					
6	232	1					
[illegible]	2	1					
Alpine	4	2					
189	18	1					
189	23	*	1				
~~[illegible]~~							
TOTAL							

Total Animals

Expenses

Place	Gas Gal.	Gas Cost	Other	Other Cost
Total				

Utah DOT (Example 2)

Expense Report

Employee Name: Tim Travel Dates: 4-2-99

COMPANY:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Totals
Transportation								
TIRES								
OIL CHANGES								
MINOR REPAIRS								
MAJOR REPAIRS								
Gas								
Total								
MORTALITY RECORD								
LOCATION	DATE	SEX	QUANTITY	LOCATION	DATE	SEX	QUANTITY	
1 40/6	Doe	Doe	2	89/255		Doe	2	
2 40/32		Buck	1	89/243		Buck	1	
3 40/55		Doe	2	89/242		Doe	1	
4 6/214		Doe	1	89/239		Doe	3	
5 6/210		Doe	1	89/227		Doe	2	
6 6/202		Buck	2	132/61		Doe	1	
7 6/199		Doe	2	132/58		Buck	1	
8 6/198		Doe	1	132/55		Doe	1	
9 6/192		Doe	1	132/51		Doe	2	
Total				89/211		Buck	1	
Mileage				89/210		Doe	2	
Actual Miles				28/7		Doe	2	
Time to Complete				28/22		Doe	1	
Total				28/36		Doe	1	
Port of Entry				28/40		Doe	1	
1. DATE	4-2-99	4-2-99		146/3		Buck	1	
2. TIME	845	4:12		146/2		Doe	1	
3. LOCATION	Daniels	Parleys		92/13		Doe	1	
4. ST. SIGNATURE	[signature]	D [signature]		189/22		B. Elk	1	
Summary	HOURS		DAYS					

	MILES	EXPENSES		
			Cash Advances	
1			Charged to Company	
2				
3			**Due Employee**	

Authorized by Date

Vermont DOT

VTMATS MISC. ROADWAY INFORMATION (ROAD KILL and ANIMAL CROSSINGS)													
MSRI Code	MSRI Code Descr	Alias (Observer)	Begin Date	End Date	Begin Town	End Town	Town Descr	Route	Route Descr	Begin MM	End MM	Comment
Bear	Bear	R., Jen	6/23/2005	6/23/2005	1203	1203	Berlin	890	I 89	47	47	Black Bear tried to cross
Bear	Bear	NULL	9/18/2005	9/18/2005	1007	1007	Derby	910	I 91	175.25	175.25	Bear dead in road
Bear	Bear	bear	10/24/2005	10/24/2005	215	215	Sunderl	70	US 7	4.8	4.8	100 to 150 lb dead bear
Bear	Bear	NULL	11/15/2005	11/16/2005	401	401	Bolton	890	I 89	68.65	68.65	hit by car
Moose	Moose	tlewis	1/22/2005	1/22/2005	507	507	Concord	20	US 2	9.7	9.7	Vehicle struck a moose
Moose	Moose	RCARRIER	4/14/2005	4/14/2005	212	212	Searsbu	80	VT 8	0.65	0.65	ADULT MOOSE CROSSING
Moose	Moose	V.S.P.	5/5/2005	5/5/2005	1314	1314	Rocking	910	I 91	38.05	38.05	moose hit by car
Moose	Moose	Digi, Chris	6/23/2005	6/23/2005	401	401	Bolton	20	US 2	4.03	4.03	Moose (Adult Female)
Moose	Moose	MOOSE	6/23/2005	6/28/2005	212	212	Searsbu	80	VT 8	2.1	2.1	A MOTHER AND TWO CALFS
Moose	Moose	removed by game warden	7/13/2005	7/13/2005	909	909	Randolp	890	I 89	34	34	young male moose.
Moose	Moose	RCARRIER	7/14/2005	7/15/2005	1321	1321	Whiting	1000	VT 100	10.3	10.3	MOTHER AND CALF
Moose	Moose	dalehall	7/16/2005	7/16/2005	514	514	Lunenbu	20	US 2	2.2	2.2	The Moose was hit
Moose	Moose	tlewis	9/22/2005	9/22/2005	507	507	Concord	20	US 2	6.4	6.4	Bull moose struck and killed
Moose	Moose	moose	10/10/2005	10/10/2005	804	804	Elmore	120	VT 12	2.6	2.6	Crossing Road.
Moose	Moose	RCARRIER	11/22/2005	11/23/2005	1308	1308	Halifax	1120	VT 112	3.25	3.25	BULL MOOSE CROSSING
Moose	Moose	RCARRIER	11/7/2005	11/23/2005	209	214	Readsbo	1000	VT 100	1.5	1.5	TWO BULLS AND A FEMALE
Moose	Moose	RCARRIER	11/29/2005	11/30/2005	1321	1321	Whiting	1000	VT 100	9.9	9.9	ADULT COW MOOSE
Deer	Deer	Andrew Masson	3/1/2005	3/1/2005	609	609	Highgat	890	I 89	124.25	124.25	Two doe
Deer	Deer	jbowley	3/21/2005	3/21/2005	1409	1409	Hartland	50	US 5	4.1	4.1	NULL

Virginia DOT

D.E./SB

V.D.O.T.

DEAD ANIMAL PATROL

Daily Sheet

DATE 1/7/05

ROUTE NO#	DEER	OPOSSUM	RACCOONS	SKUNKS	GR. HOG	SQUIRREL	DOG	CAT	RABBIT
173.6 I-81-S									✓ Turkey
162.6 I-81-N									
164. I-81-N				✓					
172.4 I-81-S	✓								
166.9 I-81-N	✓								
Rt. 11		✓							✓

FORM M-73

WILDLIFE HIGHWAY MORTALITY FORM

fence types:
"A" 32" WW & 2 BW
"B" 32" WW & 3 BW
"C" 26" WW & 2 BW
"D" 4 BW & 1 SW
"E" 3 BW & 2 SW
"F" 4 BW
"G" 5 BW
"H" 6 BW
"Temporary" 3 BW
"Barrier" 26" WW
WW = woven, BW = barbed & SW = smooth wire

DATE (MONTH / DAY)	ROUTE (US 85, WY 341, I-80, etc.)	MP (To the nearest tenth of a mile (00.1))	LANE (E = east, W = west, S = south, N = north, M = median, O = other (describe))	SPECIES (MD = mule deer, WTD = white tail deer, P = pronghorn, E = elk, M = moose, BHS = big horn sheep, BB = black bear, ML = mtn lion, OTHER - list name)	SEX (M = male, F = female, U = unknown)	AGE (A = adult, Y = yearling, J = juvenile, U = unknown)	CAUSE (C = collision, F = fence (entanglement), O = other (describe), U = unknown)	TYPE OF FENCE (See Standard Plan Sheet 4 607-01D for more details)	COMMENTS	* SPECIES CODE	* HERD CODE	* HUNT AREA	* ENTERED IN WOS
2-6	US 26	103	W	WTD	F	A	C	B					
2-6	US 26	115	E	MD	F	A	C	G					
2-9	US 20 789	111.3	S	MD	F	A	C	A					
2-13	US 26	119.4	W	MD	F	A	C	F					
2-13	US 26	123.4	W	WTD	F	Y	C	B					
2-17	US 26	119.3	E	MD	F	J	C	B					
2-23	US 26	103.5	N	WTD	F	Y	C	F					
2-27	789	102.7	W	MD	F	A	C	B					
1-2	US 26	121.	S	MD	F	J	C	F					
2-13	US 26	132	S	MD	F	A	C	No fence	in City Limits				
2-14	US 26	128.4	W	MD	F	A	C	F					
2-15	US 26	111.1	S	MD	M	A	C	F					
2-16	US 26	117	N	MD	F	Y	C	F					
3-17	US 26	127	S	MD	F	A	C	F					
3-21	789	109.2	E	MD	M	A	C	B					
3-22	133	5.2	E	MD	F	J	C	D					
3-22	24	20.5	S	MD	F	A	C	F					
3-23	789	112.8	E	MD	M	J	O	B					
3-23	789	107.5	W	MD	M	A	C	4					

Mail completed form to appropriate "LOCAL" Regional Wyoming Game and Fish Dept., attn: Wildlife Biologist.

** Shaded areas to be completed by Wyoming Game and Fish Dept.*

Wyoming DOT

APPENDIX E

Responses to Introductory Survey

#	QUESTION	RESPONSE	DOT		DNR	
Q. 1	Does your agency collect or manage AVC data?	Yes	26	65%	13	36%
		No	14	35%	23	64%
		No response	0	0%	0	0%
Q. 2	Does your agency collect or manage AC data?	Yes	14	35%	18	50%
		No	24	60%	18	50%
		No response	2	5%	0	0%
Q. 3	Why your agency does NOT collect/manage AVC or AC data (check all that apply)	Too expensive	2	5%	4	11%
		Too time consuming	2	5%	2	6%
		Too difficult	0	0%	0	0%
		Not interested	4	10%	0	0%
		Someone else collects	4	10%	8	22%
		Other	2	5%	1	3%
		No response	32	80%	25	69%
Q. 4	In your opinion, should your agency begin collecting AVC or AC data?	Yes	2	5%	2	6%
		No	3	8%	8	22%
		Don't know	3	8%	0	0%
		No response	32	80%	26	72%
Q. 5	What changes need to be made before your agency will begin collecting AVC or AC data?	More money	4	10%	5	14%
		More personnel	2	5%	4	11%
		Better training	3	8%	1	3%
		Demonstrated need	7	18%	8	22%
		Other	2	5%	1	3%
		Don't know	0	0%	0	0%
		Nothing will make us collect it	0	0%	1	3%
		No response	32	80%	26	72%

APPENDIX F

Responses to Animal–Vehicle Collision Survey

Table F1. AVC Section 1

#	QUESTION	RESPONSE	DOT		DNR	
Q. 1	Why does your agency collect/manage AVC data? Rank the following, with 1 being most important. Part 1: PUBLIC SAFETY	Rank 1	20	80%	5	38%
		Rank 2	3	12%	4	31%
		Rank 3	0	0%	2	15%
		Rank 4	1	4%	1	8%
		No response	1	4%	1	8%
	Why does your agency collect/manage AVC data? Rank the following, with 1 being most important. Part 2: WILDLIFE MANAGEMENT	Rank 1	2	8%	6	46%
		Rank 2	11	44%	5	38%
		Rank 3	4	16%	0	0%
		Rank 4	2	8%	0	0%
		No response	6	24%	2	15%
	Why does your agency collect/manage AVC data? Rank the following, with 1 being most important. Part 3: ACCOUNTING	Rank 1	2	8%	0	0%
		Rank 2	2	8%	1	8%
		Rank 3	8	32%	6	46%
		Rank 4	2	8%	1	8%
		No response	11	44%	5	38%
	Why does your agency collect/manage AVC data? Rank the following, with 1 being most important. Part 4: OTHER	Rank 1	1	4%	1	8%
		Rank 2	2	8%	0	0%
		Rank 3	3	12%	0	0%
		Rank 4	1	4%	2	15%
		No response	18	72%	10	77%
Q. 2	When did your agency start collecting AVC data?	1990–2006	6	24%	0	0%
		1980–1989	4	16%	2	15%
		1970–1979	7	28%	3	23%
		Before 1969	1	4%	2	15%
		Not applicable	0	0%	2	15%
		Unknown or no response	7	28%	4	31%
Q. 3	On what basis does your agency collect AVC data?	No response	1	4%	4	31%
		Voluntary	3	12%	1	8%
		Semi-voluntary	3	12%	2	15%
		Mandatory	18	72%	6	46%
Q. 4	Please describe the road types for which your agency collects/manages AVC data (check all that apply)	Interstates	24	96%	10	77%
		Arterial roads	24	96%	10	77%
		Collector roads	19	76%	6	46%
		Local roads	13	52%	8	62%
		No response	0	0%	3	23%

Table F1 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 5	Please describe the geographic limits of the reporting area	All roads in state/province	10	40%	5	38%
		All public roads in state/province	4	16%	2	15%
		All roads in state/province with exceptions	2	8%	1	8%
		All state and/or federal roads	7	28%	3	23%
		Not applicable or other	0	0%	0	0%
		No response	2	8%	2	15%
Q. 6	How would you characterize the landscape surrounding these areas?	Rural	2	8%	0	0%
		Urban	0	0%	0	0%
		Both	22	88%	10	77%
		No response	1	4%	3	23%
Q. 7	What other organizations or individuals collect AVC data on the roads your agency reports on?	DOT	1	4%	6	46%
		DNR	8	32%	1	8%
		Law enforcement	8	32%	5	38%
		NGOs or local individuals/groups	1	4%	3	23%
		Other governmental	2	8%	2	15%
		None	4	16%	2	15%
		No response	4	16%	1	8%
Q. 8	If your agency does not cover all road types and areas, what other organizations or individuals are responsible for collecting data in these areas?	DOT	0	0%	1	8%
		DNR	0	0%	0	0%
		Law enforcement	3	12%	0	0%
		NGOs or local individuals/groups	0	0%	1	8%
		Other governmental	3	12%	2	15%
		None or not applicable	10	40%	2	15%
		No response or unknown	10	40%	8	62%

Table F2. AVC Section 2

#	QUESTION	RESPONSE	DOT		DNR	
Q. 9	**What organization(s) does the actual animal–vehicle data collection? (check all that apply)**	A DOT	7	28%	6	46%
		A DNR	4	16%	7	54%
		Highway patrol/law enforcement	16	64%	9	69%
		Other	4	16%	2	15%
		No response	4	16%	0	0%
Q. 10	**Who reports the AVC to the agency or data collector? (check all that apply)**	Driver	16	64%	9	69%
		Agency	9	36%	8	62%
		Other	5	20%	5	38%
		No response	5	20%	0	0%
Q. 11	**Does your agency have a reporting threshold for AVCs?**	Yes	16	64%	4	31%
		No	5	20%	8	62%
		No response	4	16%	1	8%
Q. 12	**If yes, what is the reporting threshold? (select all that apply)**	Human injury	9	36%	2	15%
		A certain $ of property damage	12	48%	4	31%
		Certain species involved	6	24%	3	23%
		No response	8	32%	8	62%
Q. 13	**How would you characterize the search and reporting effort for AVCs?**	Incidental observations	6	24%	3	23%
		Monitoring	8	32%	5	38%
		Other	7	28%	4	31%
		No response	4	16%	1	8%
Q. 14	**What is the frequency of surveys or checks for AVCs on a given road section?**	Daily	4	16%	3	23%
		Weekly	3	12%	1	8%
		Monthly	0	0%	1	8%
		As they occur or are reported	6	24%	5	38%
		Annually	2	8%	0	0%
		Other	4	16%	1	8%
		No response	6	24%	2	15%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 1: DATE**	Always	19	76%	5	38%
		Usually	0	0%	3	23%
		Sometimes	0	0%	1	8%
		Rarely	0	0%	0	0%
		Never	0	0%	0	0%
		No response	6	24%	4	31%
	Do you record one or more of the following parameters? Part 2: TIME	Always	13	52%	3	23%
		Usually	2	8%	1	8%
		Sometimes	1	4%	2	15%
		Rarely	0	0%	2	15%
		Never	1	4%	1	8%
		No response	8	32%	4	31%
	Do you record one or more of the following parameters? Part 3: DISTRICT or UNIT	Always	15	60%	5	38%
		Usually	2	8%	2	15%
		Sometimes	0	0%	1	8%
		Rarely	1	4%	0	0%
		Never	1	4%	0	0%
		No response	6	24%	5	38%
	Do you record one or more of the following parameters? Part 4: NAME of OBSERVER	Always	12	48%	4	31%
		Usually	2	8%	3	23%
		Sometimes	0	0%	1	8%
		Rarely	2	8%	1	8%
		Never	1	4%	0	0%
		No response	8	32%	4	31%
	Do you record one or more of the following parameters? Part 5: ROAD/ROUTE ID	Always	18	72%	4	31%
		Usually	1	4%	2	15%
		Sometimes	0	0%	2	15%
		Rarely	0	0%	0	0%
		Never	0	0%	0	0%
		No response	6	24%	5	38%
	Do you record one or more of the following parameters? Part 6: COLLISION LOCATION	Always	14	56%	3	23%
		Usually	3	12%	5	38%
		Sometimes	0	0%	1	8%
		Rarely	0	0%	0	0%
		Never	1	4%	1	8%
		No response	7	28%	3	23%
	Do you record one or more of the following parameters? Part 7: FATALITIES	Always	14	56%	5	38%
		Usually	0	0%	1	8%
		Sometimes	0	0%	1	8%
		Rarely	0	0%	0	0%
		Never	3	12%	1	8%
		No response	8	32%	5	38%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 8: INJURIES**	Always	12	48%	4	31%
		Usually	1	4%	1	8%
		Sometimes	1	4%	2	15%
		Rarely	0	0%	0	0%
		Never	3	12%	1	8%
		No response	8	32%	5	38%
	Do you record one or more of the following parameters? Part 9: TYPE OF INJURY	Always	6	24%	1	8%
		Usually	0	0%	3	23%
		Sometimes	1	4%	0	0%
		Rarely	1	4%	2	15%
		Never	7	28%	2	15%
		No response	10	40%	5	38%
	Do you record one or more of the following parameters? Part 10: PROPERTY DAMAGE	Always	12	48%	2	15%
		Usually	2	8%	1	8%
		Sometimes	0	0%	2	15%
		Rarely	0	0%	1	8%
		Never	3	12%	2	15%
		No response	8	32%	5	38%
	Do you record one or more of the following parameters? Part 11: AMOUNT OF PROPERTY DAMAGE	Always	6	24%	1	8%
		Usually	2	8%	1	8%
		Sometimes	1	4%	2	15%
		Rarely	2	8%	1	8%
		Never	5	20%	3	23%
		No response	9	36%	5	38%
	Do you record one or more of the following parameters? Part 12: ANIMAL SPECIES	Always	7	28%	7	54%
		Usually	5	20%	2	15%
		Sometimes	3	12%	0	0%
		Rarely	0	0%	0	0%
		Never	2	8%	0	0%
		No response	8	32%	4	31%
	Do you record one or more of the following parameters? Part 13: SEX OF ANIMAL	Always	2	8%	3	23%
		Usually	0	0%	3	23%
		Sometimes	4	16%	1	8%
		Rarely	2	8%	1	8%
		Never	9	36%	1	8%
		No response	8	32%	4	31%
	Do you record one or more of the following parameters? Part 14: AGE OF ANIMAL	Always	1	4%	2	15%
		Usually	0	0%	2	15%
		Sometimes	3	12%	2	15%
		Rarely	2	8%	1	8%
		Never	11	44%	2	15%
		No response	8	32%	4	31%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	Do you record one or more of the following parameters? Part 15: REMOVAL OF CARCASS	Always	4	16%	4	31%
		Usually	0	0%	2	15%
		Sometimes	2	8%	2	15%
		Rarely	2	8%	0	0%
		Never	9	36%	0	0%
		No response	8	32%	5	38%
Q. 16	How is collision location recorded? Part 1: GPS	Always	1	4%	0	0%
		Usually	0	0%	1	8%
		Sometimes	1	4%	2	15%
		Rarely	3	12%	1	8%
		Never	11	44%	3	23%
		No response	9	36%	6	46%
	How is collision location recorded? Part 2: MAP	Always	1	4%	2	15%
		Usually	2	8%	1	8%
		Sometimes	6	24%	3	23%
		Rarely	0	0%	1	8%
		Never	7	28%	2	15%
		No response	9	36%	4	31%
	How is collision location recorded? Part 3: REFERENCE or MILE POST	Always	11	44%	0	0%
		Usually	4	16%	1	8%
		Sometimes	2	8%	4	31%
		Rarely	1	4%	0	0%
		Never	1	4%	2	15%
		No response	6	24%	6	46%
	How is collision location recorded? Part 4: ROAD SECTION	Always	7	28%	0	0%
		Usually	6	24%	3	23%
		Sometimes	1	4%	3	23%
		Rarely	0	0%	0	0%
		Never	4	16%	1	8%
		No response	7	28%	6	46%
	How is collision location recorded? Part 5: OTHER	Always	0	0%	0	0%
		Usually	0	0%	1	8%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	0	0%
		Never	4	16%	0	0%
		No response	21	84%	12	92%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 17	How precise is the collision information? Part 1: WITHIN 1 YARD OR METER	Always	0	0%	1	8%
		Usually	1	4%	0	0%
		Sometimes	2	8%	0	0%
		Rarely	3	12%	4	31%
		Never	7	28%	2	15%
		No response	12	48%	6	46%
	How precise is the collision information? Part 2: WITHIN 15 YARDS OR METERS	Always	1	4%	0	0%
		Usually	0	0%	0	0%
		Sometimes	3	12%	1	8%
		Rarely	4	16%	3	23%
		Never	4	16%	2	15%
		No response	13	52%	7	54%
	How precise is the collision information? Part 3: WITHIN 30 YARDS OR METERS	Always	0	0%	0	0%
		Usually	1	4%	1	8%
		Sometimes	4	16%	2	15%
		Rarely	3	12%	2	15%
		Never	4	16%	2	15%
		No response	13	52%	6	46%
	How precise is the collision information? Part 4: WITHIN 0.1 MILE OR KILOMETER	Always	7	28%	0	0%
		Usually	6	24%	2	15%
		Sometimes	1	4%	1	8%
		Rarely	3	12%	2	15%
		Never	2	8%	2	15%
		No response	6	24%	6	46%
	How precise is the collision information? Part 5: WITHIN 1 MILE OR KILOMETER	Always	5	20%	2	15%
		Usually	1	4%	3	23%
		Sometimes	3	12%	2	15%
		Rarely	0	0%	0	0%
		Never	3	12%	1	8%
		No response	13	52%	5	38%
	How precise is the collision information? Part 6: OTHER	Always	0	0%	2	15%
		Usually	0	0%	1	8%
		Sometimes	0	0%	1	8%
		Rarely	0	0%	0	0%
		Never	4	16%	0	0%
		No response	21	84%	9	69%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 18	If reference or mi/km posts are used for location, how far apart are these signs?	1 mile	7	28%	1	8%
		0.1 mile	2	8%	2	15%
		1 kilometer	1	4%	0	0%
		0.2 mile	2	8%	0	0%
		Length varies	2	8%	1	8%
		Other	2	8%	2	15%
		No response	10	40%	7	54%
Q. 19	Amphibians are usually identified to:	Species	2	8%	0	0%
		Genus	0	0%	0	0%
		Family	0	0%	0	0%
		Order	0	0%	1	8%
		Class	0	0%	0	0%
		Never	13	52%	8	62%
		Other	3	12%	2	15%
		No response	7	28%	2	15%
Q. 20	Amphibian groups recorded include: (check all that apply)	All	2	8%	1	8%
		Endangered	0	0%	0	0%
		Other	0	0%	0	0%
		Never	10	40%	6	46%
		No response	13	52%	6	46%
Q. 21	Reptiles are usually identified to:	Species	0	0%	0	0%
		Genus	2	8%	0	0%
		Family	0	0%	0	0%
		Order	0	0%	1	8%
		Class	0	0%	0	0%
		Never	14	56%	6	46%
		Other	1	4%	3	23%
		No response	8	32%	3	23%
Q. 22	Reptile groups recorded include: (check all that apply)	All	1	4%	0	0%
		Endangered	1	4%	1	8%
		Other	0	0%	1	8%
		Never	10	40%	5	38%
		No response	13	52%	6	46%
Q. 23	Birds are usually identified to:	Species	1	4%	2	15%
		Genus	3	12%	0	0%
		Family	0	0%	0	0%
		Order	2	8%	1	8%
		Class	2	8%	0	0%
		Never	5	20%	4	31%
		Other	5	20%	3	23%
		No response	7	28%	3	23%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 24	Bird groups recorded include: (check all that apply)	All	2	8%	0	0%
		Endangered	2	8%	3	23%
		Game birds	1	4%	3	23%
		Raptors	3	12%	3	23%
		Songbirds	0	0%	0	0%
		Other	5	20%	3	23%
		Never	2	8%	4	31%
		No response	11	44%	4	31%
Q. 25	Large wild mammals (deer and larger) are usually identified to:	Species	3	12%	9	69%
		Genus	11	44%	1	8%
		Family	0	0%	0	0%
		Order	0	0%	1	8%
		Class	0	0%	0	0%
		Never	1	4%	0	0%
		Other	3	12%	2	15%
		No response	7	28%	0	0%
Q. 26	Large wild mammal groups recorded include: (check all that apply)	All	5	20%	2	15%
		Endangered	2	8%	1	8%
		Game	7	28%	5	38%
		Ungulates	8	32%	8	62%
		Carnivores	4	16%	3	23%
		Non-natives	0	0%	1	8%
		Other	4	16%	3	23%
		Never	1	4%	0	0%
		No response	8	32%	0	0%
Q. 27	Small wild mammals (smaller than deer) are usually identified to:	Species	2	8%	4	31%
		Genus	3	12%	0	0%
		Family	1	4%	1	8%
		Order	2	8%	0	0%
		Class	0	0%	0	0%
		Never	7	28%	1	8%
		Other	2	8%	3	23%
		No response	8	32%	4	31%

Table F2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 28	Small wild mammal groups recorded include: (check all that apply)	All	3	12%	1	8%
		Endangered	1	4%	1	8%
		Game	1	4%	3	23%
		Carnivores	2	8%	4	31%
		Non-natives	0	0%	1	8%
		Other	4	16%	2	15%
		Never	6	24%	2	15%
		No response	11	44%	4	31%
Q. 29	Domestic animals are usually identified to:	Species	10	40%	2	15%
		Class	0	0%	0	0%
		Other	5	20%	5	38%
		Never	3	12%	3	23%
		No response	7	28%	3	23%
Q. 30	Domestic animal groups recorded include:	All	5	20%	0	0%
		Large species only	3	12%	3	23%
		Other	4	16%	1	8%
		Never	4	16%	3	23%
		No response	12	48%	6	46%
Q. 31	Part 1: Are animal carcasses or parts thereof collected for further analyses?	Yes	9	36%	7	54%
		No	9	36%	6	46%
		No response	7	28%	0	0%
	Part 2: If yes, for what reasons?	Disease	3	12%	4	67%
		Population info.	1	4%	2	33%
		Other	3	12%	0	0%

Table F3. AVC Section 3

#	QUESTION	RESPONSE	DOT		DNR	
Q. 32	Do AVC data collectors receive training?	Yes	9	36%	1	8%
		No	4	16%	8	62%
		Don't know	8	32%	3	23%
		No response	4	16%	1	8%
Q. 33	How often does training occur?	Once	4	16%	0	0%
		Monthly	0	0%	0	0%
		Yearly	1	4%	0	0%
		Other	6	24%	1	8%
		No response	14	56%	12	92%
Q. 34	Data collectors are trained in: (check all that apply)	Purpose of collecting data	9	36%	1	8%
		Importance of accuracy	9	36%	1	8%
		Filling out forms	10	40%	1	8%
		Which AVCs to record	5	20%	1	8%
		Species ID	3	12%	1	8%
		Carcass aging	1	4%	1	8%
		Carcass sexing	0	0%	1	8%
		Necropsy	0	0%	0	0%
		GPS use	1	4%	1	8%
		Accuracy of locations	6	24%	1	8%
		Data entry and management	1	4%	0	0%
		Other	1	4%	1	8%
		No response	14	56%	12	92%
Q. 35	How is training conducted? (check all that apply)	Literature	3	12%	0	0%
		On the job	8	32%	1	8%
		Seminars	3	12%	1	8%
		Other	3	12%	0	0%
		No response	14	56%	12	92%
Q. 36	What tools and materials are provided to assist with AVC data collection?	Species ID guides	1	4%	0	0%
		GPS units	1	4%	0	0%
		Necropsy kit	0	0%	0	0%
		Other	3	12%	0	0%
		Data sheets/forms	3	12%	1	8%
		No response	18	72%	12	92%

Table F4. AVC Section 4

#	QUESTION	RESPONSE	DOT		DNR	
Q. 37	Part 1: Are the raw data shared with other organizations or individuals?	Yes	19	76%	6	46%
		No	1	4%	5	38%
		Don't know	2	8%	1	8%
		No response	3	12%	1	8%
	Part 2: If yes, with whom?	DOT	1	4%	1	8%
		DNR	7	28%	2	15%
		Law enforcement	3	12%	0	0%
		General public	4	16%	1	8%
		Anyone	4	16%	1	8%
		Other	5	20%	0	0%
Q. 38	Are the data analyzed by your agency?	Yes	17	68%	11	85%
		No	3	12%	1	8%
		Don't know	2	8%	0	0%
		No response	3	12%	1	8%
Q. 39	If the data are not analyzed by your agency, then who does the analysis?	N/A	4	16%	1	8%
		DOT	2	8%	0	0%
		DNR	2	8%	0	0%
		Law enforcement	1	4%	0	0%
		Other	1	4%	1	8%
		No response	17	68%	11	85%
Q. 40	What is the purpose of the data analysis?	ID of problem areas	17	68%	7	54%
		Monitoring wildlife trends	2	8%	8	62%
		Disease monitoring	1	4%	1	8%
		Other wildlife/ecology	2	8%	3	23%
		Other transportation	3	12%	2	15%
		No response	6	24%	1	8%
Q. 41	What other purpose do the data serve?	None	6	24%	1	8%
		Wildlife population (general)	1	4%	3	23%
		Budget allocation/appropriation	1	4%	0	0%
		Public relations	0	0%	1	8%
		Non-native species monitoring	1	4%	1	8%
		General DNR reasons	2	8%	0	0%
		Other	2	8%	0	0%
		No response	12	48%	7	54%

Table F4 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 43	Which of the following data processing tools are used? (check all that apply)	Computer database	18	72%	10	77%
		Frequency graphs for road section	13	52%	5	38%
		Statistical analysis for clusters	9	36%	4	31%
		Statistical analysis for trends	6	24%	7	54%
		Data entered in a GIS	8	32%	6	46%
		No response	6	24%	2	15%
Q. 44	Are the data integrated in one database for the entire state or province?	Yes	16	64%	7	54%
		No	3	12%	4	31%
		No response	6	24%	2	15%
Q. 45	How much time passes between data collection and entry in a centralized database?	≤1 month	7	28%	4	31%
		From 1 to 6 months	6	24%	3	23%
		>6 months	2	8%	1	8%
		Varies widely	2	8%	1	8%
		Unknown	1	4%	2	15%
		No response	7	28%	3	23%
Q. 46	Who performs the analysis?	Wildlife biologist	3	12%	8	62%
		Personnel from MDT (non-biologist)	14	56%	1	8%
		Other	4	16%	2	15%
		No response	6	24%	2	15%
Q. 47	How often are the data analyzed?	<1 year	3	12%	0	0%
		Annually	8	32%	8	62%
		>1 year	2	8%	0	0%
		As needed/on request	5	20%	3	23%
		Project specific	2	8%	1	8%
		No response	8	32%	4	31%
Q. 48	How often are the results published?	<1 year	1	4%	1	8%
		Annually	8	32%	7	54%
		>1 year	1	4%	1	8%
		As needed/on request	4	16%	2	15%
		Not published	3	12%	2	15%
		No response	8	32%	2	15%
Q. 49	How are the data and results disseminated?	Internet, e-mail, or e-files	7	28%	5	38%
		Public media (news, radio)	1	4%	0	0%
		To other agencies	3	12%	1	8%
		Other publication methods	2	8%	3	23%
		By request	2	8%	2	15%
		Not applicable	1	4%	1	8%
		No response	11	44%	3	23%

Table F4 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 50	Are the results shared with the people who collect the data?	Yes	13	52%	10	77%
		No	5	20%	2	15%
		No response	7	28%	1	8%
Q. 51	Part 1: Are the results (analyzed, discussed) shared with other organizations or individuals?	Yes	16	64%	11	85%
		No	2	8%	0	0%
		No response	7	28%	2	15%
	Part 2: If yes, with whom?	Other government agencies	3	12%	1	8%
		Law enforcement	2	8%	0	0%
		DNR	7	28%	0	0%
		General public	3	12%	6	46%
		Internally	5	20%	2	15%
		Any group, upon request	3	12%	2	15%
		Other	1	4%	0	0%
Q. 52	Part 1: Do the data lead to on the ground mitigation measures?	Yes	18	72%	9	69%
		No	0	0%	2	15%
		No response	7	28%	2	15%
	Part 2: Please describe.	Warning signs	13	52%	6	46%
		Crossing structures	4	16%	0	0%
		Fencing	5	20%	0	0%
		Speed limit reduction	0	0%	2	15%
		Roadside vegetation alteration	3	12%	1	8%
		Other	3	12%	0	0%
Q. 53	Who does this mitigation?	DOT only	14	56%	5	38%
		DNR only	0	0%	0	0%
		Both DOT and DNR	1	4%	2	15%
		Other	3	12%	1	8%
		N/A	0	0%	1	8%
		No response	8	32%	4	31%

Table F5. AVC Section 5

#	QUESTION	RESPONSE	DOT		DNR	
Q. 54	What problems have you experienced with AC data collection?	Data quality	4	16%	4	31%
		Spatial accuracy	4	16%	2	15%
		Underreporting	7	28%	1	8%
		Lack of technology	2	8%	1	8%
		Timeliness	1	4%	2	15%
		None	2	8%	1	8%
		Other	1	4%	2	15%
		No response	8	32%	4	31%
Q. 55	How can AVC data collection methods be improved?	Data quality	6	24%	3	23%
		Spatial accuracy	4	16%	6	46%
		Species ID	3	12%	1	8%
		Timeliness	2	8%	1	8%
		Resources	2	8%	2	15%
		None	2	8%	1	8%
		Other	4	16%	1	8%
		No response	9	36%	4	31%
Q. 56	What problems have you experienced with AVC data analysis?	Data quality	5	20%	4	31%
		Spatial accuracy	4	16%	3	23%
		Underreporting	3	12%	0	0%
		None	5	20%	3	23%
		Other	1	4%	1	8%
		No response	9	36%	5	38%
Q. 57	How can AVC data analysis methods be improved?	Data quality	4	16%	1	8%
		Spatial accuracy	5	20%	3	23%
		Timeliness	5	20%	3	23%
		Cluster analyses	3	12%	2	15%
		None	0	0%	2	15%
		Not sure	3	12%	1	8%
		Other	3	12%	2	15%
		No response	9	36%	5	38%
Q. 58	What problems have you experienced with AVC data dissemination?	No problems (or N/A)	11	44%	8	62%
		Unknown	0	0%	1	8%
		Other	4	16%	0	0%
		No response	10	40%	4	31%
Q. 59	How can AVC data collection methods be improved?	No problems (or N/A or not sure)	7	28%	5	38%
		Other	13	52%	8	62%
		No response	5	20%	0	0%
Q. 60	Do you know of any successful AC data collection, analysis, and use program within your state/province?	Yes	8	32%	2	15%
		No	11	44%	7	54%
		No response	6	24%	4	31%
Q. 61	Do you know of any successful AC data collection, analysis, and use program outside your state/province?	Yes	5	20%	0	0%
		No	13	52%	9	69%
		No response	7	28%	4	31%

APPENDIX G

Responses to Animal Carcass Survey

Table G1. AC Section 1

#	QUESTION	RESPONSE	DOT		DNR	
Q. 1	Why does your agency collect/manage AC data? Rank the following, with 1 being most important. Part 1: PUBLIC SAFETY	Rank 1	5	45%	1	6%
		Rank 2	3	27%	5	31%
		Rank 3	2	18%	4	25%
		Rank 4	0	0%	1	6%
		No response	1	9%	5	31%
	Why does your agency collect/manage AC data? Rank the following, with 1 being most important. Part 2: WILDLIFE MANAGEMENT	Rank 1	2	18%	9	56%
		Rank 2	5	45%	2	13%
		Rank 3	3	27%	1	6%
		Rank 4	0	0%	0	0%
		No response	1	9%	4	25%
	Why does your agency collect/manage AC data? Rank the following, with 1 being most important. Part 3: ACCOUNTING	Rank 1	4	36%	2	13%
		Rank 2	1	9%	2	13%
		Rank 3	3	27%	3	19%
		Rank 4	0	0%	1	6%
		No response	3	27%	8	50%
	Why does your agency collect/manage AC data? Rank the following, with 1 being most important. Part 4: OTHER	Rank 1	1	9%	0	0%
		Rank 2	1	9%	1	6%
		Rank 3	0	0%	0	0%
		Rank 4	0	0%	0	0%
		No response	9	82%	15	94%
Q. 2	When did your agency start collecting AC data?	1990–2006	4	36%	4	25%
		1980–1989	1	9%	4	25%
		1970–1979	2	18%	1	6%
		Before 1969	0	0%	1	6%
		Not applicable	0	0%	0	0%
		Unknown or no response	4	36%	6	38%
Q. 3	On what basis does your agency collect AC data?	Voluntary	1	9%	1	6%
		Semi-voluntary	4	36%	3	19%
		Mandatory	5	45%	7	44%
		No response	1	9%	5	31%
Q. 4	Please describe the road types for which your agency collects/manages AC data (check all that apply)	Interstates	9	82%	11	69%
		Arterial roads	8	73%	11	69%
		Collector roads	5	45%	10	63%
		Local roads	1	9%	7	44%
		No response	2	18%	4	25%

Table G1 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 5	Please describe the geographic limits of the reporting area.	All roads in state/province	2	18%	5	31%
		All roads in state/province with exceptions	0	0%	3	19%
		All highways under jurisdiction	5	45%	0	0%
		Highways, Interstates, state and/or county roads	2	18%	1	6%
		Other	2	18%	3	19%
		No response	1	9%	4	25%
Q. 6	How would you characterize the landscape surrounding these areas?	Rural	2	18%	2	13%
		Urban	0	0%	0	0%
		Both	8	73%	10	63%
		No response	1	9%	4	25%
Q. 7	What other organizations or individuals collect AC data on the roads your agency reports on?	DOT	0	0%	5	31%
		DNR	4	36%	1	6%
		Law enforcement	1	9%	5	31%
		NGOs or local individuals/groups	2	18%	2	13%
		Other governmental	1	9%	2	13%
		None	4	36%	3	19%
		No response	1	9%	4	25%
Q. 8	If your agency does not cover all road types and areas, what other organizations or individuals are responsible for collecting data in these areas? (check all that apply)	DOT	0	0%	1	6%
		DNR	1	9%	1	6%
		Law enforcement	0	0%	2	13%
		NGOs or local individuals/groups	1	9%	0	0%
		Other governmental	2	18%	0	0%
		None or not applicable	1	9%	0	0%
		No response or unknown	7	64%	12	75%

Table G2. AC Section 2

#	QUESTION	RESPONSE	DOT		DNR	
Q. 9	**Who reports the carcass to the agency or data collector? (check all that apply)**	DOT	9	82%	7	44%
		DNR	3	27%	12	75%
		Private company	2	18%	3	19%
		Highway patrol/law enforcement	2	18%	9	56%
		Other	0	0%	6	38%
		No response	1	9%	2	13%
Q. 10	**How is the agency or data collector typically notified of an animal carcass? (check all that apply)**	Driver	6	55%	12	75%
		Agency	10	91%	11	69%
		Other	5	45%	3	19%
		No response	1	9%	2	13%
Q. 11	**Does your agency have a reporting threshold for ACs?**	Yes	1	9%	2	13%
		No	7	64%	8	50%
		No response	3	27%	6	38%
Q. 12	**If yes, what is the reporting threshold? (select all that apply)**	Carcasses between white lines	5	45%	1	6%
		Carcasses in the ROW regardless of visibility	6	55%	2	13%
		Carcasses in the right-of-way—If visible	6	55%	2	13%
		Certain animal species or groups	5	45%	7	44%
		Other	0	0%	1	6%
		No response	2	18%	7	44%
Q. 13	**How would you characterize the search and reporting effort for ACs?**	Incidental observations	2	18%	10	63%
		Monitoring	6	55%	3	19%
		Other	2	18%	1	6%
		No response	1	9%	2	13%
Q. 14	**What is the frequency of surveys or checks for ACs on a given road section?**	Daily	5	45%	2	13%
		Weekly	2	18%	1	6%
		Monthly	0	0%	1	6%
		As they occur or are reported	0	0%	6	38%
		Varies	1	9%	2	13%
		Daily during 1 month period	0	0%	1	6%
		Daily and weekly	2	18%	0	0%
		Don't know or no response	1	9%	3	19%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 1: DATE**	Always	9	82%	8	50%
		Usually	1	9%	2	13%
		Sometimes	0	0%	1	6%
		Rarely	0	0%	0	0%
		Never	0	0%	0	0%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 2: TIME	Always	1	9%	3	19%
		Usually	2	18%	1	6%
		Sometimes	2	18%	2	13%
		Rarely	0	0%	2	13%
		Never	5	45%	3	19%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 3: DISTRICT or UNIT	Always	7	64%	8	50%
		Usually	1	9%	2	13%
		Sometimes	0	0%	1	6%
		Rarely	0	0%	0	0%
		Never	2	18%	0	0%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 4: NAME of OBSERVER	Always	3	27%	5	31%
		Usually	3	27%	2	13%
		Sometimes	2	18%	4	25%
		Rarely	0	0%	0	0%
		Never	2	18%	0	0%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 5: ROAD/ROUTE ID	Always	8	73%	5	31%
		Usually	2	18%	3	19%
		Sometimes	0	0%	2	13%
		Rarely	0	0%	0	0%
		Never	0	0%	1	6%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 6: CARCASS LOCATION	Always	6	55%	4	25%
		Usually	2	18%	3	19%
		Sometimes	1	9%	2	13%
		Rarely	0	0%	1	6%
		Never	1	9%	1	6%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 7: FATALITIES	Always	0	0%	1	6%
		Usually	0	0%	1	6%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	1	6%
		Never	10	91%	8	50%
		No response	1	9%	5	31%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 8: INJURIES**	Always	0	0%	1	6%
		Usually	0	0%	0	0%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	2	13%
		Never	10	91%	8	50%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 9: TYPE OF INJURY	Always	0	0%	0	0%
		Usually	0	0%	1	6%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	2	13%
		Never	10	91%	8	50%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 10: PROPERTY DAMAGE	Always	0	0%	1	6%
		Usually	0	0%	0	0%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	3	19%
		Never	10	91%	7	44%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 11: AMOUNT OF PROPERTY DAMAGE	Always	0	0%	0	0%
		Usually	0	0%	1	6%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	2	13%
		Never	10	91%	8	50%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 12: ANIMAL SPECIES	Always	7	64%	8	50%
		Usually	1	9%	3	19%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	0	0%
		Never	1	9%	0	0%
		No response	2	18%	5	31%
	Do you record one or more of the following parameters? Part 13: SEX OF ANIMAL	Always	1	9%	4	25%
		Usually	2	18%	3	19%
		Sometimes	4	36%	2	13%
		Rarely	1	9%	1	6%
		Never	2	18%	1	6%
		No response	1	9%	5	31%
	Do you record one or more of the following parameters? Part 14: AGE OF ANIMAL	Always	0	0%	2	13%
		Usually	1	9%	4	25%
		Sometimes	3	27%	0	0%
		Rarely	2	18%	4	25%
		Never	4	36%	1	6%
		No response	1	9%	5	31%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	Do you record one or more of the following parameters? Part 15: REMOVAL OF CARCASS	Always	4	36%	5	31%
		Usually	1	9%	1	6%
		Sometimes	0	0%	2	13%
		Rarely	0	0%	0	0%
		Never	5	45%	3	19%
		No response	1	9%	5	31%
Q. 16	How is carcass location recorded? Part 1: GPS	Always	0	0%	0	0%
		Usually	0	0%	1	6%
		Sometimes	0	0%	3	19%
		Rarely	1	9%	2	13%
		Never	8	73%	4	25%
		No response	2	18%	6	38%
	How is carcass location recorded? Part 2: MAP	Always	0	0%	1	6%
		Usually	0	0%	1	6%
		Sometimes	2	18%	3	19%
		Rarely	1	9%	3	19%
		Never	6	55%	3	19%
		No response	2	18%	5	31%
	How is carcass location recorded? Part 3: REFERENCE or MILE POST	Always	6	55%	1	6%
		Usually	3	27%	1	6%
		Sometimes	1	9%	5	31%
		Rarely	0	0%	2	13%
		Never	0	0%	1	6%
		No response	1	9%	6	38%
	How is carcass location recorded? Part 4: ROAD SECTION	Always	4	36%	1	6%
		Usually	4	36%	4	25%
		Sometimes	0	0%	3	19%
		Rarely	0	0%	0	0%
		Never	2	18%	1	6%
		No response	1	9%	7	44%
	How is carcass location recorded? Part 5: OTHER	Always	0	0%	2	13%
		Usually	0	0%	1	6%
		Sometimes	0	0%	1	6%
		Rarely	0	0%	0	0%
		Never	1	9%	0	0%
		No response	10	91%	12	75%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 17	How precise is the carcass information? Part 1: WITHIN 1 YARD OR METER	Always	0	0%	1	6%
		Usually	1	9%	0	0%
		Sometimes	0	0%	0	0%
		Rarely	1	9%	1	6%
		Never	5	45%	7	44%
		No response	4	36%	7	44%
	How precise is the carcass information? Part 2: WITHIN 15 YARDS OR METERS	Always	0	0%	0	0%
		Usually	0	0%	0	0%
		Sometimes	0	0%	0	0%
		Rarely	1	9%	1	6%
		Never	5	45%	7	44%
		No response	5	45%	8	50%
	How precise is the carcass information? Part 3: WITHIN 30 YARDS OR METERS	Always	0	0%	0	0%
		Usually	0	0%	0	0%
		Sometimes	1	9%	1	6%
		Rarely	0	0%	2	13%
		Never	5	45%	5	31%
		No response	5	45%	8	50%
	How precise is the carcass information? Part 4: WITHIN 0.1 MILE OR KILOMETER	Always	2	18%	2	13%
		Usually	4	36%	1	6%
		Sometimes	3	27%	1	6%
		Rarely	0	0%	1	6%
		Never	0	0%	4	25%
		No response	2	18%	7	44%
	How precise is the carcass information? Part 5: WITHIN 1 MILE OR KILOMETER	Always	4	36%	0	0%
		Usually	0	0%	4	25%
		Sometimes	1	9%	2	13%
		Rarely	1	9%	1	6%
		Never	1	9%	1	6%
		No response	4	36%	8	50%
	How precise is the carcass information? Part 6: OTHER	Always	0	0%	3	19%
		Usually	0	0%	0	0%
		Sometimes	0	0%	0	0%
		Rarely	0	0%	0	0%
		Never	0	0%	0	0%
		No response	11	100%	13	81%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 18	If reference or mi/km posts are used for location, how far apart are these signs?	1 mile	5	45%	4	25%
		0.1 mile	3	27%	1	6%
		Other	2	18%	0	0%
		No response	2	18%	12	75%
Q. 19	Amphibians are usually identified to:	Species	0	0%	1	6%
		Genus	0	0%	0	0%
		Family	0	0%	0	0%
		Order	0	0%	1	6%
		Class	0	0%	0	0%
		Never	7	64%	7	44%
		Other	1	9%	4	25%
		No response	3	27%	4	25%
Q. 20	Amphibian groups recorded include: (check all that apply)	All	0	0%	0	0%
		Endangered	0	0%	0	0%
		Other	1	9%	1	6%
		Never	9	82%	11	69%
		No response	1	9%	4	25%
Q. 21	Reptiles are usually identified to:	Species	0	0%	1	6%
		Genus	0	0%	0	0%
		Family	0	0%	0	0%
		Order	0	0%	1	6%
		Class	0	0%	0	0%
		Never	8	73%	8	50%
		Other	1	9%	1	6%
		No response	2	18%	5	31%
Q. 22	Reptile groups recorded include: (check all that apply)	All	0	0%	1	6%
		Endangered	0	0%	0	0%
		Other	1	9%	1	6%
		Never	8	73%	10	63%
		No response	2	18%	4	25%
Q. 23	Birds are usually identified to:	Species	0	0%	4	25%
		Genus	1	9%	0	0%
		Family	0	0%	0	0%
		Order	2	18%	0	0%
		Class	1	9%	0	0%
		Never	4	36%	5	31%
		Other	1	9%	2	13%
		No response	2	18%	5	31%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 24	Bird groups recorded include: (check all that apply)	All	0	0%	1	6%
		Endangered	0	0%	2	13%
		Game birds	0	0%	1	6%
		Raptors	3	27%	0	0%
		Songbirds	0	0%	0	0%
		Other	3	27%	4	25%
		Never	4	36%	8	50%
		No response	1	9%	3	19%
Q. 25	Large wild mammals (deer and larger) are usually identified to:	Species	7	64%	11	69%
		Genus	3	27%	0	0%
		Family	0	0%	1	6%
		Order	0	0%	0	0%
		Class	0	0%	0	0%
		Never	0	0%	1	6%
		Other	0	0%	0	0%
		No response	1	9%	3	19%
Q. 26	Large wild mammal groups recorded include: (check all that apply)	All	5	45%	2	13%
		Endangered	1	9%	4	25%
		Game	5	45%	4	25%
		Ungulates	3	27%	7	44%
		Carnivores	2	18%	4	25%
		Non-natives	1	9%	1	6%
		Other	0	0%	4	25%
		Never	0	0%	1	6%
		No response	1	9%	3	19%
Q. 27	Small wild mammals (smaller than deer) are usually identified to:	Species	2	18%	4	25%
		Genus	0	0%	0	0%
		Family	2	18%	0	0%
		Order	0	0%	0	0%
		Class	0	0%	0	0%
		Never	4	36%	4	25%
		Other	2	18%	2	13%
		No response	1	9%	6	38%
Q. 28	Small wild mammal groups recorded include: (check all that apply)	All	2	18%	1	6%
		Endangered	0	0%	1	6%
		Game	0	0%	0	0%
		Carnivores	0	0%	1	6%
		Non-natives	0	0%	1	6%
		Other	4	36%	3	19%
		Never	5	45%	6	38%
		No response	1	9%	4	25%

Table G2 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 29	Domestic animals are usually identified to:	Species	6	55%	2	13%
		Class	0	0%	0	0%
		Other	3	27%	6	38%
		Never	1	9%	1	6%
		No response	1	9%	7	44%
Q. 30	Domestic animal groups recorded include:	All	1	9%	0	0%
		Large species only	5	45%	3	19%
		Other	2	18%	3	19%
		Never	4	36%	4	25%
		No response	1	9%	6	38%
Q. 31	Part 1: Are animal carcasses or parts thereof collected for further analyses?	Yes	6	55%	9	56%
		No	4	36%	4	25%
		No response	1	9%	3	19%
	Part 2: If yes, for what reasons?	Disease	3	27%	4	44%
		Population info.	0	0%	3	33%
		Other	3	27%	2	22%

Table G3. AC Section 3

#	QUESTION	RESPONSE	DOT		DNR	
Q. 32	Do AC data collectors receive training?	Yes	5	45%	2	13%
		No	3	27%	10	63%
		Don't know	2	18%	2	13%
		No response	1	9%	2	13%
Q. 33	How often does training occur?	Once	2	18%	0	0%
		Monthly	0	0%	0	0%
		Yearly	1	9%	0	0%
		Other	2	18%	3	19%
		No response	6	55%	13	81%
Q. 34	Data collectors are trained in: (check all that apply)	Purpose of collecting data	5	45%	2	13%
		Importance of accuracy	4	36%	2	13%
		Filling out forms	4	36%	3	19%
		Which ACs to record	3	27%	2	13%
		Species ID	2	18%	1	6%
		Carcass aging	1	9%	1	6%
		Carcass sexing	0	0%	1	6%
		Necropsy	0	0%	1	6%
		GPS use	0	0%	1	6%
		Accuracy of locations	2	18%	2	13%
		Data entry and management	0	0%	0	0%
		Other	1	9%	0	0%
		No response	6	55%	13	81%
Q. 35	How is training conducted? (check all that apply)	Literature	1	9%	0	0%
		On the job	4	36%	3	19%
		Seminars	1	9%	0	0%
		Other	0	0%	2	13%
		No response	6	55%	13	81%
Q. 36	What tools and materials are provided to assist with AC data collection?	Species ID guides	0	0%	1	6%
		GPS units	0	0%	1	6%
		Necropsy kit	0	0%	1	6%
		Other	1	9%	1	6%
		No response	10	91%	14	88%

Table G4. AC Section 4

#	QUESTION	RESPONSE	DOT		DNR	
Q. 37	Part 1: Are the raw data shared with other organizations or individuals?	Yes	9	82%	8	50%
		No	1	9%	6	38%
		Don't know	0	0%	1	6%
		No response	1	9%	1	6%
	Part 2: If yes, with whom?	DOT	0	0%	3	19%
		DNR	4	36%	0	0%
		Law enforcement	0	0%	0	0%
		General public	0	0%	4	25%
		Anyone	1	9%	1	6%
		Other	7	64%	2	13%
Q. 38	Are the data analyzed by your agency?	Yes	7	64%	11	69%
		No	2	18%	3	19%
		Don't know	0	0%	1	6%
		No response	2	18%	1	6%
Q. 39	If the data are not analyzed by your agency, then who does the analysis?	DNR	2	18%	2	13%
		DOT	0	0%	0	0%
		Other	1	9%	1	6%
		No response	8	73%	13	81%
Q. 40	What is the purpose of the data analysis?	ID of problem areas	8	73%	7	44%
		Monitoring wildlife trends	1	9%	5	31%
		Disease monitoring	0	0%	0	0%
		Other wildlife/ecology	1	9%	4	25%
		Other transportation	0	0%	0	0%
		No response	1	9%	5	31%
Q. 41	What other purpose do the data serve?	None	1	9%	1	6%
		Wildlife population (general)	4	36%	3	19%
		Budget allocation/appropriation	0	0%	0	0%
		Public relations	0	0%	1	6%
		Non-native species monitoring	0	0%	1	6%
		General DNR reasons	1	9%	0	0%
		Other	1	9%	0	0%
		No response	5	45%	11	69%
Q. 43	Which of the following data processing tools are used? (check all that apply)	Computer database	8	73%	9	56%
		Frequency graphs by road section	4	36%	2	13%
		Statistical analysis for clusters	2	18%	2	13%
		Statistical analysis for trends	1	9%	6	38%
		Data entered in a GIS	4	36%	3	19%
		No response	2	18%	5	31%
Q. 44	Are the data integrated in one database for the entire state or province?	Yes	6	55%	8	50%
		No	3	27%	3	19%
		No response	2	18%	5	31%

Table G4 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 45	How much time passes between data collection and entry in a centralized database?	≤1 month	4	36%	4	25%
		From 1 to 6 months	2	18%	1	6%
		>6 months	0	0%	3	19%
		Varies widely	2	18%	3	19%
		Unknown	1	9%	0	0%
		No response	2	18%	6	38%
Q. 46	Who performs the analysis?	Wildlife biologist	2	18%	10	63%
		Personnel from MDT (non-biologist)	9	82%	0	0%
		Other	0	0%	0	0%
		No response	2	18%	6	38%
Q. 47	How often are the data analyzed?	<1 year	0	0%	0	0%
		Annually	4	36%	7	44%
		>1 year	0	0%	0	0%
		As needed/on request	6	55%	2	13%
		Project specific	1	9%	0	0%
		No response, unknown, or varies	4	36%	8	50%
Q. 48	How often are the results published?	<1 year	4	36%	0	0%
		Annually	1	9%	7	44%
		>1 year	1	9%	0	0%
		As needed/on request	2	18%	0	0%
		Not published	0	0%	4	25%
		No response, unknown, or varies	4	36%	5	31%
Q. 49	How are the data and results disseminated?	Internet, e-mail, or e-files	2	18%	1	6%
		Public media (news, radio)	1	9%	1	6%
		To other agencies	1	9%	0	0%
		Other publication methods	2	18%	3	19%
		By request	3	27%	3	19%
		Not applicable	0	0%	1	6%
		No response or varies	3	27%	7	44%
Q. 50	Are the results shared with the people who collect the data?	Yes	7	64%	7	44%
		No	2	18%	2	13%
		No response	2	18%	7	44%

Table G4 (*Continued*)

#	QUESTION	RESPONSE	DOT		DNR	
Q. 51	Part 1: Are the results (analyzed, discussed) shared with other organizations or individuals?	Yes	9	82%	8	50%
		No	0	0%	2	13%
		No response	2	18%	6	38%
	Part 2: If yes, with whom?	DOT	2	18%	2	13%
		DNR	5	45%	2	13%
		Law enforcement	0	0%	0	0%
		Other governmental agencies	1	9%	1	6%
		General public	0	0%	2	13%
		Any group, upon request	0	0%	3	19%
Q. 52	Part 1: Do the data lead to on the ground mitigation measures?	Yes	8	73%	5	31%
		No	1	9%	5	31%
		No response	2	18%	6	38%
	Part 2: Please describe.	Warning signs	7	64%	4	25%
		Crossing structures	4	36%	1	6%
		Fencing	5	45%	1	6%
		Speed limit reduction	0	0%	0	0%
		Roadside vegetation alteration	0	0%	0	0%
		Other	1	9%	2	13%
Q. 53	Who does this mitigation?	DOT only	7	64%	2	13%
		DNR only	1	9%	1	6%
		Both DOT and DNR	0	0%	1	6%
		DOT and law enforcement	0	0%	1	6%
		Other	2	18%	0	0%
		No response	3	27%	11	69%

Table G5. AC Section 5

#	QUESTION	RESPONSE	DOT		DNR	
Q. 54	What problems have you experienced with AC data collection?	Consistency	6	55%	9	56%
		No problems	3	27%	1	6%
		Other	1	9%	4	25%
		No response	1	9%	4	25%
Q. 55	How can AC data collection methods be improved?	Consistency	4	36%	4	25%
		Spatial accuracy	4	36%	5	31%
		Centralize databases	0	0%	2	13%
		Additional resources	2	18%	1	6%
		Other	0	0%	1	6%
		No response	3	27%	6	38%
Q. 56	What problems have you experienced with AC data analysis?	Consistency	6	55%	5	31%
		Spatial accuracy	1	9%	1	6%
		Lack of resources	2	18%	2	13%
		None	1	9%	2	13%
		Other	1	9%	0	0%
		No response	2	18%	7	44%
Q. 57	How can AC data analysis methods be improved?	Integration with GIS	5	45%	2	13%
		Faster data entry	4	36%	1	6%
		More consistent data entry	2	18%	1	6%
		None	3	27%	3	19%
		Other	0	0%	2	13%
		No response	4	36%	8	50%
Q. 58	What problems have you experienced with AC data dissemination?	Lack of resources	2	18%	1	6%
		None	4	36%	8	50%
		Database consistency/compatibility	2	18%	1	6%
		Other	1	9%	0	0%
		No response	3	27%	6	38%
Q. 60	Do you know of any successful AC data collection, analysis, and use program within your state/province?	Yes	2	18%	3	19%
		No	8	73%	9	56%
		No response	1	9%	4	25%
Q. 61	Do you know of any successful AC data collection, analysis, and use program outside your state/province?	Yes	3	27%	1	6%
		No	7	64%	10	63%
		No response	1	9%	5	31%

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation