NCHRP Project 20-05/Topic 37-12

Animal-Vehicle Collision Data Collection

SECOND DRAFT REPORT

By

Marcel P. Huijser, Ph.D., Research Ecologist;
Julie Fuller, M.Sc., Research Ecologist;
Meredith E. Wagner, M.Sc., Research Ecologist;
Amanda Hardy, M.Sc., Research Ecologist; and
Anthony P. Clevenger, Ph.D., Senior Research Ecologist

Western Transportation Institute
College of Engineering
Montana State University
PO BOX 174250, Bozeman, MT 59717-4250

Prepared for the

Transportation Research Board
Of the National Academies
500 Fifth St., NW
Washington, DC 20001

September 5, 2006

TABLE OF CONTENTS

SUMMARY

Animal-vehicle collisions affect human safety, property and wildlife, and the number of animal-vehicle collisions has substantially increased across much of North America over the last decades. Systematically collected animal-vehicle collision data help quantify the magnitude of the 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 allow for 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. 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 animal-vehicle collisions. Furthermore, the agencies that do record such data often use different methods, causing difficulties with data integration and interpretation, and ultimately with the usefulness of the data.

This synthesis examined 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 transportation agencies (DOTs) and natural resource management agencies (DNRs) for each state or province.

Most DOTs and DNRs collect or manage AVC or AC data or both. Most AVC data are actually collected by law enforcement agencies while the AC data are typically collected by the DOTs and DNRs themselves. The two agency types have a partially 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 extend for wildlife conservation reasons (AC data). DNRs are motivated by a mixture of human safety and wildlife conservation reasons (AVC data) or mainly by wildlife conservation reasons (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 either. Furthermore, there is an emphasis on large wild and domesticated animals (deer size and up), especially in AC data collection programs. These factors typically lead to a substantial underestimation of animal-vehicle collision events, 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 related to 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 GPS.

DOTs mainly 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 are also interested in identifying hotspots, but 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, including GPS technology, faster data entry, centralized databases, and GIS 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, the authors of this report formulated suggestions 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 deer-vehicle collisions was estimated at more than 1 million per year 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 over U.S. $ one billion in property damage a year (Conover et al., 1995; Williams and Wells, 2005). In 2000, Canada experienced over 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 over one billion dollars in material damage (Groot Bruinderink & 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 & Bissonette, 1996a; 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 & 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 & 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 & Bissonette, 1996a; Conover, 1997; Huijser, 2006a).

Systematically collected animal-vehicle collision data help quantify 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 allow for 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. This above results in two types of data: data from crash forms and data based on animal carcass counts. However, not all transportation agencies, law enforcement agencies and/or natural resource management agencies record animal-vehicle collisions. Furthermore, the agencies that do record such data often use different methods, causing difficulties with data integration and interpretation, and ultimately with the usefulness of the data.

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 animal-vehicle collision data or animal carcass data (e.g. hospitals, private individuals) were identified through interviews with representatives of transportation agencies and natural resource management agencies, but were not approached for separate or additional interviews. Furthermore, 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 suggestions for initiating or improving such programs.

Organization of the report

Chapter 2 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 3 reports on the survey of transportation agencies and natural resource management agencies in the United States and Canada. Chapter 4 gives successful examples of animal-vehicle collision data collection practices, and the conclusions, the needs and benefits of data collection programs, and suggestions for initiating or improving data collection programs are listed in Chapter 5.

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 DC). 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, the transportation agency of some states or provinces has a different or slightly different name (e.g., Alaska Department of Transportation and Public Facilities, 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)".

Abbreviations

AC data:	Animal Carcass data (for definition see previous section)
AVC data:	Animal-Vehicle Collision data (for definition see previous section)
DNR:	Department of Natural Resources or similar organization at the state or provincial level
DOT:	Department of Transportation or similar organization at the state or provincial level
FHWA:	Federal Highway Administration
GIS:	Geographical Information System
GPS:	Global Positioning System
WTI-MSU:	Western Transportation Institute at Montana State University

CHAPTER TWO: LITERATURE REVIEW

Introduction

Animal-vehicle collisions are not only a safety and economic concern for humans, but they also typically result in road-killed animals (see Chapter 1, Introduction). Road-killed animals are perhaps the most noticeable effect of roads and traffic on the natural environment, with publications documenting road-killed animals as early as in 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 (Appendix A). The 54 publications that were reviewed originated mostly from the United States and Canada. The publications were reviewed with regard to two issues:

1. What parameters were collected?
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 five feet through the use of Global Positioning System (GPS) technology, to one mile (Bissonette & Hammer, 2000; Clevenger et al., 2003). Reference posts (mi or km) are often used, and a vehicle's odometer is sometimes used to estimate the distance to the nearest 0.1 mi or km from a mile marker (Garrett & Conway, 1999). Many studies are species-specific, making species identification an assumed parameter (Bashore et al., 1985; Garrett & 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, datasets derived from crash forms may not report the species name of the animal involved at all, regardless of the size of the animal (see Chapter 3, Survey).

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, small mammals). "Time" is also collected but 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, 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 evaluating 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

Animal-vehicle collision and animal carcass 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 animal-vehicle collisions events and animal carcasses 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, AVC and AC data are used to:

- understand the magnitude of the animal-vehicle collisions (e.g. Kline et al., 1998; Garrett & 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 which 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 AVCs and ACs are most likely to occur (e.g. Finder et al., 1999; Malo et al., 2004; Seiler, 2005),
- prioritize mitigation efforts and assess animal-vehicle collision mitigation methods (e.g. Barnum 2003; Bertwistle, 2003; Pokorny, 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 under reported by perhaps 50% or more (Allen & McCullough, 1976; Romin & Bissonette, 1996a). 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 effort 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 the 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 & Casey, 2005). Knowing how many accidents are occurring, how severe those accidents are, and who is involved is a necessary first step to identify and address the issue. Without this information, it is impossible to understand 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 & Williams, 2005), whether there is an age or sex bias (Aresco, 2005; Ramakrishnan & 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 number of injuries, lives lost, and lost wildlife viewing and other recreational opportunities (Conn, 2004; Sielecki, 2004). Combining animal-vehicle collision and animal carcass data help 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

While 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. Collision and mortality events do not occur randomly in time or space (Barnum, 2003; Clevenger et al., 2003), rather, they often occur at certain locations ("hotspots") during certain times. Hotspots are road sections that experience greater than average levels of animal-vehicle collisions, but definitions vary. Knowledge about the presence and location of hotspots can help planners make safer roads for humans and animals through incorporating mitigation efforts at the correct locations.

AC and AVC data are often plotted on maps using 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 that are familiar with the species and area concerned, including the road sections where animals may cross or are killed most. Habitat modeling and expert opinion are usually followed by more detailed studies of animal carcasses 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 & 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 e.g. 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 e.g. 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 AVCs and ACs

It is not sufficient to know where hotspots occur; managers must also know what characteristics about a hotspot make it more prone to accidents in order to be able to effectively address the problem. Landscape spatial patterns can concentrate or funnel animals onto certain road sections while 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 animal-vehicle collisions. 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 & 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 are most accurate when the data used to develop them are spatially accurate. The methods used for this application are similar to those described for identifying hotspots (see above).

Mitigation methods

AVC and AC monitoring data often play an important, 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 & Hammer, 2000; Dodd et al., 2004). However, mitigation measures should also be evaluated with regard to safe crossing opportunities for wildlife as 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 (Romin & Bissonette 1996a; Feldhamer et al., 1986; Ward, 1982; Putman, 1997, Clevenger et al., 2001), or wildlife inclusion fencing in combination with wildlife under- and overpasses (Foster & Humphrey, 1995; Land & 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, 1996a; Lamoureux and Belanger, 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

Introduction

This chapter contains the methodology and results for the Animal-Vehicle Collision (AVC) and Animal Carcass (AC) data survey. See the introduction (Chapter 1) 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 in Appendix B. If the Department of Transportation (DOT) or Department of Natural Resources (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 filled out 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 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 datasheets used for the collection of AVC and AC data (Appendix C and D).

The panel members (Appendix E) requested to approach at least two key persons 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 Transportation Research Board (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 abovementioned contacts occasionally forwarded the survey to others within in their organization if they believed others 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. WTI-MSU's network; 3. Suggestions from individuals at the state or provincial DOTs and DNRs.

Table 1: Number of individuals approached for the survey.

NUMBER OF INDIVIDUALS APPROACHED FOR THE SURVEY	United States	Canada	Total
TRB representatives for DOT (1 per state or province)	50	13	63
Known specialist for DOT (1 per state or province)	50	13	63
Additional representatives for DOT	43	7	50
Subtotal	143	33	176
Known specialist for DNR (1 per state or province)	50	13	63
Additional specialists for DNR	8	0	8
Subtotal	58	13	71
Total	201	46	247

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 which could be sent in by e-mail, fax or mail.

The TRB sent the survey to the interviewees on 6 March 2006. The interviewees were reminded to fill out the survey on 15 March, 27 March, 3 April and the website was closed for responses on 5 April 2006.

The Institutional Review Board (IRB) 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 9 February 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 National Highway Traffic Safety Administration (NHTSA, 2006) for all 50 states were reviewed. The review focused on the following topics: 1. Are animal vehicle collisions recorded? 2. Do the forms differentiate between wild and domestic species? 3. Do the forms allow for the entry of the species name of the animal that is involved in a collision? 4. Are there reporting thresholds (e.g., $1000, a human injury, or a vehicle towed)? and 5. How is the location of the accident described (e.g. use of coordinates (GPS or map), distance to the nearest landmark). The data for the 50 states (NHTSA, 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. The answers for these respondents were combined into one response. This 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 through 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 (1 for the DOT and 1 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 (Appendix F, G, H). The percentages in the summary tables are calculated differently than in the text. The percentages in the summary table were based on the number of agencies that responded to the survey as a whole, so that non-response to certain questions could be assessed. Using the example above with 25 DOTs responding to the AVC survey, and 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 out of 63 states and provinces) (Table 2). DOTs (63%) had a slightly higher response rate than DNRs (57%) (Table 2; Figures 1 and 2). Thus, 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 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.

Table 2: Number of responding states and provinces.

NUMBER OF 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 (DOT or DNR)	25	8	33
Response to some portion of AVC (DOT)	19	6	25
Response to some portion of AVC (DNR)	9	4	13
Response to some portion of AC (DOT or DNR)	21	4	25
Response to some portion of AC (DOT)	10	1	11
Response to some portion of AC (DNR)	13	3	16

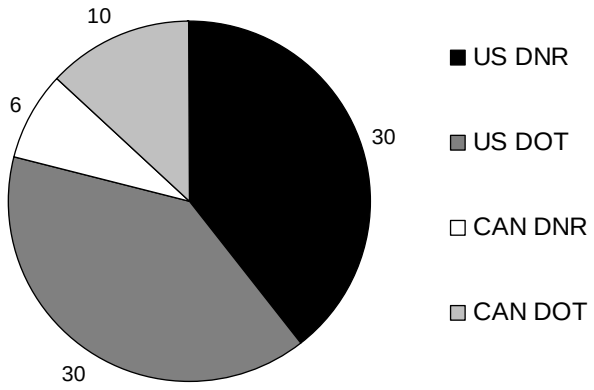


Figure 1: The respondents to the introduction, AVC and/or AC surveys by nation and agency type

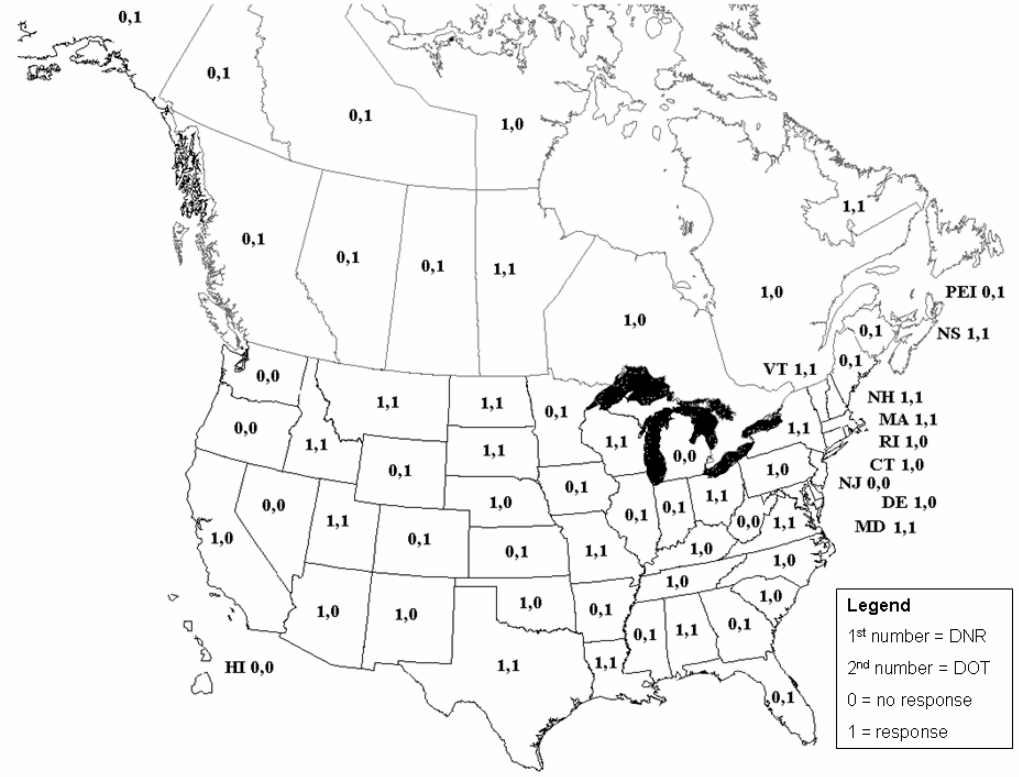


Figure 2: Study area and respondents by state and province.

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).

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

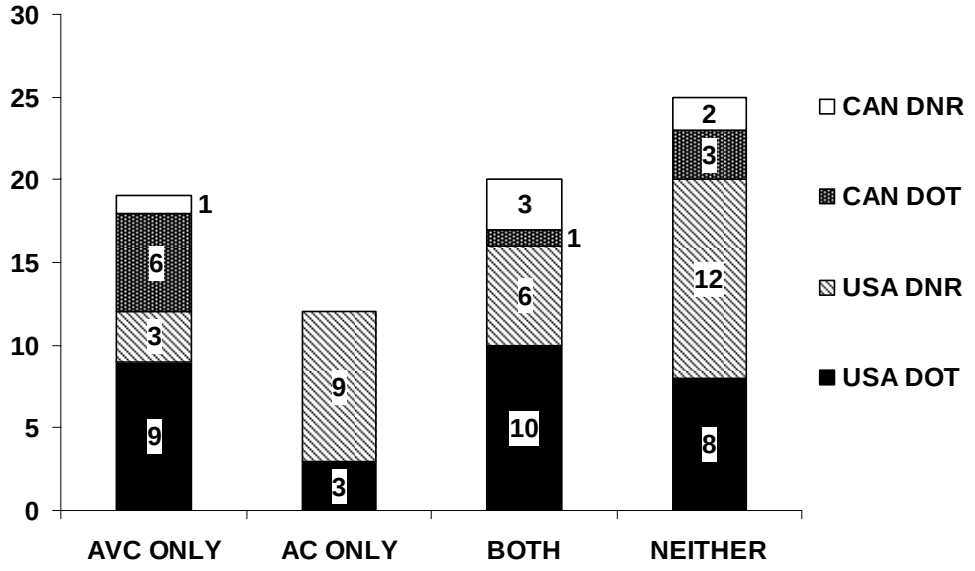


Figure 3: The number of agencies from the United States and Canada that collect AVC data and/or AC data.

Absence of AVC and AC data collection programs (Introduction Survey)

This section relates only to the DOTs and DNRs that stated 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 2 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 (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 8 respondents, 3 (38%) answered "yes", while 2 answered "no" (25%) and 3 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 (form in Appendix B, summary data in Appendix G)

Rationale for AVC data collection and roads and/or areas included (AVC Section 1)

The 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 public safety was the number one reason they collect AVC data (n = 20; 83%) with wildlife management or conservation as the number two reason (n = 11; 58%) and accounting as 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 $1000 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 placed (n = 2; New Hampshire and Alberta), which is closely linked to public safety as well.

DNR respondents were divided between public safety and wildlife management/ conservation as number one and number two reasons they collected or managed AVC data, with accounting reasons forming the third 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).

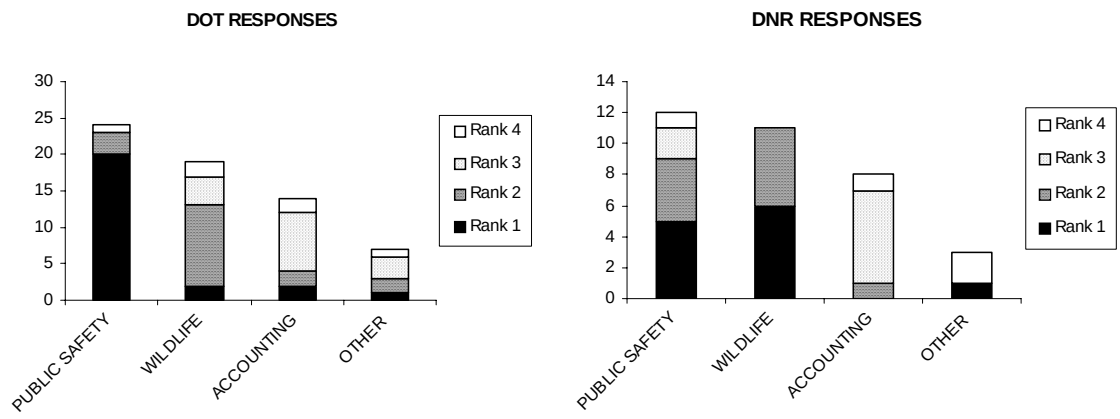


Figure 4: The ranked reasons why DOTs and DNRs collect AVC data.

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 1950's, the longest recording period of all respondents. Note that some answers were unquantifiable, with answers including "many years ago" and "for ever". These types of answers 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 local roads. One of these DOTs collects data on interstates only and the Northwest Territories DOT collects all roads except for interstates, because it has no interstates. Out of the 10 DNRs that responded to the question, all collect data on interstates and arterial

roads, 6 (60%) also collect data on collector roads, and 8 (80%) also collect 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 1 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., non-governmental 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? (Check all that apply)". Multiple agencies collected AVC data, but 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%). 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%) while 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 $1000 U.S. or Canadian dollars, while 2 respondents indicated that excess of $500 would be required to report the collision, and one respondent indicated 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 their threshold depends 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 $1000 (22 states and 4 provinces), although many states have damage thresholds of $500-$750 (19 states). Four states have reporting thresholds under $500, and 2 states (Alaska and Delaware) have reporting thresholds over $1000. Texas, Connecticut, Maryland, and Alberta have non-monetary thresholds including all reported crashes, or crashes where the vehicle is towed. Note that 5 states will report collisions with less damage than the threshold if there is a human injury or fatality involved.

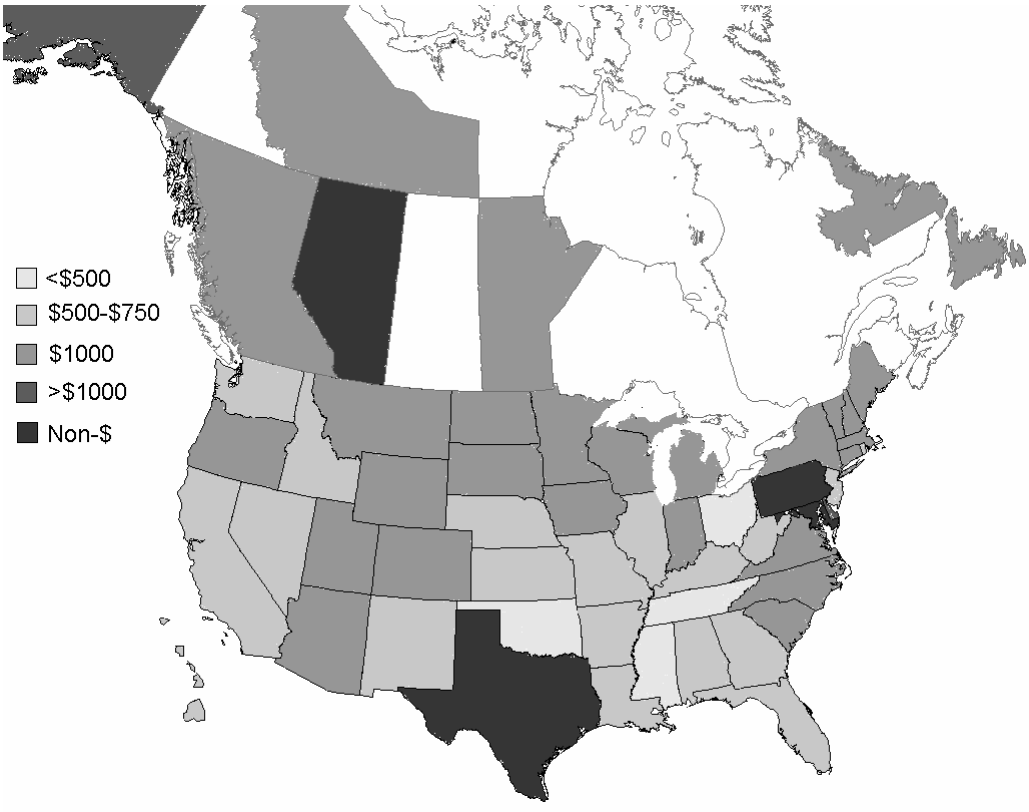


Figure 5: The minimum reporting threshold for a collision based on a review of the crash forms (US) and the survey responses (Canada). No information was available for the provinces that are marked white.

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 out 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.

Surveys or checks for AVCs largely occur as these collisions are reported or seen for DOTs and DNRs (n = 11; 37%), while 7 respondents (23%) indicated that checks occur daily (4 = DOT; 3 = DNR), 4 (13%) indicated they occur weekly (3 DOT; 1 DNR), 1 DNR checks for AVCs monthly, and 2 DOTs check annually. "Other" responses from

DOTs included 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 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 (7 DOTs always record the species name, 5 usually and 3 sometimes). DNR responses mainly differed from DOT responses in that the majority of DOT responses were either "always" or "never" while DNR responses also included the other categories (usually, sometimes, rarely; Table 3). Interestingly most DNRs (n = 7; 78%) always record the species name and always or usually included 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 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.

Table 3: Animal-Vehicle Collision parameters recorded by DNRs and DOTs (all in %). Gray-shaded areas mark the category with the most frequent response.

	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 ID	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
$ OF PROP. 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

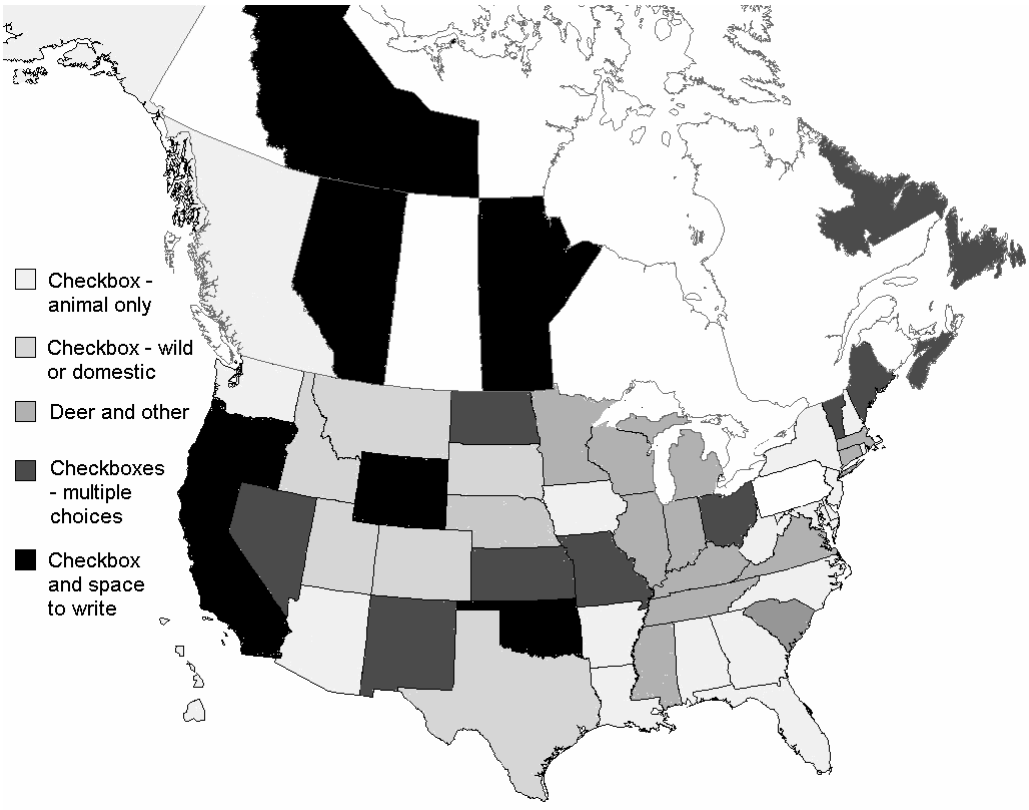


Figure 6: The way AVCs are indicated on the crash forms. Blank provinces or states did not collect AVC data on crash forms or they represent and provinces with missing data.

AVC location recording and spatial resolution (AVC Section 2 – continued)

Based on the survey responses most DOTs (n = 11; 58%) always use reference posts (mi or km) 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 y or m (DOTs n = 7, 58%; DNRs n = 4, 57%). The AVC data from DOTs is always or usually accurate to 0.1 mi or km (n = 13; 68%) or 1 mi or km (n = 6; 50%) whereas the data from DNRs are rarely or never accurate to 0.1 mi or km (n = 4; 58%). However, the data from DNRs are always or usually accurate to 1 mi or km (n = 5; 63%). One DNR always reports locations within 1 yard or meter, while 1 DOT usually and 2 DOTs sometimes report locations with this resolution. One DNR sometimes reports locations within 15 yards or meters, while the Mississippi DOT always 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 (mi or km) used in describing animal-vehicle collision locations were mostly 1 mi or 1 km apart (n = 7; 44%), while only one DNR uses reference posts at this distance. Two DNRs and two DOTs use reference posts 0.1 miles apart. Two DOTs have reference posts 0.2 mi 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, while 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/longitude or other 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.

Table 4: How Animal-Vehicle Collision location data are reported by DNRs and DOTs (all in %). Gray-shaded areas mark the category with the most frequent response.

	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
MI/KM 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

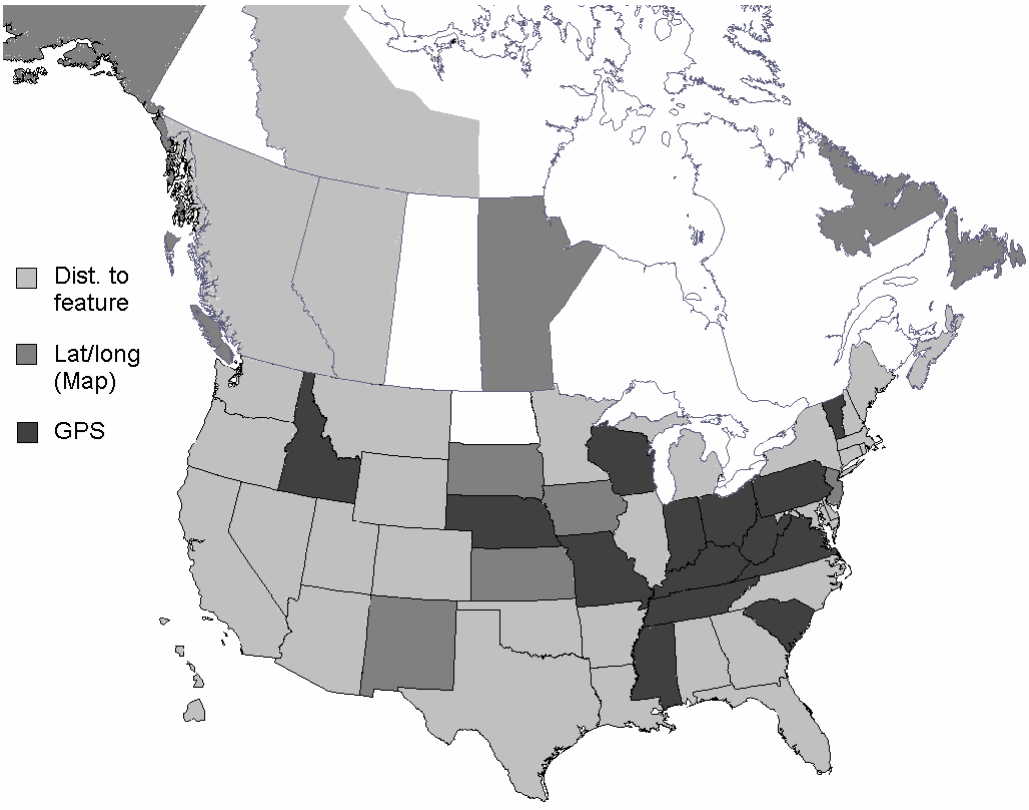


Figure 7: The location system used by each state, province or territory cased on a review of the crash forms. If it was uncertain as to whether GPS or maps were used to derive coordinates for location, the state was assigned to the category for map coordinates. White-colored states, provinces, and territories did not have information available.

Species and species groups recorded for AVCs (AVC Section 2 - continued)

Amphibians are generally never recorded by DOTs and DNRs (Table 5). However, 2 DOTs do record amphibians to the species (Vermont and Northwest Territories). Kansas DOT records amphibians as "other wild animal". Vermont DNR records amphibians to "order". In all, two DOTs and one DNR noted they record all amphibian groups, endangered and otherwise (Vermont DOT and DNR, Northwest Territories DOT).

Table 5: Species groups recorded by DNRs and DOTs in AVC data collection programs (all in %). Gray-shaded areas mark the category with the most frequent response. X = not an option for responses.

	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
LG WILD MAMMALS	69	8	0	8	0	0	15	0	12	44	0	0	0	4	12	28
SM 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

Reptiles are generally never identified by DOTs and DNRs (Table 5). However, two DOTs record reptiles to genus (Mississippi, Northwest Territories), and Vermont DNR records reptiles to the order. Vermont DOT records endangered reptiles only, while 1 Northwest Territories DOT records all reptile groups.

Birds were recorded by some DOTs and DNRs (Table 5). Five DOTs never report birds, and 5 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, 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, as 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 (Table 5). Most DOTs record large wild mammals to the genus while most DNRs identified 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 records only black bear, white-tailed deer and moose (no other bear or deer species in their area, Nova Scotia), and one DNR records white-tailed deer only (Rhode Island). One DNR reported furbearers (Ohio). Large mammal groups of interest to DOTs included 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 (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 identified 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 1 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 (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 animal 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 mentioned disease (n = 4; Connecticut, Kentucky, Rhode Island, 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, but it is unclear what parameter and for what purpose.

Training and instruction for AVC data collectors (AVC Section 3)

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 provides employees with species identification guides and GPS units to document AVC location information (Mississippi). 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 out of 22 (86%) DOTs share their data, compared to 6 out of 12 (50%) of DNRs. 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 who may be interested (n = 4). The DNRs that share data most frequently do so internally or with other natural resource agencies (n = 2) while 1 shares information with the public, 1 shares information with stakeholders or "whomever requests it", and 1 shares with DOTs.

Most responding DOTs (n = 17; 77%) and DNRs (n = 11; 91%) analyze AVC data. Differences between DOTs and DNRs were not significant (P = 0.561). DOTs noted that data analysis also occur by local DNRs (n = 2) or by law enforcement (n = 3), but 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 2 analyze data at periods 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 3 DNRs analyzing data as needed or on request and 1 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%), while only 2 (11%) DOT respondents included monitoring wildlife trends, diseases (n = 1; 5%), other wildlife or ecological concerns (n = 2; 11%) and other transportation concerns (n = 3). DOTs reported ancillary purposes including: to investigate the frequency of deer/vehicle collisions; to track shifts in populations of certain species and the spread of non-native species; to provide data to a DNR, to budget for future projects and identify areas where maintenance needs to focus on; and to receive reimbursement from 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%), while 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/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 statistical cluster analysis (n = 9; 47%). Less than half of the respondents use statistical analysis for trends (n = 6; 32%) or GIS (n = 8; 42%). All but 1 of the responding DNRs also 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 (75%) states and provinces. However, the DOT respondent from one province noted that data are put in a province-wide data base, but 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 2 DOTs enter the data more than 6 months after data collection, and 1 DNR and 2 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 4 DOTs (New Hampshire, Ohio, Maryland, and

Wyoming) and 2 DNRs (Newfoundland and Nova Scotia) publishing as needed or upon request. One DOT and 1 DNR publish at intervals longer than 1 year, and 1 DOT (Colorado) and 1 DNR (Manitoba) publish at intervals shorter than 1 year (i.e., monthly and quarterly). Three DOTs and 2 DNRs do not publish the results of their data for external review. Both DOT's (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 7 (46%) of responding DOTs and 5 (45%) of responding DNRs preferring this method. Two DNRs and 2 DOTs publish in different media depending upon request. One DNR and 3 DOTs send media to other agencies, and 1 DOT relies upon 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, while 82% of DNRs (n = 9) responded similarly. Two DNRs indicated that 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 measure are put in place because of the DOT alone, while one DOT indicated that mitigation results from cooperation between DNRs and DOTs. Three DOTs noted other parties involved, including planners, MTCE , Transportation District Management, local individuals, field personnel and analysts. Similarly, 5 (55%) of responding DNRs indicated that DOTs perform the mitigation, with 2 respondents indicating mitigation occurs through cooperation between DNRs and DOTs. One respondent noted that it depends 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%), while data quality (consistency, accuracy and/or completeness) was identified as a problem by 4 DOTs, and the lack of spatial accuracy was identified as a problem by 4 DOTs. One DOT felt that automated tools in the database could simplify data analysis, while 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 (n = 6; 38%) in terms of consistency, accuracy and completeness. Improving spatial accuracy is important to 25% of respondents. Increasing accuracy of species identification is important to 19%. 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 the public seeing a value in collecting these data would be important, while 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 8 responding DNRs, 50% has concerns with data quality (i.e., inconsistency, inaccuracy, and/or incompleteness). Spatial accuracy concerns 25% of respondents, and one DNR also mentioned underreporting. 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 9 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, while 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 though to have similar problems. Eleven DOTs indicated one or more problems with AVC data analyses, while 5 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 8 responding DNRs (50%) indicated poor data quality was problematic. Spatial accuracy was problematic to 3 (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 38% (Alaska, Alberta, Maryland, Utah and Wyoming). Minnesota, New Hampshire and Wyoming (23%) indicated that improving data quality (consistency, accuracy and completeness) is important. British Columbia, Maine, Maryland, Manitoba 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). Vermont, Ontario, and Rhode Island DNRs (43%) indicated that timeliness with data entry would facilitate data analyses, and the Newfoundland

DNR indicated 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 (1 DOT), that there is little support for reducing animal-vehicle collisions and iproving AVC data collection programs because animal-vehicle collisions form only a small portion (<1%) of the total number of collisions that result in human injuries or fatalities (1 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 (1 DOT), that coordinating data collection and dissemination with other state agencies could be problematic (1 DOT), that making information available through the internet may be beneficial (1 DOT), and that a more formal annual report would aid in data dissemination (1 DOT).

AC Survey (form in Appendix B, summary data in Appendix H)

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 human 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). 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 human safety ranking second (n = 5; 45%). Other reasons why DNRs collect or manage AC data include disease monitoring.

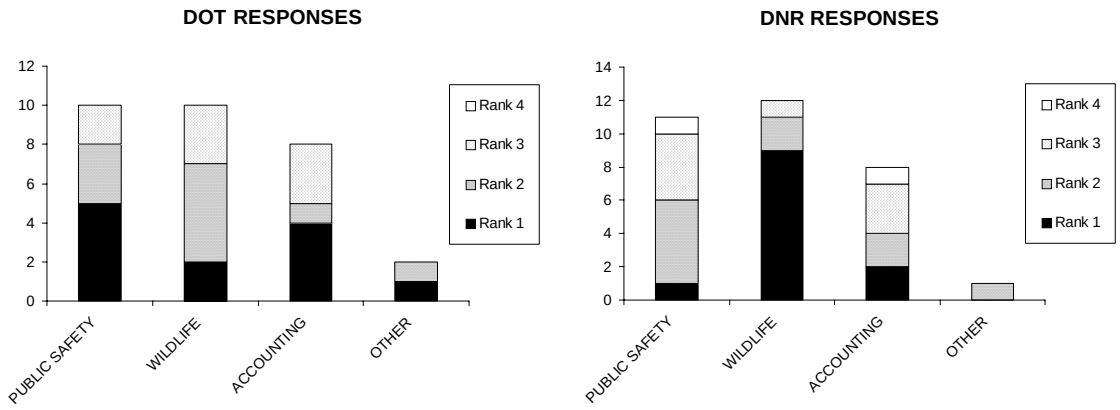


Figure 8: Ranked reasons why DOT and DNR collect AC data

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 began 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), while 36% reported it is voluntary or semi-voluntary (n = 1 and 3). These percentages were not statistically different ($P = 0.850$).

Of the 9 DOTs that responded, all collect data on interstates (100%), 8 (89%) collect data on arterial roads, 5 (55%) collect data on collector roads, and one (11%) collects on local roads. Of the 12 DNRs that responded, 11 (92%) collect data on interstates, 11 (92%) collect data on arterial roads, 10 collect data on collector roads (83%), 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 mainly 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”. British Columbia DOT records data on all numbered highways under the agency’s jurisdiction, except for those maintained by the

federal government, and 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 the 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). North Dakota DNR reports on all interstate, state, and county highways in all areas, and 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 4 respondents indicating the surrounding landscape is predominantly rural (North Dakota DNR, Oklahoma DNR, Utah DOT, 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., non-governmental 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? (check all that apply)". 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 (12; 86%) are the most frequent data sources for animal carcasses for DNR.s

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, 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 Utah and Montana DOTs indicated that both monitoring and incidental reporting occur, depending on the routes.

The frequency of checks for ACs is variable. Five 5 (38%) DOTs search daily, 2 (15%) searching weekly, 2 (15%) searching daily and weekly (depending on road type and classification), and 1 (8%) reporting that 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 1 additional DNR searching 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 2 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 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 the frequency of recording these parameters by DNR and DOT (all in %). Gray-shared areas mark the category with the most frequent response.

	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 ID	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
$ OF PROP. 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

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 land marks (e.g., 1 mi north of Swift River), zoogeographic region, or county name.

Table 7: How Animal Carcass location data are reported by DNR and DOT (all in %). Gray-shaded areas mark the category with the most frequent response.

	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
MI/KM 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

The accuracy for AC locations is generally at or over 0.1 mile or kilometer, with only 1 of the 9 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 slightly 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 they always record 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), 1 DNR usually (Vermont), 1 DNR sometimes (Wyoming), 1 DNR rarely (Wisconsin), and 4 DNRs never report to this level of accuracy. Four DNRs usually record AC locations to 1 mile or kilometer, while 2 others sometimes, 1 rarely, and 1 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 DOT's (n = 5) and DNRs (n = 4) collect data on, and

fewer are located at 0.1 miles interval (DNR = 1; DOT = 3). Maryland DOT uses reference posts located 500 feet 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, while 1 DOT almost never records amphibians. Of the 12 DNRs responding, only 1 DNR (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).

Table 8: Species groups recorded by DNRs and DOTs in AC data collection programs (all in %). Gray-shaded areas mark the category with the most frequent response. X = not an option for responses.

	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
LG WILD MAMMALS	69	0	6	0	0	6	0	19	64	27	0	0	0	0	0	9
SM 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

Reptiles are also rarely recorded by DOTs and DNRs (Table 8). Of the 9 responding DOTs, 8 never record reptiles, while 1 DOT almost never records reptiles. Of the 11 DNRs responding, only one DNR records reptiles to the species level, although reptiles are only incidentally reported. 1 DNR records all reptile groups to order (Kentucky), 8 DNRs never record them, and 1 DNR noted that their agency does not have jurisdiction over reptiles.

Birds are generally recorded with more detail than reptiles or amphibians (Table 8). Of the 8 responding DOTs, the Wyoming DOT records all raptors to genus, the British Columbia DOT reports birds at the discretion of their personnel, the Idaho DOT records raptors and other "large birds", Virginia identifies hawks and turkeys and Maryland identifies turkeys, owls and eagles. Four DOTs never record birds (50%), and 1 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, the New Hampshire DNR records endangered birds to species, while the 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) (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), 2 record carnivores (Idaho

and Utah), 1 records endangered species (Idaho), and 1 records non-native species (Idaho). All but 1 of 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 (n = 1; South Dakota).

Small mammals are classified to the species level by 2 (20%) of responding DOTs, to family by 2 (20%) DOTs, are never recorded by 4 (40%) DOTs, and are rarely recorded by 2 (20%) DOTs (Table 8). New York 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). British Columbia DOT records small wild mammal groups at the discretion of the maintenance contractors. Small mammals are identified to species by 4 (40%) of responding DNRs, while 4 (40%) respondents never and 2 (20%) respondents 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 (Table 8). Five DOTs record large species only (45%), while 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 2 of the 9 responding DNRs, with 1 DNR never recording

domestic animals. Six (67%) responding DNRs marked "other", but did not elaborate. When asked which groups of domestic animals are recorded, 3 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 (n = 5; 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 s (n = 5; 50%) than DNRs (n = 2; 14%) train their AC data collectors, but in order to obtain the appropriate sample size for the chi-square test (5 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, while 3 train them on the job and 1 uses a seminar. The two DNRs that train their AC data collectors noted that their training was not specific to AC data collection, but 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, 4 train their data collectors in the importance of recording accurate information, 4 train in filling out forms (Idaho, Montana, Ohio, and Wyoming), 3 train in which ACs to record (Idaho, Ohio, and Wyoming), 2 train in species identification (Idaho and Wyoming), 1 trains in aging a carcass (Wyoming), 2 train in obtaining accurate information (Idaho and Montana), and 1 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 their 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 their 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)

More 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%), inter-departmentally (n = 5; 56%), with consultants and academic institutions (n = 1; 11%), whomever requests the data (n = 1; 11%), and one DOT shares data via GeoData Services data linkage efforts. Of the 8 responding DNRs, 3 (38%) share their data with DOTs, the general public (n = 4; 50%), inter-departmentally (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 1 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 2 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 upon 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 7 responding DNRs (64%), while 1 analyzes either annually or on request, 1 analyzes data only as needed or on request, and 2 reported that analysis frequency varies.

Respondents were asked to describe the purpose 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 2 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 6 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 5 responses (45%), and other wildlife and/or ecological reasons received 4 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 noted 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 1 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, New York), and, although less-frequently, statistical cluster analyses (Iowa and Wyoming) and statistical analysis for trends (Iowa). All but 2 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, South Dakota).

Data are entered into one centralized database for most states and provinces (12 out of 17 responding states and 2 out 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 1-2 business days. One DOT estimated the time interval at 3 months, while another DOT noted it could take 1 to 6 months to have the data entered, and one DNR noted it could take 1 to 2 months. Three DNR respondents noted that data entry could take more than 6 months. Three DNR respondents and 2 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 1 agency publishing at frequencies less 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), or 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 2 respondents (18%) publishing data only in internal reports and 2 (18%) not publishing data currently. Data are published in a manner as requested by 3 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 they are working towards 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 been implemented yet. 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 a lack

of follow-up procedures to verify certain data, lack of 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 1 DNR reported no problems with AC data collection.

Most responding DNRs and DOT's 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, 5 (50%) mentioned improvements in the spatial accuracy of the data, while 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 9 DOTs that responded, 6 (67%) believe data quality (i.e., consistency, accuracy and completeness) is problematic for analysis, two DOTs felt that lack of resources makes analyses more difficult, One DOT felt that lack of spatial accuracy presents difficulty with the analyses,

and that the lack of data on "small animals" is also problematic. One DOT felt there are no problems with AC data analyses. Of the 9 DNRs responding to this question, 5 (56%) felt that lack of consistency in data collection is problematic for analysis, one DOT felt that lack of spatial accuracy is problematic, and two DOTs felt that the lack of resources makes AC data analyses more difficult. Two DOTs believe there are no problems with data analyses.

Of the 5 responding DOTs 4 believe integration with GIS will improve analysis, 4 felt faster and/or automated data entry will improve analysis, while 2 felt that more consistent data entry and collection will improve data analysis. One other DOT suggested cluster analyses. The 8 responding DNRs believe that data analyses can be improved through integration with GIS (2 DNRs), faster data entry (1 DNR), more consistent data entry (1 DNR), making reporting mandatory (1 DNR), and obtaining better data (1 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 (2 DOTs and 1 DNR) and that a lack of the consistency or compatibility of the data and reporting procedures makes dissemination of data difficult (2 DOTs and 1 DNR). Suggestions to improve AC data dissemination include 1) Dedicating personnel to this activity, 2) Enhancing communication between DOTs and DNRs, 3) Disseminating data electronically instead of on paper, and 4) Entering the data into a centralized database.

CHAPTER FOUR: SUCCESSFUL EXAMPLES

Introduction

This chapter gives examples of "successful practices" for the collection, analyses, reporting and the application of AVC and AC data. For the purpose of this chapter success was defined as follows: 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 AVC 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 the such species. For a crash form to be filled out the crash has to be reported first (often to law enforcement personnel) and minimum thresholds often apply. Therefore AVC data only report a fraction of the total number of animal-vehicle collisions by definition. 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 (WARS in British Columbia and LARS in Maryland (Pers. com., L. Sielecki, British Columbia DOT; Pers. com. W.

Branch, Maryland DOT; Henke et al., 2002; Sielecki, 2003a; 2003b; 2004; 2005)) were both implemented with a top down approach, which 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 which facilitated acceptance of the program and procedures as it is fully integrated with daily practices and in order to receive salary, the forms have to be completed and submitted (Pers. com. W. Branch, Maryland DOT). 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 looked at and that they are considered important (Pers. com., L. Sielecki, British Columbia DOT). In British Columbia, the data collection is done by contractors who have a contractual obligation to collect data on road-killed animals. In Maryland the forms are submitted on a daily basis, but in British Columbia the forms are submitted on a monthly 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 (Pers. com., L. Sielecki, British Columbia DOT). 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 e.g. a field guide with distribution maps that helps identify the most

commonly found road killed species (Pers. com., L. Sielecki, British Columbia DOT; 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 species that are of interest to either human safety and/or conservation (Pers. com. Annette Piepers, Dutch Ministry of Transportation, Public Works and Water Management). Furthermore, the species should be easily identifiable by the personnel collecting the data, but training (may be justified to recognize rare, or threatened or endangered species (Pers. com., L. Sielecki, British Columbia DOT). Species that are not a concern to human safety or natural resource conservation, and species that are very abundant and/or not easily identifiable should generally not be included in the program as 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 (Pers. com., L. Sielecki, British Columbia DOT). Perhaps most important is to demonstrate the need for a data collection program (see also the section on Needs and Benefits in Chapter 5, Conclusions).

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 to verify on unusual data. The use of a hand-held field computer that is integrated with a GPS (Huijser, 2006b) may help

such timely checks as 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 (Pers. Com Michael Pawlovich, Iowa Department of Transportation). 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 (Pers. Com Michael Pawlovich, Iowa Department of Transportation). 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, statistical software for cluster analyses) (Pers. Com Michael Pawlovich, Iowa Department of Transportation; Pers. com., L. Sielecki, British Columbia DOT). 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 they 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 while 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 (Pers. com. Duane Brunell, Maine Department of Transportation) The report should be made available to decision makers that 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. Publishing the report on the internet allows for a widely available report at low cost.

Applications

Chapter 2 lists the most common applications of AVC and AC data. These include 1. Understanding the magnitude of the animal-vehicle collisions (e.g. Kline et al., 1998; Garrett & Conway 1999), 2. Identifying animal-vehicle collision and road-mortality hotspots (e.g. Clevenger et al. 2003; Huijser et al., 2006a), 3. Identifying road, traffic, human and environmental factors which contribute to animal-vehicle collisions (e.g. Caro et al., 2000; Clevenger et al., 2003; Huijser et al., 2006a), 4. Developing predictive models to determine where AVCs and ACs are most likely to occur (e.g. Finder et al., 1999; Malo et al., 2004; Seiler, 2005), 5. Prioritizing mitigation efforts and assessing animal-vehicle collision mitigation methods (e.g. Barnum 2003; Bertwistle, 2003; Pokorny, 2003; Dodd et al., 2004), and 6. Create an index of population size for selected wildlife species (e.g. Dickerson 1939; Case, 1978; Baker et al., 2004).

While 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 as 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 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) and the driver education, video, brochure, newspaper articles, television broadcasts and posters on deer and moose collisions distributed in Main (Maine Department of Transportation) (Figure 9).

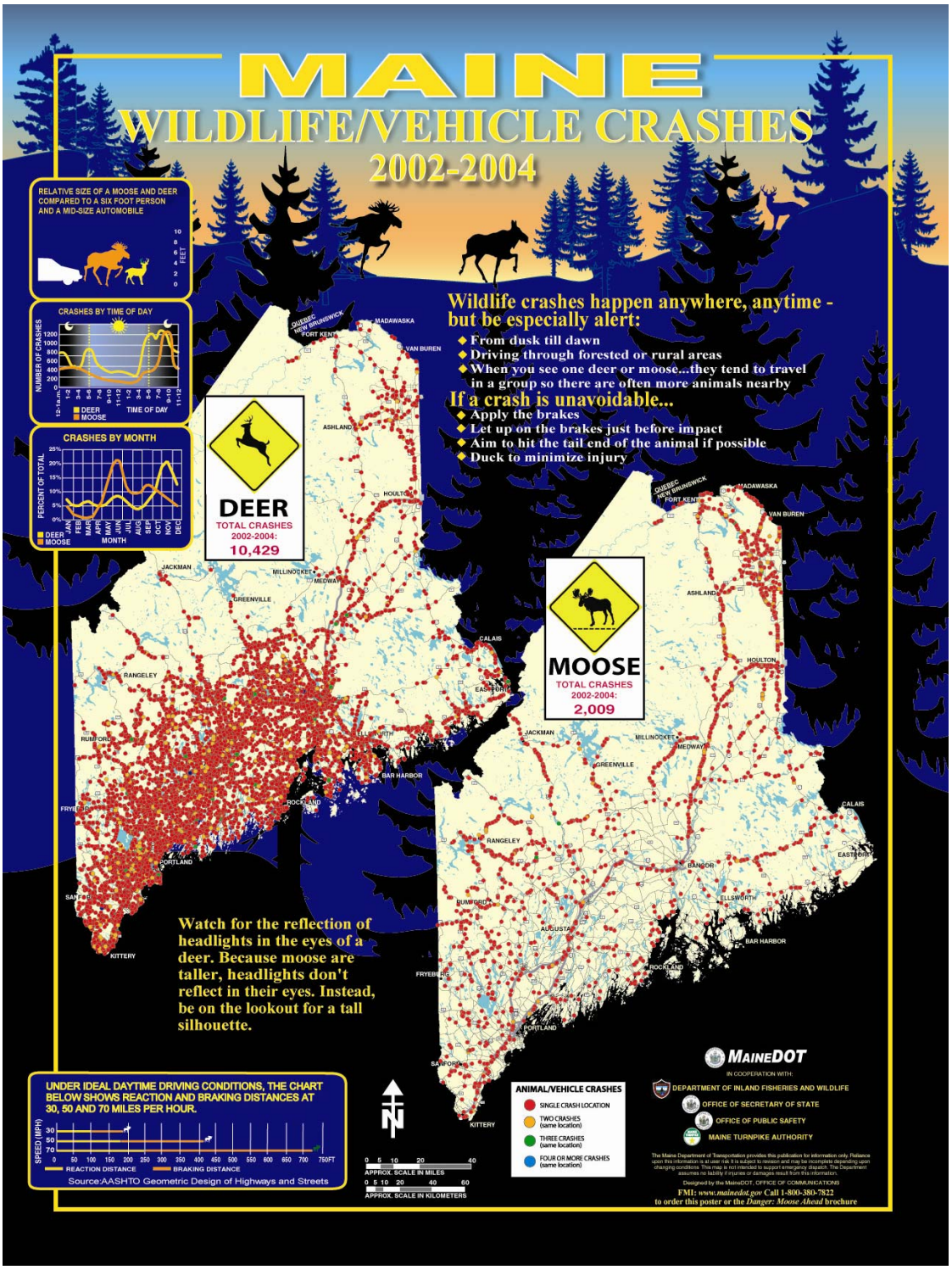


Figure 9: Poster on deer and moose collisions in Maine distributed by the Maine Department of Transportation (reprinted with permission from the Maine Department of Transportation).

CHAPTER FIVE: CONCLUSIONS

AVC and AC programs

Most of the responding DOTs (65%) and some DNRs (36%) collect AVC data. However, a review of the crash forms showed that 49 out 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 even less precise), and relatively few states and province uses coordinates (obtained through either 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 as 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 DOTs (50%) and some DNRs (37%) collect 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 (typically 0.1 mi/km accuracy, sometimes even less

precise), 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 extend for accounting reasons. While the sex and age of the animal concerned and other animal related parameters 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 analyses this may introduce the notion that the data are more precise than they actually are. This 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 database in a computer. However, the time period between recording the data and data entry varies greatly (a couple of business days up to more than 6 months). DOTs mainly had engineers analyze the AVC and AC data using frequency and cluster analyses to identify animal-vehicle collision hotspots. DNRs typically had the AVC and AC data analyzed by biologists. DNRs were also interested in identifying hotspots. However, they also used the data to detect wildlife population trends and typically used 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.

Needs and benefits of AVC/AC data collection programs

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.

Considerations for AVC and AC programs

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 check box 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 road.
- 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 organization, 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 handheld 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.
    - Identify and prioritize road sections that may require mitigation measures and to evaluate their effectiveness in reducing collisions.

- Evaluate the status and performance of the program on a regular base and make adjustments where necessary.

References

Adams, L.W. and A.D. Geis, "Effects of Roads on Small Mammals," *Journal of Applied Ecology*, Vol. 20, 1983, pp. 403-415.

Allen, R.E. and D.R. McCullough, "Deer-Car Accidents in Southern Michigan," *Journal of Wildlife Management*, Vol. 40, 1976, pp. 317-325.

Aresco, M.J., "The Effect of Sex-Specific Terrestrial Movements and Roads on the Sex Ratio of Freshwater Turtles," *Biological Conservation*, Vol. 123, 2005, pp. 37-44.

Baker, P.J., S. Harris, C.P.J. Robertson, G. Saunders, and P.C.L. White, "Is It Possible to Monitor Mammal Population Changes From Counts of Road Traffic Casualties? An Analysis Using Bristol's Red Foxes *Vulpes vulpes* as an Example," *Mammal Review*, Vol. 34, No. 1, 2004, pp. 115-130.

Barnum, S.A., "Identifying the Best Locations Along Highways to Provide Safe Crossing Opportunities for Wildlife: A Handbook for Highway Planners and Designers," *CDOT report CDOT-DTD-UCD-2003-9*, Colorado Department of Transportation, Research Branch, Denver, CO, 2003, 67 pp.

Bashore, T.L., W.M. Tzilkowski, and E.D. Bellis, "Analysis of Deer-Vehicle Collision Sites in Pennsylvania," *Journal of Wildlife Management*, Vol. 49, 1985, 769-774.

Bellis, E.D. and H.B. Graves, "Deer Mortality on a Pennsylvania Interstate," *Journal of Wildlife Management*, Vol. 39, 1971, pp.232-237.

Bertwistle, J., "The Effects of Reduced Speed Zones on Reducing Bighorn Sheep and Elk Collisions with Vehicles on the Yellowhead Highway in Jasper National Park," *Proceedings of the International Conference on Ecology and Transportation*, Center for Transportation and the Environment, Raleigh, N.C., 2003, pp. 384.

Biggs, J., S. Sherwood, S. Michalak, L. Hansen, and C. Bare, "Animal-Related Vehicle Accidents at the Los Alamos National Laboratory, New Mexico," *The Southwestern Naturalist*, Vol. 49, No. 3, 2004, pp. 384-394.

Bissonette, J.A. and M. Hammer, "Effectiveness of Earthen Return Ramps in Reducing Big Game Highway Mortality in Utah, Final Report," UT-01.09, Utah Cooperative Fish and Wildlife Research Unit, Logan, Utah, 2000.

Boarman, W.I. and Sazaki, M., "Highway Mortality in Desert Tortoises and Small Vertebrates: Success of Barrier Fences and Culverts," *Trends in Addressing Transportation Related Wildlife Mortality*, FL-ER-73-99, Florida Department of Transportation, Tallahassee, FL, 1996, pp. 263-277.

Brooks, R.J., G.P. Brown, and D.A. Galbraith, "Effects of a Sudden Increase in the Natural Mortality of Adults in a Population of the Common Snapping Turtle (*Chelydra serpentina*)," *Canadian Journal of Zoology*, Vol. 69, 1991, pp. 1314-1320.

"California's Habitat and Highways," Defenders of Wildlife, Sacramento, CA, 2006 [Online]. Available: http://www.defenders.org/california/hh.html [2006, May 25].

Caro, T.M., J.A. Shargel, and C.J. Stoner, "Frequency of Medium-Sized Mammal Road Kills in an Agricultural Landscape in California," *American Midland Naturalist*, Vol. 144, No. 2, 2000, pp. 362-369.

Case, R.M., "Interstate Highways Road-Killed Animals: A Data Source for Biologists," *Wildlife Society Bulletin*, Vol. 6, 1978, pp. 8-13.

Clevenger, A.P., B. Chruszcz and K. Gunson, *"Highway mitigation fencing reduces wildlife-vehicle collisions," Wildlife Society Bulletin, Vol.* 29, 2001, pp. 646-653.

Clevenger, A.P., B. Chruszcz, K. Gunson and J. Wierzchowski, *Roads and Wildlife in the Canadian Rocky Mountain Parks – Movements, Mortality and Mitigation*, Final report to Parks Canada, Banff, Alberta, Canada, 2002a.

Clevenger, A.P., B. Chruszcz, and K.E. Gunson, "Spatial Patterns and Factors Influencing Small Vertebrate Fauna Road-Kill Aggregations," *Biological Conservation*, Vol. 109, 2003, pp. 15-26.

Clevenger, A.P., J. Wierzchowski, B. Chruszcz, and K. Gunson, "GIS-Generated, Expert-Based Models for Identifying Wildlife Habitat Linkages and Planning Mitigation Passages," *Conservation Biology*, Vol. 16, 2002b, pp. 503-514.

Conn, J.M., J.L. Annest, and A. Dellinger, "Nonfatal Motor-Vehicle Animal Crash-Related Injuries—United States, 2001-2002," *Journal of Safety Research*, Vol. 35, 2004, pp. 571-574.

Conover, M.R., "Monetary and Intangible Valuation of Deer in the United States," *Wildlife Society Bulletin*, Vol. 25, No. 2, 1997, pp. 298-305.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. DuBow, and W.A. Sanborn, "Review of Human Injuries, Illnesses, and Economic Losses Caused by Wildlife in the United States," *Wildlife Society Bulletin*, Vol. 95, No. 3, 1995, pp. 407-414.

"Deercrash: Reducing Deer-Vehicle Collisions Through Enhanced Road Safety Practices," Deer Vehicle Crash Information Clearinghouse, Madison, WI, 2006 [Online]. Available: http://www.deercrash.com [2006, June 26].

Dickerson, L.M., "The Problem of Wildlife Destruction by Automobile Traffic," *Journal of Wildlife Management*, Vol. 3, No. 2, 1939, pp. 104-116.

Dodd, C.K., W.J. Barichivich, and L.L. Smith, "Effectiveness of a Barrier Wall and Culverts in Reducing Wildlife Mortality on a Heavily Traveled Highway in Florida," *Biological Conservation*, Vol. 188, 2004, pp. 619-631.

Dreyer, W.A., "The Question of Wildlife Destruction by the Automobile," *Science*, Vol. 82, No. 2132, 1935, pp. 439-440.

Evink, G., *National Cooperative Highway Research Program Synthesis 305. Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice*, Transportation Research Board, Washington D.C., 2002, 78 pp. http://trb.org/publications/nchrp/nchrp_syn_305.pdf

Farrell, T.M., et al., "Moose-Motor Vehicle Collisions: An Increasing Hazard in Northern New England," *Archives of Surgery*, Vol. 131, No. 4, 1996, pp. 377-381.

Feldhamer, G.A., J.E. Gates, D.M. Harman, A.J. Loranger, and K.R. Dixon, "Effects of Interstate Highway Fencing on White-Tailed Deer Activity," *Journal of Wildlife Management*, Vol. 50, 1986, pp. 497-503.

Finder, R.A, J.L. Roseberry, and A. Woolf, "Site and Landscape Conditions at White-Tailed Deer/Vehicle Collision Locations in Illinois," *Landscape and Urban Planning*, Vol. 44, 1999, pp. 77-85.

Forman, R.T.T. and L.E. Alexander, "Roads and Their Major Ecological Effects," *Annual Review of Ecology and Systematics*, Vol. 29, 1998, pp. 207-231.

Forman, R.T.T. and R.D. Deblinger, "The Ecological Road-Effect Zone of a Massachusetts (U.S.A.) Suburban Highway," *Conservation Biology*, Vol. 14, No. 1, 2000, pp. 36-46.

Forman, R.T.T., D. Sperling, J.A. Bissonette, A.P. Clevenger, C.D. Cutshall, V.H. Dale, L. Fahrig, R. France, Ch.R. Goldman, K. Heanue, J.A. Jones, F.J. Swanson, Th. Turrentine, Th.C. Winter. *Road Ecology: Science and Solutions*, Island Press, Washington DC, 2003, 481 pp.

Foster, M.L. and S.R. Humphrey, "Use of Highway Underpasses by Florida Panthers and Other Wildlife," *Wildlife Society Bulletin*, Vol. 23, No. 1, 1995, pp. 95-100.

Garrett, L.C. and G.A. Conway, "Characteristics of Moose-Vehicle Collisions in Anchorage, Alaska, 1991-1995," *Journal of Safety Research*, Vol. 30, No. 4, 1999, pp. 219-223.

Gibbs, J.P. and W.G. Shriver, "Can Road Mortality Limit Populations of Pool-Breeding Amphibians?" *Wetlands Ecology and Management*, Vol. 13, 2005, pp. 281-289.

Gibbs, J.P. and W.G. Shriver, "Estimating the Effects of Road Mortality on Turtle Populations," *Conservation Biology*, Vol. 16, No. 6, 2002, pp. 1647-1652.

Gunson, K.E., B. Chruszcz, and A.P. Clevenger, "Large Animal-Vehicle Collisions in the Central Canadian Rocky Mountains: Patterns and Characteristics," *Proceedings of the International Conference on Ecology and Transportation*, Center for Transportation and the Environment, Raleigh, N.C., 2003, pp. 355-366.

Gunther, K.A., M.J. Biel, and H.L. Robison, "Factors Influencing the Frequency of Road-Killed Wildlife in Yellowstone National Park," *Proceedings of the International Conference on Wildlife Ecology and Transportation*, FL-ER-69-98, Florida Department of Transportation, Tallahassee, 1998, pp. 32-42.

Groot Bruinderink, G.W.T.A. and E. Hazebroek, "Ungulate Traffic Collisions in Europe" *Conservation Biology*, Vol. 10, 1996, pp. 1059-1067.

Harden, B., "Saving Lives of Moose and Men: Highways Across U.S. Adapted to Reduce Collisions With Wildlife," *The Washington Post*, May 3, 2004, p. A1. Available: http://www.defenders.org/newsroom/moose [2006, 27 June].

Hedlund, J.H., P.D. Curtis, G. Curtis, and A.F. Williams, *Methods to Reduce Traffic Crashes Involving Deer: What Works and What Does Not*, Insurance Institute for Highway Safety, Arlington, VA, October 2003, 21 pp.

Henke, M.B., J. Cibor and B.J. Dayton, *Assessment of Deer-Vehicle Collisions in MD Using GIS,* Report MD-02-SP107B4H, Earthspan, Inc., Baltimore, MD, USA, 2002, 42pp.

Hicks, A.C., "Using Road-Kills as an Index to Moose Population Changes," *Alces*, Vol. 29, 1993, pp. 243-247.

Hughes, W.E., A.R. Saremi, and J.F. Paniati, "Vehicle-Animal Crashes: An Increasing Safety Problem," *Institute of Transportation Engineers Journal*, Vol. 66, 1996, pp. 24-28.

Huijser, M.P., "Cost-Benefit Analyses for Animal Detection Systems," *Animal Vehicle Crash Mitigation Using Advanced Technology. Phase I: Review, Design and Implementation, SPR 3(076)*, Report FHWA-OR-TPF-07-01, Western Transportation Institute – Montana State University, Bozeman, MT, USA, 2006a, pp. 185-192.

Huijser, M.P, "New tool to record animal-vehicle collision data will be further developed and field tested". *Committee on Ecology and Transportation Newsletter Summer 2006*, Transportation Research Board Committee ADC30 (formerly ADC30T), 2006b, p. 3.

Huijser, M.P. and P.J.M. Bergers, "The Effect of Roads and Traffic on Hedgehog (*Erinaceus europaeus*) Populations," *Biological Conservation*, Vol. 95, 2000, pp. 111-116.

Huijser, M.P., K.E. Gunson, and C. Abrams, *Animal-Vehicle Collisions and Habitat Connectivity Along Montana Highway 83 in the Seeley Swan Valley, Montana: A Reconnaissance*, Report FHWA/MT-06-002/8177, Montana Department of Transportation, Helena, MT, 2006a, 163 pp.

Huijser, M.P., P.T. McGowen, W. Camel, A. Hardy, P. Wright, A.P. Clevenger, L. Salsman and T. Wilson. *"Animal Vehicle Crash Mitigation Using Advanced Technology, Phase I: Review, Design and Implementation, SPR 3(076)"*, Report FHWA-OR-TPF-07-01, Western Transportation Institute – Montana State University, Bozeman, MT, USA, 2006b, 271 pp.

IIHS, "Deer, Moose Collisions with Motor Vehicles Peak in Spring and Fall," *Status Report*, Vol. 29, No. 4, 1993, 2 pp.

IIHS, "Lots of Approaches are Under Way to Reduce Deer Collisions, but Few have Proven Effective," *Status Report*, Vol. 39, No. 1, 2004, pp. 5-7.

Iowa Department of Public Safety. Don't veer for Deer, Available: http://www.dps.state.ia.us/commis/gtsb/deercrashes/index.shtml [2006, 31 August].

Iuell, B., et al., *Wildlife and Traffic - A European Handbook for Identifying Conflicts and Designing Solutions*, Prepared by COST 341 - Habitat Fragmentation Due to Transportation Infrastructure, 2003.

Jahn, L.R., "Highway Mortality as an Index of Deer-Population Change," *Journal of Wildlife Management*, Vol. 23, 1959, pp.187-197.

Kassar, C., and J.A. Bissonette, *Deer-Vehicle Crash Hotspots in Utah: Data for Effective Mitigation*, UTCFWRU Project Report No. 2005(1):1-128, Utah Cooperative Fish and Wildlife Research Unit, Utah State University, Logan, UT, 2005, 128 pp.

Khattak, A.J., "Human Fatalities in Animal-Related Highway Crashes," *Transportation Research Record*, Vol. 1840, No. 03-2187, 2003, pp. 158-166.

Kline, N.C. and D.E. Swann, "Quantifying Wildlife Road Mortality in Saguaro National Park," *Proceedings of the International Conference on Wildlife Ecology and Transportation*, FL-ER-69-98, Florida Department of Transportation, Tallahassee, 1998, pp. 23-31.

Kline, N.C., D.E. Swann, A. Schaefer, K. Beupre, and M. Pokorny, "Model for Estimating Wildlife Mortality on Roads and Its Implication for Mitigation and Management," *Proceedings of the International Conference on Ecology and Transportation*, Keystone, CO, 2001, pp. 533.

Knapp, K.K., X. Yi, T. Oakasa, W. Thimm, E. Hudson, and C. Rathmann, *Deer-Vehicle Crash Countermeasure Toolbox: A Decision and Choice Resource*, Wisconsin Department of Transportation, Report No. DVCIC-02, 2004, Madison, WI, USA, 2004, 263 pp.

Knapp, K.K. and A. Witte, *Strategic Agenda for Reducing Deer-Vehicle Crashes, Results from the Conference, Deer-Vehicle Crash Reductions: Setting a Strategic Agenda,* Midwest Regional University Transportation Center, Deer-Vehicle Crash Information Clearinghouse, University of Wisconsin-Madison, Madison, WI , USA, 2006, 20 pp.

Lamoureux, J., M. Crete and M. Belanger, "Effects of reopening hunting on survival of White-tailed Deer, Odocoileus virginianus, in the Bas-Saint-Laurent region, Quebec," Canadian Field-Naturalist Vol. 115, 2001, pp. 99-105.

Land, D. and M. Lotz, "Wildlife Crossings Design and Use by Florida Panthers and Other Wildlife in Southwest Florida," *Trends in Addressing Wildlife Mortality: Proceedings of the Transportation Related Wildlife Mortality Seminar*, FL-ER-58-96, Florida Department of Transportation, Tallahassee, 1996, pp.379-386.

Lehnert, M.E. and J.A. Bissonette, "Effectiveness of Highway Crosswalk Structures at Reducing Deer-Vehicle Collisions," *Wildlife Society Bulletin*, Vol. 25, 1997, pp. 809-818.

Lehnert, M.E., J.A. Bissonette, and J.W. Haefner, "Deer (*Cervidae*) Highway Mortality: Using Models to Tailor Mitigative Efforts," *Gibier Faune Sauvage, Game Wildlife*, Vol. 15, 1998, pp. 835-841.

Lloyd, J., and A. Casey, "Wildlife Hotspots Along Highways in Northwestern Oregon," *Report to Oregon Department of Transportation*, Salem, Oregon, 2005, 64 pp.

Maine Department of Transportation, Available:
http://www.state.me.us/mdot/safety-programs/pdf/animalcrash2005.pdf
http://www.state.me.us/mdot/safety-programs/pdf/moosepage2005.pdf
http://www.state.me.us/mdot/safety-programs/pdf/deerpage2005.pdf
[2006, 12 July].

Maine Department of Transportation, "Collisions between wildlife species and motor vehicles in Maine 2000-2004," *Report to Maine Department of Transportation,* Bureau of Maintenance and Operations, Augusta, ME, USA, 2005, 26 pp.

Urbitran Associates, Cambridge Systematics and Howard/Stein-Hudson Associates, "Strategies for Addressing Deer-Vehicle Crashes", *Report to North Jersey Transportation Planning Authority,* Development of Regional Safety Priorities, 2005, 27 pp.

Malo, J.E., F. Suarez, and A. Diez, "Can We Mitigate Animal-Vehicle Accidents Using Predictive Models?" *Journal of Applied Ecology*, Vol. 41, 2004, pp. 701-710.

McCaffrey, K.R., "Road-Kills Show Trends in Wisconsin Deer Population," *Journal of Wildlife Management*, Vol. 37, 1973, pp. 212-216.

Meyer, E., and I. Ahmed, "Modeling of Deer-Vehicle Crash Likelihood Using Roadway and Roadside Characteristics," *Proceedings of the Transportation Research Board Annual Meeting*, Transportation Research Board, National Research Council, Washington, D.C., 2004.

Ministerie van Verkeer en Waterstaat. *Dieren op en langs de weg*. Ministerie van Verkeer en Waterstaat, Rijkswaterstaat, Dienst Weg- en Waterbouwkunde, Delft, The Netherlands, 1995, 144 pp.

Mosler-Berger, Chr. and J. Romer, "Wildwarnsystem CALSTROM," *Wildbiologie,* No. 3, 2003, pp. 1-12.

Mumme, R.L., S.J. Schoech, G.E. Woolfenden, and J.W. Fitzpatrick, "Life and Death in the Fast Lane: Demographic Consequences of Road Mortality in the Florida Scrub-Jay," *Conservation Biology*, Vol. 14, No. 2, 2000, pp. 501-512.

NHTSA, Crash forms, National Center for Statistics and Analysis of the National Highway Traffic Safety Administration (NHTSA), 2006 [Online]. Available: http://www.nhtsa-tsis.net/crashforms/

National Research Council, *Assessing and Managing the Ecological Impacts of Paved Roads*, National Academies Press, Washington, D.C., 2005, 294 pp. http://darwin.nap.edu/books/0309100887/html

"National Road Network, Canada, Level 1 (NRNC1)," Geobase, Quebec, 2006 [Online]. Available: http://www.geobase.ca/geobase/en/data/nrnc1.html [2006, June 27].

"Notice of Procurement Contract Award," State of New York, Department of Transportation, Albany, NY, 2005 [Online]. Available: http://www.dot.state.ny.us/cmb/procure/files/roadkill.pdf [2006, April 27].

Oxley, D.J., M.B. Fenton, and G.R. Carmody, "The Effects of Roads on Populations of Small Mammals," *The Journal of Applied Ecology*, Vol. 11, No. 1, 1974, pp. 51-59.

Perrin, J. and R. Disegni, *Safety Benefits of UDOT Highway Program: Animal-Vehicle Accident Analysis*, Report No. UT-03.31, Utah Department of Transportation Research and Development Division, SLC, UT, 2003, 35 pp.

Pojar, T.M., R.A. Prosence, D.F. Reed, and R.H. Woodward, "Effectiveness of a Lighted, Animated Deer Crossing Sign," *Journal of Wildlife Management*, Vol. 39, 1975, pp. 87-91.

Proctor, M.F., *Genetic Analysis of Movement, Dispersal and Population Fragmentation of Grizzly Bears in Southwestern Canada*, Ph.D. dissertation, The University of Calgary, Calgary, Canada, 2003.

Puglisi, M.J., J.S. Lindzey, and E.D. Bellis, "Factors Associated with Highway Mortality of White-Tailed Deer," *Journal of Wildlife Management*, Vol. 38, 1974, pp. 799-807.

Putman, R.J., "Deer and Road Traffic Accidents: Options for Management," *Journal of Environmental Management*, Vol. 51, 1997, pp. 53-57.

Ramakrishnan, U. and S.C. Williams, "Effects of Gender and Season on Spatial and Temporal Patterns of Deer-Vehicle Collisions," *Proceedings of the International Conference on Ecology and Transportation*, 2005, pp. 478-488.

Rea, R.V., *Investigating Methods to Reduce Urban Moose-Related Vehicular Collisions Within the City of Prince George, British Columbia*, Prince George, BC, 2004, 31 pp.

Reed, D.F., "Effectiveness of Highway Lighting in Reducing Deer-Vehicle Collisions," *Journal of Wildlife Management*, Vol. 45, 1981, pp. 721-726.

Reeve, A.F. and S.H. Anderson, "Ineffectiveness of Swareflex Reflectors at Reducing Deer-Vehicle Collisions," *Wildlife Society Bulletin*, Vol. 21, 1993, pp. 127-132.

Rogers, E., *An Ecological Landscape Study of Deer-Vehicle Collision in Kent County, Michigan*, White Water Associates, Inc., Kent County Road Commission, Grand Rapids, MI, 2004, 56 pp.

Rolley, R.E. and L.E. Lehman, "Relationships Among Raccoon Road-Kill Surveys, Harvests, and Traffic," *Wildlife Society Bulletin*, Vol. 20, 1992, pp. 313-318.

Romin, L.A. and J.A. Bissonette, "Deer-Vehicle Collisions: Status of State Monitoring Activities and Mitigation Efforts," *Wildlife Society Bulletin*, Vol. 24, No. 2, 1996a, pp. 276-283.

Romin, L.A. and J.A. Bissonette, "Temporal and spatial distribution of highway mortality of mule deer on newly constructed roads at Jordanelle Reservoir, Utah," *Great Basin Naturalist*, Vol. 56, 1996b, pp. 1-11.

Roof, J. and J. Wooding, *Evaluation of S.R. 46 Wildlife Crossing*, Technical Report #54, Florida Cooperative Fish and Wildlife Research Unit, U.S. Biological Service, 1996, 36 pp.

Ruediger, W., and J.D. Lloyd, "A Rapid Assessment Process for Determining Potential Wildlife, Fish, and Plant Habitat Linkages for Highways," *Proceedings of the International Conference on Ecology and Transportation*, Center for Transportation and the Environment, Raleigh, N.C., 2003, pp. 205-225.

Schafer, J.A. and S.T. Penland, "Effectiveness of Swareflex Reflectors in Reducing Deer-Vehicle Accidents," *Journal of Wildlife Management*, Vol. 49, 1985, 774-776.

Schwabe K.A. and P.W. Schuhmann, "Deer-Vehicle Collisions and Deer Value: An Analysis of Competing Literature," *Wildlife Society Bulletin*, Vol. 30, No. 2, 2002, pp. 609-615.

Schwabe, K.A., P.W. Schuhmann, M. Tonkovich, and E. Wu, "An Analysis of Deer-Vehicle Collisions: The Case of Ohio," in *Human Wildlife Conflicts: Economic Considerations*, L. Clark, Ed., USDA, Animal and Plant Health Inspection Service, Fort Collins, CO, 2002, pp. 91-103.

Seiler, A., "Trends and spatial patterns in ungulate-vehicle collisions in Sweden," *Wildlife Biology*, Vol. 10, 2004, pp. 301-313.

Seiler, A., "Predicting locations of moose-vehicle collisions in Sweden," *Journal of Applied Ecology*, Vol. 42, 2005, pp. 371-382.

Sielecki, L.E., *"Wildlife Accident Reporting: A Fundamental Element in B.C.'s Mitigation Efforts,"* Presented at the Wildlife Accident Workshop Session, Annual Conference of the Transportation Association of Canada, St. John's, Newfoundland and Labrador, 2003a.

Sielecki, L.E., Saving Motorists and Wildlife, *World Highways*, 2003b, pp. 49-50.

Sielecki, L.E., *WARS 1983-2002: Wildlife Accident Reporting and Mitigation in British Columbia. Special Annual Report*, Ministry of Transportation, Victoria, B.C., Canada, 2004.

Sielecki, L.E., "Comprehensive Monitoring of Wildlife Mortality on British Columbia Highways Using the WARS System," *Wild Animals and Traffic Accidents: Monitoring, Analyses, Prevention Measures, and Measure Evaluation,*

Proceedings IX International Mammalogical Congress, Sapporo, Japan, 2005, pp. 19-36.

Huijser, M.P., "Cost-Benefit Analyses for Animal Detection Systems," *Animal Vehicle Crash Mitigation Using Advanced Technology. Phase I: Review, Design and Implementation, SPR 3(076)*, Report FHWA-OR-TPF-07-01, Western Transportation Institute – Montana State University, Bozeman, MT, USA, 2006a, pp. 185-192.

Slater, F.M., "An Assessment of Wildlife Road Casualties – the Potential Discrepancy Between Numbers Counted and Numbers Killed," *Web Ecology*, Vol. 3, 2002, pp. 33-42.

Smith, D.J. and M. Voigt, *SR 200 Wildlife Impact Study Final Report*, GeoPlan Center, University of Florida, Gainesville, FL, Apr. 2005, 236 pp.

Smith, L. and C.K. Dodd, *Determination of the Effectiveness of Wildlife Barriers and Underpasses on U.S. Highway 441 Across Paynes Prairie State Preserve, Alachua County, Florida, Phase I Final Report*, Florida Department of Transportation, Gainesville, FL, Oct. 1999, 14 pp.

Spellerberg, I.F., *Ecological Effects of Roads. Land Reconstruction and Management Series Vol. 2*, Science Publishers, Inc, Enfield, NH, 2002, 251 pp.

Stoner, D., "The Toll of the Automobile," *Science*, Vol. 61, No. 1568, 1925, pp. 56-57.

Sullivan, T.L. and T.A. Messmer, "Perceptions of deer-vehicle collision management by state wildlife agency and department of transportation administrators", *Wildlife Society Bulletin,* Vol. 31, No. 1, 2003, pp. 163-173.

Tappe, P.A., "Deer-vehicle collisions in Arkansas," *Journal of the Arkansas Academy of Sciences*, Vol. 59, 2005, pp. 218-221.

Tardif, L-P & Associates, *Collisions involving motor vehicles and large animals in Canada: Final report*, Transport Canada Road Safety Directorate, Canada, 2003, 44 pp.

Thomas, S.E., *Moose-Vehicle Accidents on Alaska's Rural Highways*, State of Alaska Department of Transportation & Public Facilities, Design and Construction Division, 1995, 110 pp.

Traffic Collision Statistics: Police-attended injury and fatal collisions, British Columbia, 2003, 154 pp.

Ujvári, M., H.J. Baagøe and A.B. Madsen, "Effectiveness of wildlife warning reflectors in reducing deer-vehicle collisions: a behavioural study," *Journal of Wildlife Management* Vol. 62, 1998, pp.1094-1099.

Ward, A.L., "Mule Deer Behavior in Relation to Fencing and Underpasses on Interstate 80 in Wyoming," *Transportation Research Record*, Vol. 859, 1982, pp. 8-13.

Waring, G.H., J.L. Griffis and M.E. Vaughn, "White-tailed deer roadside behavior, wildlife warning reflectors, and highway mortality,"*Applied Animal Behaviour Science*, Vol. 29, 1991, pp. 215-223.

Williams, A.F. and J.K. Wells, "Characteristics of Vehicle-Animal Crashes in Which Vehicle Occupants are Killed," *Traffic Injury Prevention*, Vol. 6, No. 1, 2005, pp. 56-59.

Wood, P. and M.L. Wolfe, "Intercept Feeding as a Means of Reducing Deer-Vehicle Collisions," *Wildlife Society Bulletin*, Vol. 16, 1988, pp. 376-380.

Wu, E., "Economic Analysis of Deer-Vehicle Collisions in Ohio," *Proceedings of the International Conference on Wildlife Ecology and Transportation*, FL-ER-69-98, Florida Department of Transportation, Tallahassee, 1998, pp. 43-52.

Zee, F.F. van der, J. Wiertz, C.J.F. ter Braak, R.C. van Apeldoorn and J. Vink, "Landscape Change as a Possible Cause of the Badger *Meles meles* L. Decline in The Netherlands," *Biological Conservation*, Vol. 61, 1992, pp. 17-22.

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

Departments of Natural Resources (DNRs): all natural resource management agencies at the state or provincial level, despite of 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 DC).

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 AVC OR AC 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 explicity reported by the paper authors in the methods section or implicity reported in the results. Additional parameters may have been collected but not reported.

Reference	Purpose*	Collision/Carcass Parameters								Traffic/Road Parameters				Landscape Parameters			Other Parameters		
		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
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				4 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			
BC 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)	2 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	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			

*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

Table A1 - Continued

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 explicity reported by the paper authors in the methods section or implicity reported in the results. Additional parameters may have been collected but not reported.

Reference	Purpose*	Collision/Carcass Parameters								Traffic/Road Parameters				Landscape Parameters			Other Parameters		
		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 email which 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/Zipcode _____

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 form)
   - ☐ 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 road types 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 Choose one
Time Choose one
District or unit Choose one
Name observer Choose one
Road/route identification Choose one
Collision location Choose one
Occurrence of human fatalities Choose one
Occurrence of human injuries Choose one
Type of injury Choose one
Occurrence of property damage Choose one
Estimated amount of property damage Choose one
Species name of the animal involved Choose one
Sex of animal Choose one
Age of animal Choose one
Whether the animal carcass was removed or not Choose one

16. How is collision location recorded?
Coordinates through GPS Choose one
Coordinates through map Choose one
Reference or mi/km post Choose one
Road section Choose one
Other

17. How precise is the collision location information?
Within 1 y or 1 m Choose one
Within 15 y or 15 m Choose one
Within 30 y or 30 m Choose one
Within 0.1 mi/km based on reference or mi/km post Choose one
Within 1.0 mi/km based on reference or mi/km post Choose one
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: Choose one 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: Choose one 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: Choose one 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: Choose one 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: Choose one 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: Choose one 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 overtime
☐ 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 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 it) ☐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 it) ☐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.

63. 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

64. When did your agency start collecting AC data?

65. 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)

66. Please describe the road types for which your agency collects or manages AC data (check all road types 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)

67. 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.

68. How would you characterize the landscape in this area?
☐Rural
☐Urban
☐Both rural and urban

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

70. 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.

71. 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

72. 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

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

74. 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

75. How would you characterize the search and reporting effort for animal carcasses?
☐Incidental observations

☐Monitoring (consistent search and reporting effort, but this not necessarily mean that all carcasses are reported)

☐Other

76. What is the frequency of surveys/checks for ACs on a given road section?
☐Daily
☐Weekly
☐Monthly
☐Other

77. Do you record one or more of the following parameters?
Date Choose one
Time Choose one
District or unit Choose one
Name observer Choose one
Road/route identification Choose one
Carcass location Choose one
Occurrence of human fatalities Choose one
Occurrence of human injuries Choose one
Type of injury Choose one
Occurrence of property damage Choose one
Estimated amount of property damage Choose one
Species name of the animal involved Choose one
Sex of animal Choose one
Age of animal Choose one
Whether animal carcass was removed or not Choose one

78. How is carcass location recorded?
Coordinates through GPS Choose one
Coordinates through map Choose one
Reference or mi/km post Choose one
Road section Choose one
Other

79. How precise is the carcass location information?
Within 1 y or 1 m Choose one
Within 15 y or 15 m Choose one
Within 30 y or 30 m Choose one
Within 0.1 mi/km based on reference or mi/km post Choose one
Within 1.0 mi/km based on reference or mi/km post Choose one
Other

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

81. Amphibians are usually identified to: Choose one If you chose other, please describe

82. Amphibian groups recorded include (check all that apply):
☐ All
☐ Endangered species
☐ Other
☐ Amphibians are never recorded

83. Reptiles are usually identified to: Choose one If you chose other, please describe

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

85. Birds are usually identified to: Choose one If you chose other, please describe

86. Bird groups recorded include (check all that apply):
☐ All
☐ Endangered species
☐ Game birds (species that are hunted)
☐ Raptors
☐ Songbirds

☐Other
☐Birds are never recorded

87. Large wild mammals (deer and larger) are usually identified to: Choose one If you chose other, please describe

88. 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

89. Small wild mammals (smaller than deer) are usually identified to: Choose one If you chose other, please describe

90. 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

91. Domestic animals are usually identified to: Choose one If you chose other, please describe

92. Domestic animal groups recorded include (check all that apply):
☐All
☐Large species only
☐Other
☐Domestic animals are never recorded

93. 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.

94. Do AC data collectors receive training?
☐Yes ☐No (Skip to SECTION 4, question 37) ☐Don't know (Skip to SECTION 4, question 37)

95. How often does training occur?
☐Once
☐Monthly
☐Yearly
☐Other

96. 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

97. How is training conducted? (Check all that apply)
☐Literature
☐On the job
☐Seminar
☐Other

98. 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.

99. Are the raw data shared with other organizations or individuals?
☐Yes (with whom?) ☐No ☐Don't know

100. Are the data analyzed?
☐Yes ☐No (skip to SECTION 5, question 54) ☐Don't know (skip to SECTION 5, question 54)

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

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

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

104. Please describe the data analyses procedures

105. 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 overtime
☐Data entered in a GIS

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

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

108. Who performs the analysis?

109. How often are the data analyzed?

110. How often are the results published?

111. How are the data and results disseminated?

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

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

114. 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

115. 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.

116. What problems have you experienced in AC data collection?

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

118. What problems have you experienced with AC data analyses?

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

120. What problems have you experienced with AC data dissemination?

121. How can AC data dissemination be improved?

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

123. Do you know of any particularly successful AC data collection, analyses and use program outside of your state or province? ☐Yes (Please describe it) ☐No

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

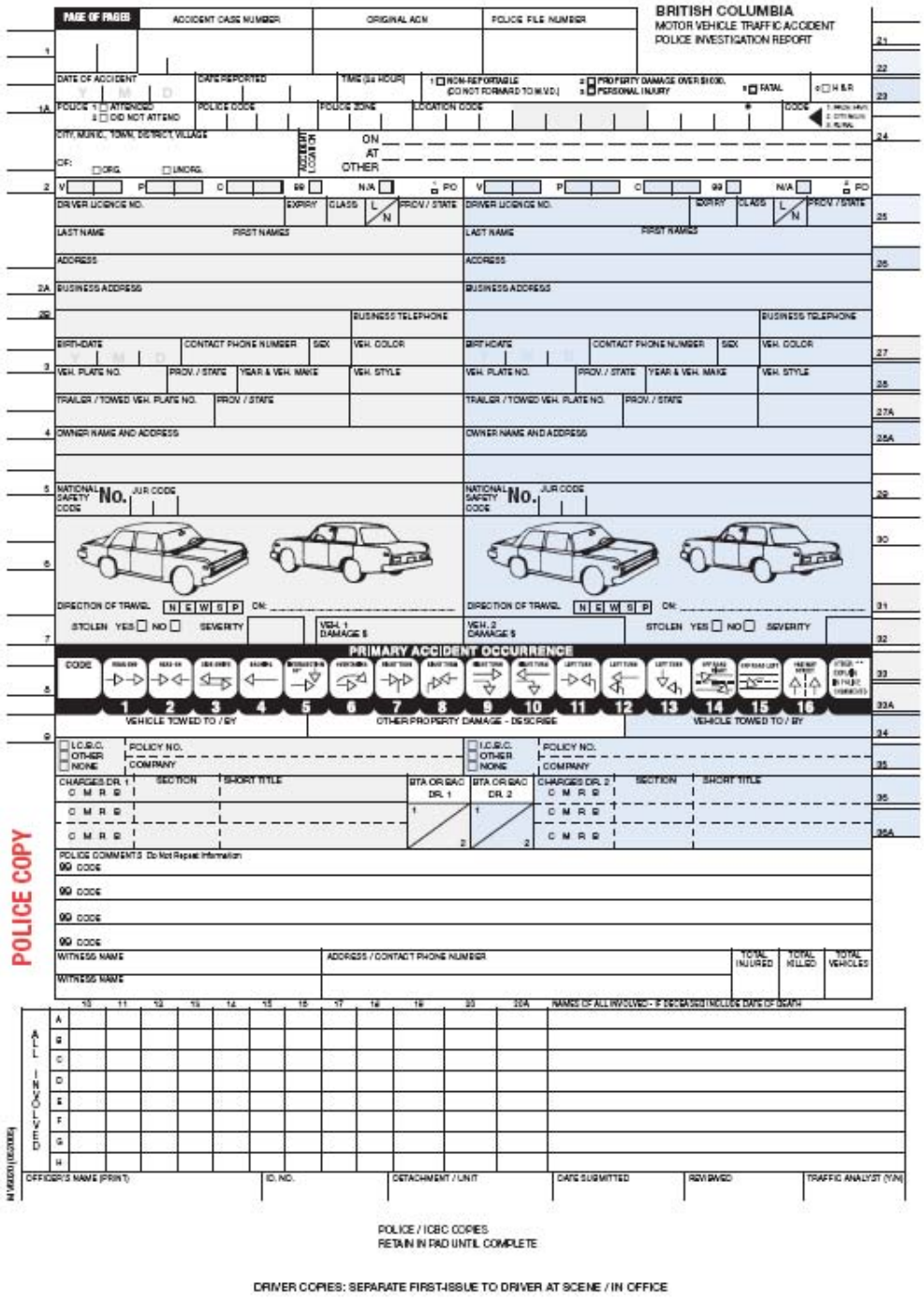
Reminder: if you do collect/manage AC data, please send us a copy of an AC data collection sheet if possible (e-mail, fax, or mail)

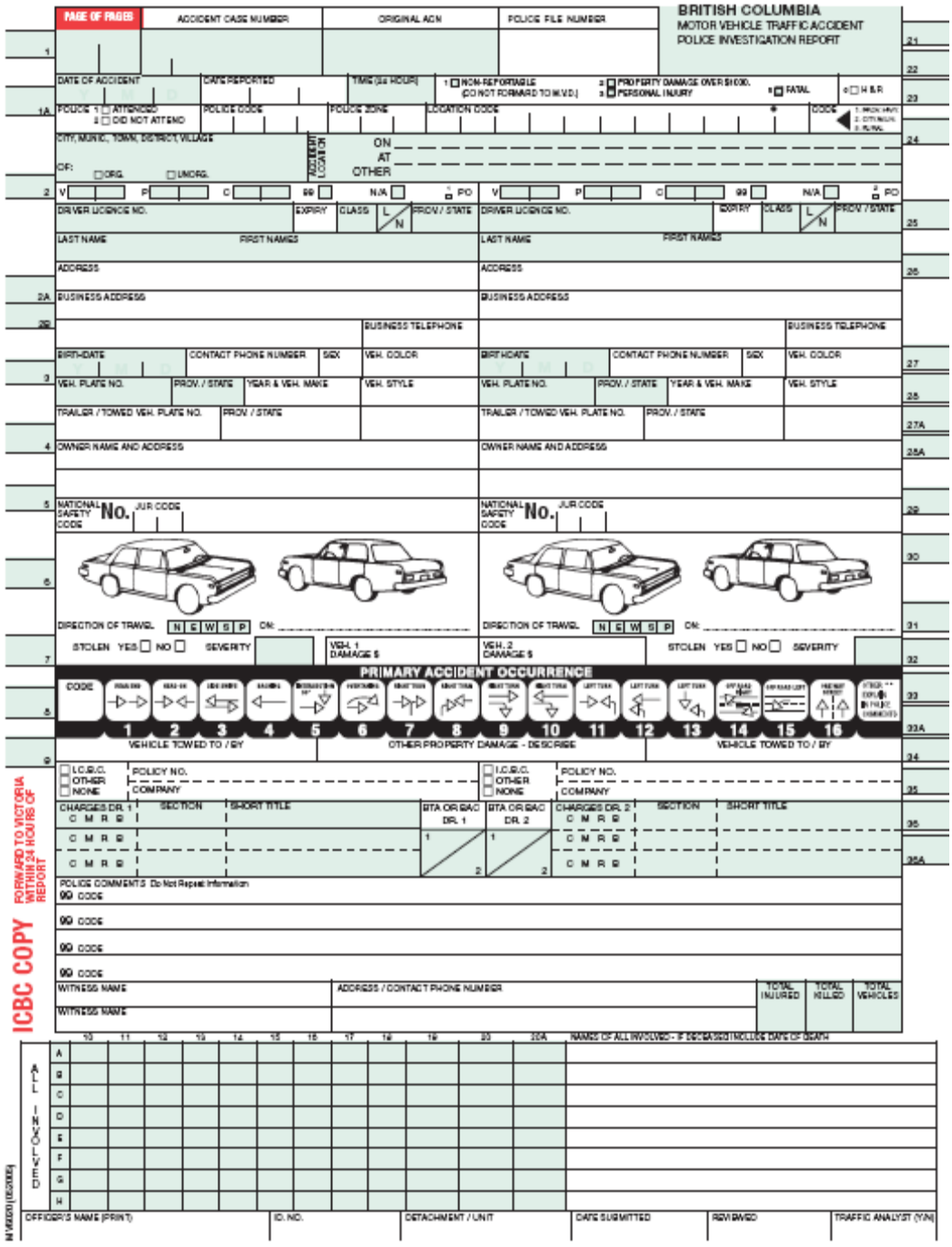
Thank you for your time. We appreciate it!

APPENDIX C: EXAMPLES AVC 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





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

BRITISH COLUMBIA
MOTOR VEHICLE TRAFFIC ACCIDENT
POLICE INVESTIGATION REPORT

DATE OF ACCIDENT | 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

POLICE 1 ATTENDED 2 DID NOT ATTEND | POLICE CODE | POLICE ZONE | LOCATION CODE | CODE

CITY, MUNIC., TOWN, DISTRICT VILLAGE | ACCIDENT LOCATION | ON AT OTHER

OF: ORG. UNORG.

V P C 99 N/A PO

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

LAST NAME | FIRST NAMES | ADDRESS | BUSINESS ADDRESS | BUSINESS TELEPHONE | BIRTHDATE | 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 Ø | SECTION | SHORT TITLE | MTA OR RAC DR. 1 | MTA OR RAC DR. 2 | CHARGES DR. 2 C M R Ø | 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

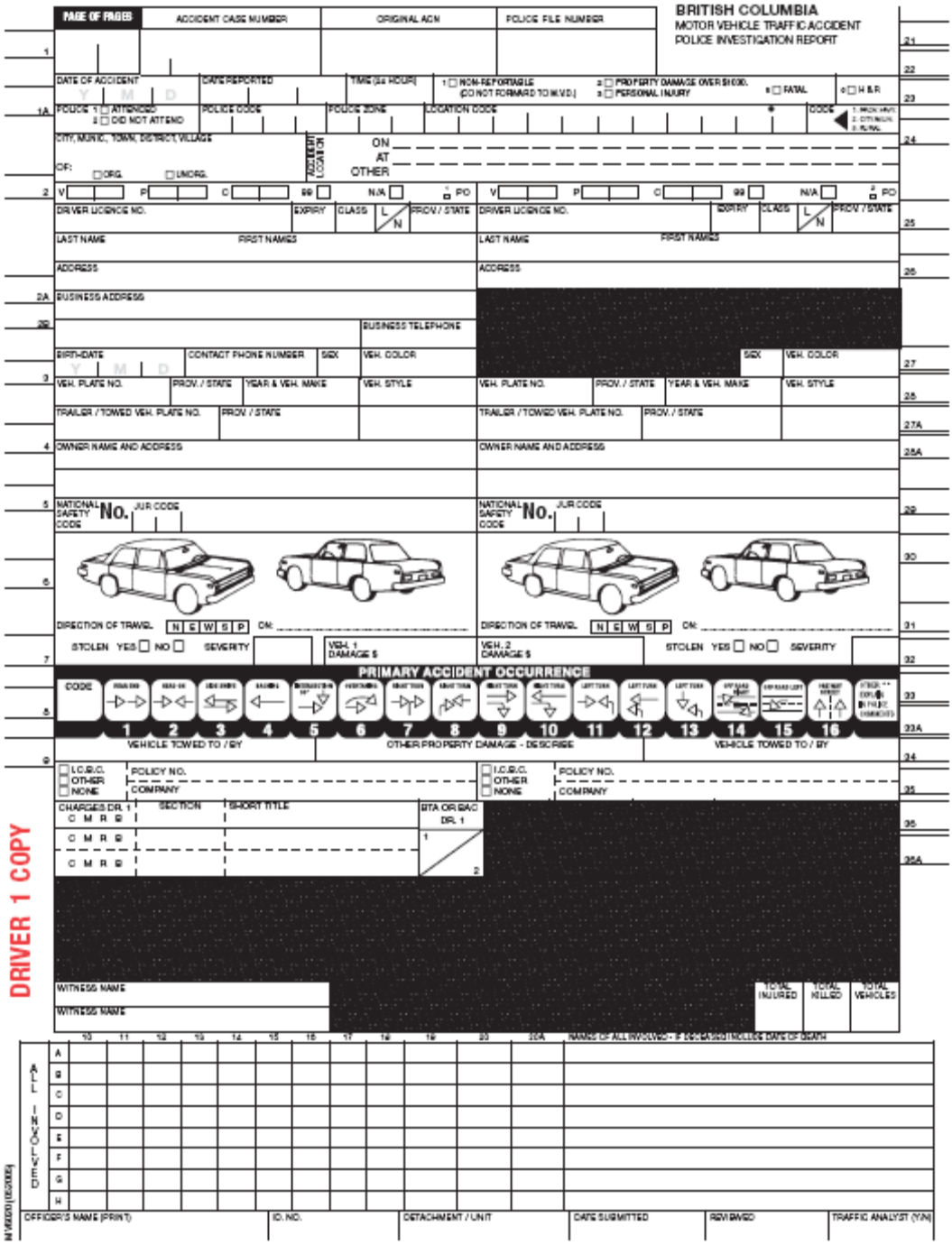
WITNESS NAME

ICBC COPY

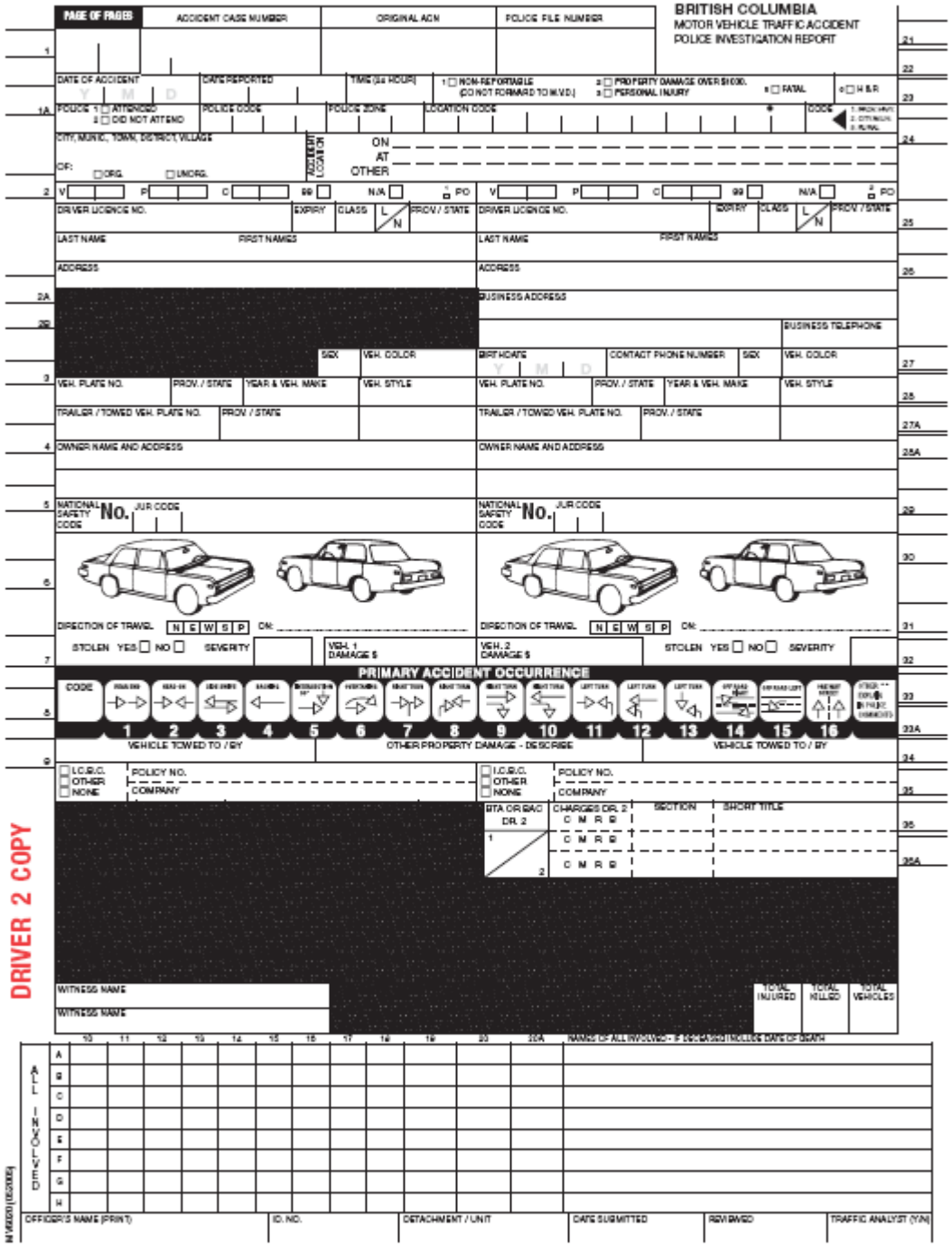
FORWARD TO VICTORIA WITHIN 24 HOURS OF REPORT

	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)



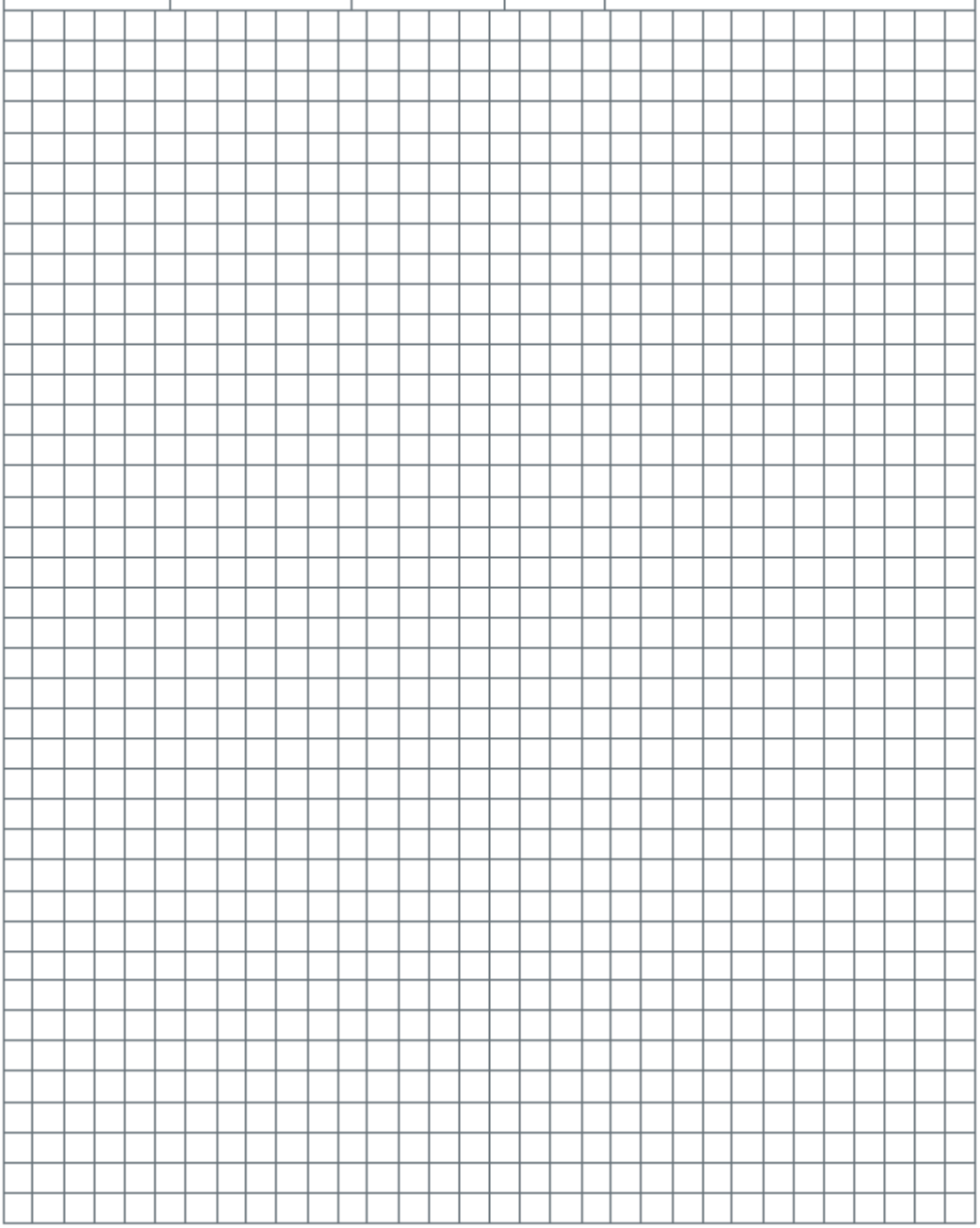
NOTE: A COPY OF THIS ACCIDENT REPORT, INCLUDING THE INFORMATION CONTAINED IN THE BLACKED OUT SECTIONS, MAY BE GIVEN TO YOUR INSURANCE COMPANY UPON THEIR REQUEST TO ASSIST THEM IN PROCESSING CLAIMS.



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 (8 N 2, 7 W E 3, 6 S 4) 9. Parked 5, 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

TYPE

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
02. Hit Stationary Object	04. Off Road Right	06. Other Single Vehicle	22. Sideswipe Same-Direction	24. Passing - Right Turn	31. Head-On

32. Sideswipe-Opposite Direction	34. Right Turn Including Conflict	36. Other Multi-Vehicle Opposite Direction	QQ. Other Collision Type
33. Left Turn Across Path	35. Right Angle	41. Hit Parked Vehicle	UU. Unknown Collision Type

DRIVER / VEHICLE

	Driver	Owner
29. VEH.SEQUENCE # / 99. Ped. UU. Unk.		
30. TOTAL OCCUPANTS UU. Unknown		
LAST NAME / FIRST NAME(S)		
ADDRESS		
ADDRESS		
DATE OF BIRTH / SEX / HOME PHONE / WORK PHONE		
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		
34. YEAR UUUU. Unk. / **MAKE/MODEL**		
LICENCE PLATE # / **EXP** / **32. PROV** / **33. VIN** U. Unknown		

OWNER

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

43. FIRST IMPACT LOCATION (1 2 3 4 5 6 20)

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
QQ. Other UU. Unknown

42. DAMAGE SEVERITY

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

61. POSITION (11 12 13 / 21 22 23 / 31 32 33)

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
9. Pedestrian
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
12. 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. Snowmobile
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 With Traffic
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

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

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.

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 1 = Dawn 2 = Day 3 = Dusk 4 = Dark	**Time of Kill**	**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**
			RFI		LKI						**Deer**			**Moose**			**Elk**			**Bear**			**Other**	
		Hwy No.	Landmark	Offset	Segment	Km	Nearest 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	Philip Harrison	Gary	Jim Eussen	Jon Holst	Jane Hann
18500 E.	905 Erie Ave	Spinuzzi	1420 2nd St.	3803 N. Main	2000 S. Holly St.
Colfax Ave	P.O Box 536	222 S. 6th St,	Greeley CO	Ave. Durango	Denver CO
Aurora CO	Pueblo CO 81002	G.J. CO	80631	CO 81301	80222
80111		81501			

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.

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		How Many?	Deer			Elk			Moose			Bear			Other species (please specify)	**What done w/ animal?**	Initials of Observer	**Additional Comments**
	Route	Mile Point to 0.1 mile		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 page 2

Materials

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

Large Wild Animals

(Deer, Bear, Coyote, Cougar)

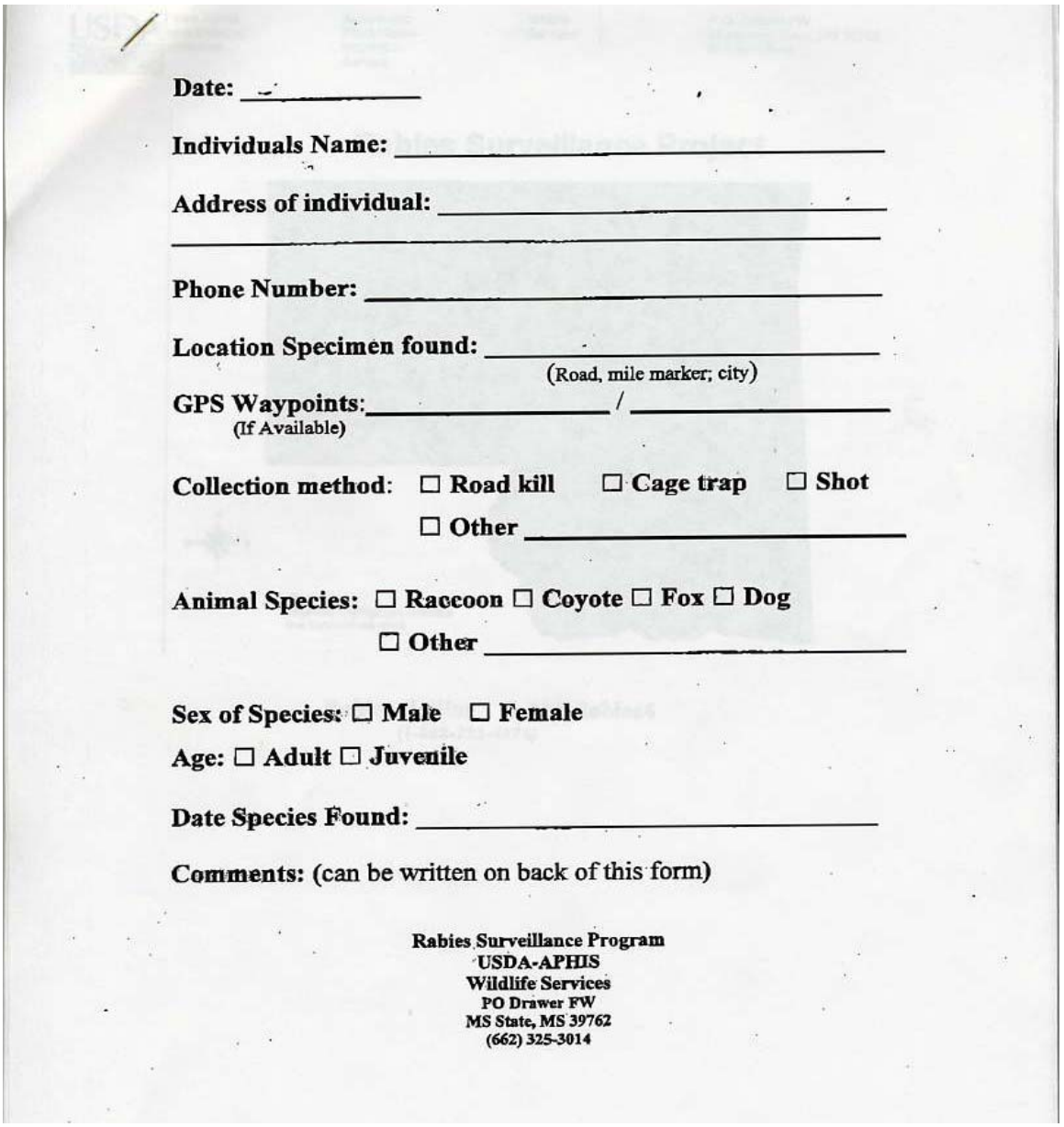
Route #	Milepoint	Direction	Specific Location	Type of Animal	Sex of Animal (M, F, Unknown)

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 ☐ Foggy ☐ 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										

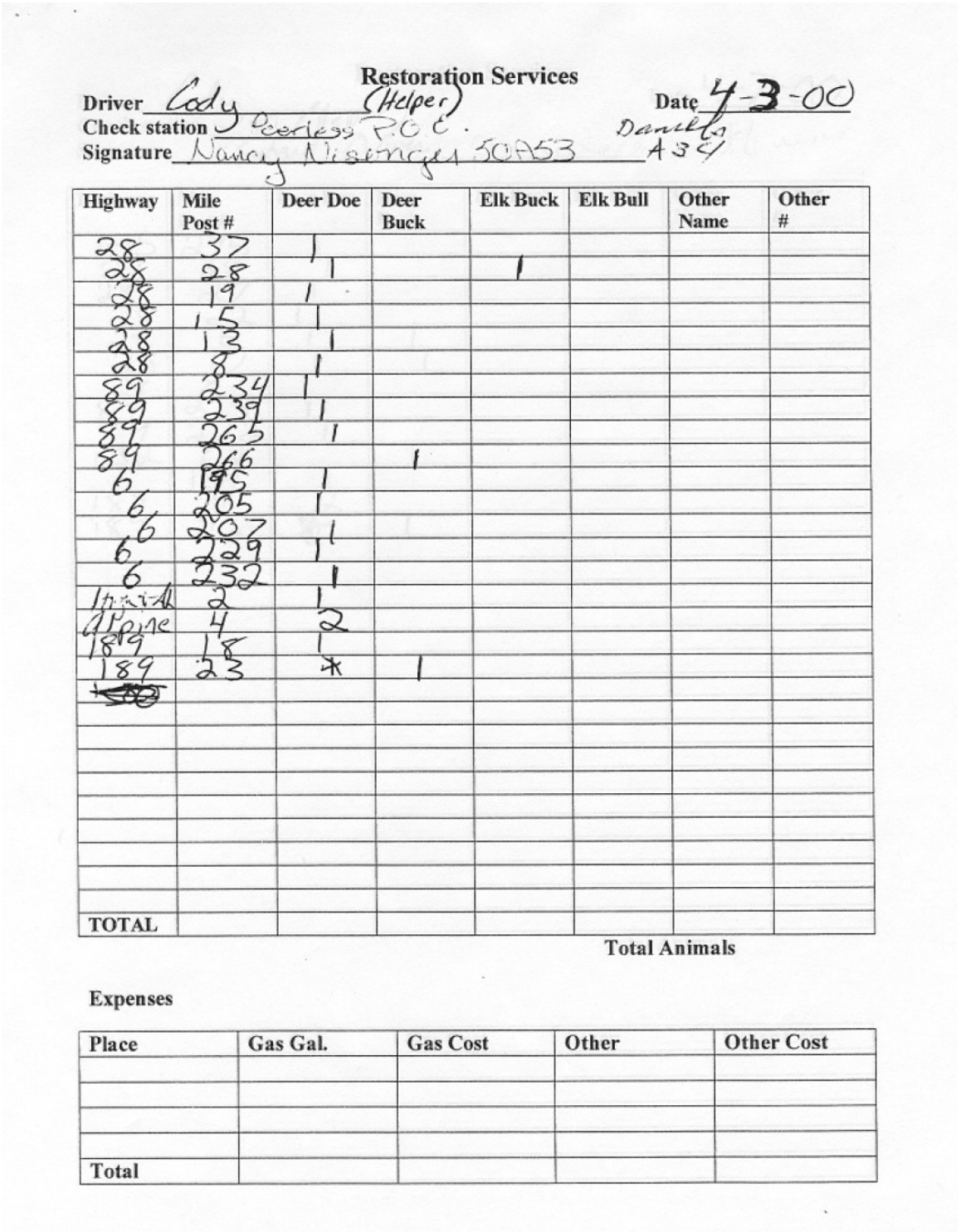
***Region note. ONLY ONE REGION PER DAY ! Please indicate ONLY the region in which you drove the most miles that day.**

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.E. Daniels

Signature Nancy Nisenger 50453 434

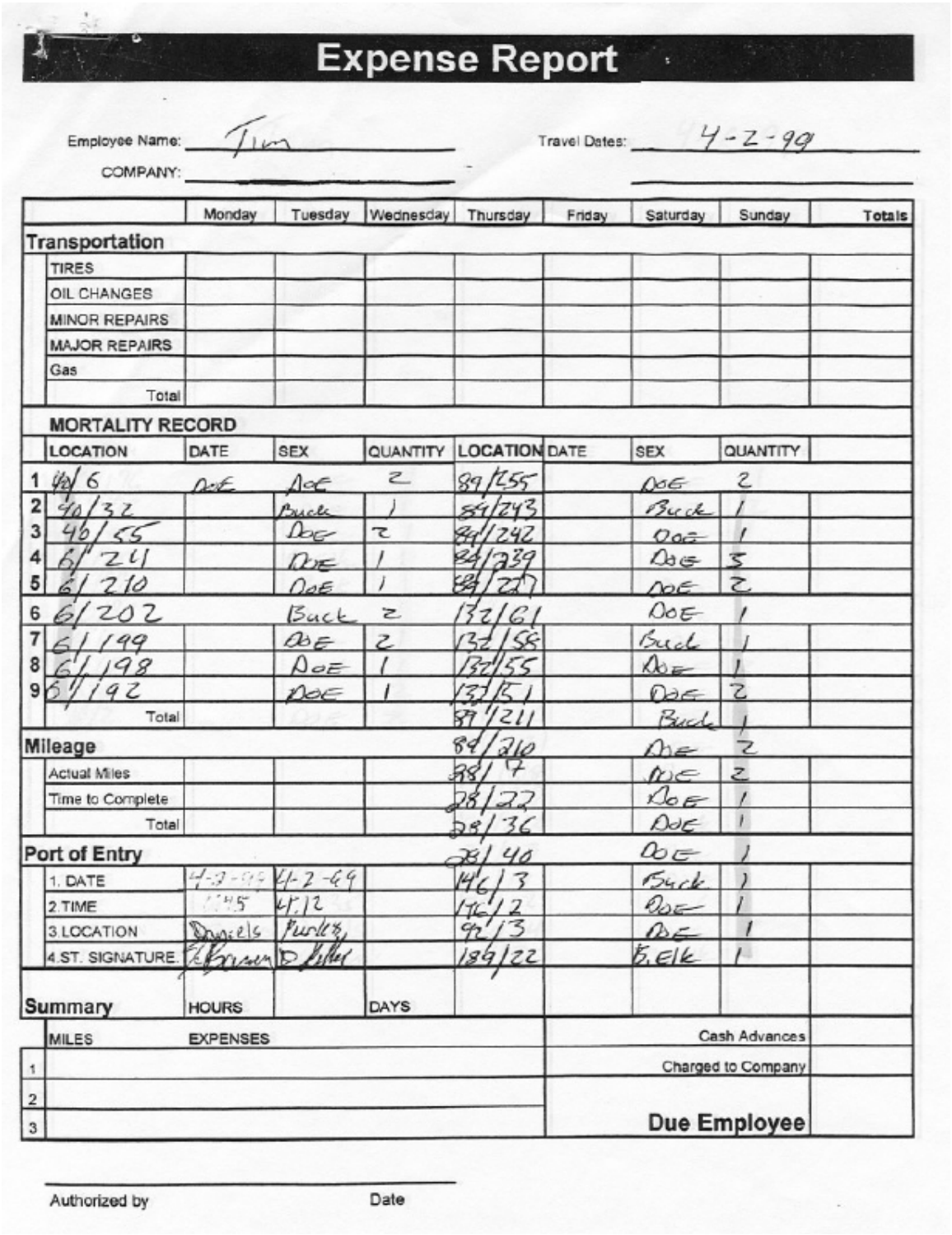
Highway	Mile Post #	Deer Doe	Deer Buck	Elk Buck	Elk Bull	Other Name	Other #
28	37	1					
28	28	1		1			
28	19	1					
28	15	1					
28	13	1					
28	8	1					
89	234	1					
89	239	1					
89	265	1					
89	266		1				
6	195	1					
6	205	1					
6	207	1					
6	229	1					
6	232	1					
Ind Rd	2	1					
Alpine	4	2					
189	18	1					
189	23	*	1				
~~189~~							
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	84/243		Buck	1
3	46/55		DOE	2	84/242		DOE	1
4	6/241		DOE	1	84/239		DOE	3
5	6/210		DOE	1	84/227		DOE	2
6	6/202		Buck	2	132/61		DOE	1
7	6/199		DOE	2	132/56		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					84/210		DOE	2
Actual Miles					38/17		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	1145	47.12			176/2		DOE	1
3.LOCATION	Daniels	Parker			9p/3		DOE	1
4.ST. SIGNATURE	T. Brown	D Miller			189/22		B. Elk	1

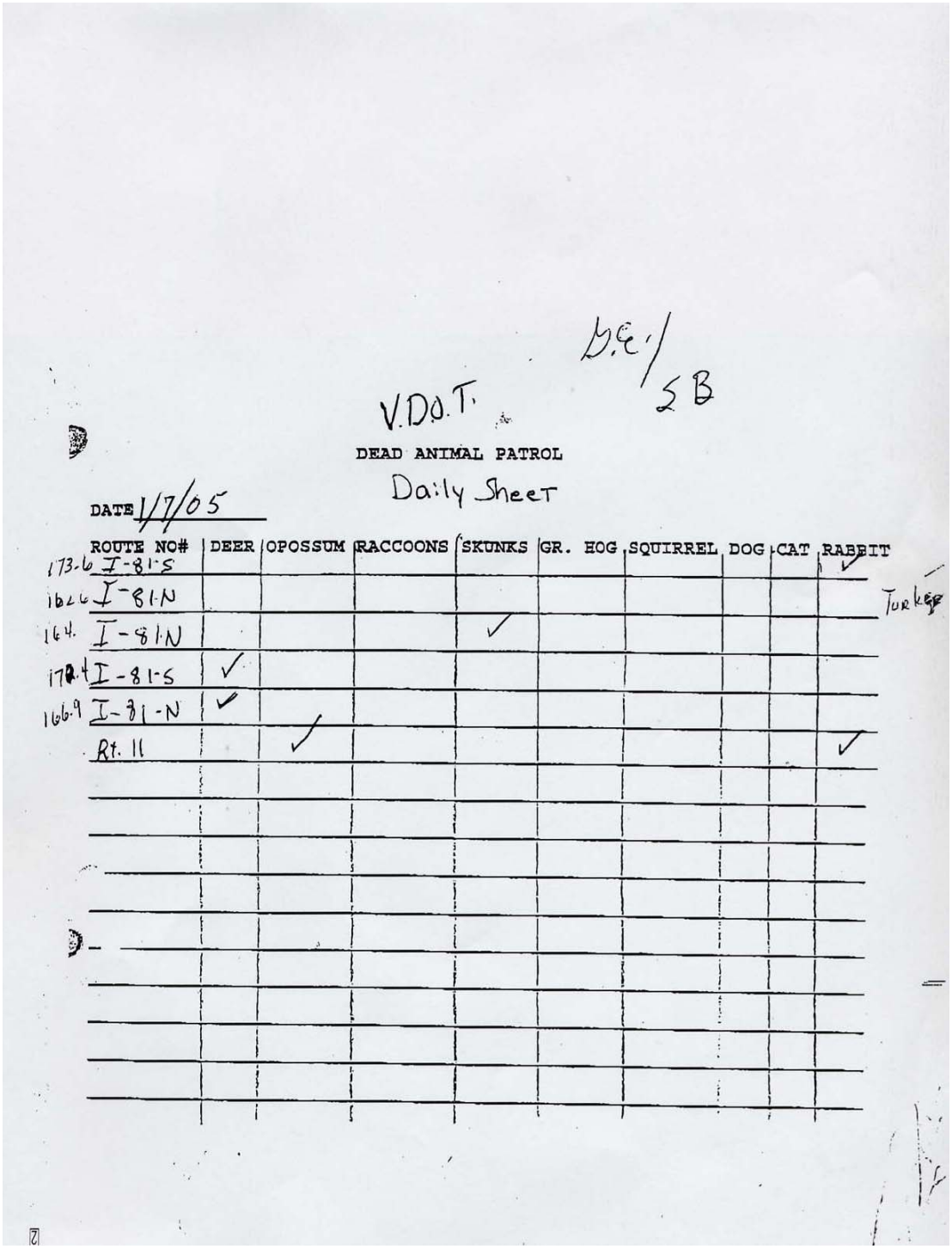
Summary	HOURS		DAYS

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

Authorized by Date

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 cro
Bear	Bear	NULL	9/18/2005	9/18/2005	1007	1007	Derby	910	I 91	175.25	175.25	Bear dead in road one
Bear	Bear	bear	10/24/2005	10/24/2005	215	215	Sunderl	70	US 7	4.8	4.8	100 to 150 lb dead bea
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	Concorc	20	US 2	9.7	9.7	Vehicle struck a moos
Moose	Moose	RCARRIER	4/14/2005	4/14/2005	212	212	Searsbu	80	VT 8	0.65	0.65	ADULT MOOSE CRO
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 TW
Moose	Moose	removed by game warden	7/13/2005	7/13/2005	909	909	Randolp	890	I 89	34	34	young male moose. kil
Moose	Moose	RCARRIER	7/14/2005	7/15/2005	1321	1321	Whiting	1000	VT 100	10.3	10.3	MOTHER AND CAL
Moose	Moose	dalehall	7/16/2005	7/16/2005	514	514	Lunenb	20	US 2	2.2	2.2	The Moose was hit by
Moose	Moose	tlewis	9/22/2005	9/22/2005	507	507	Concorc	20	US 2	6.4	6.4	Bull moose struck and
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 CROS
Moose	Moose	RCARRIER	11/7/2005	11/23/2005	209	214	Readsbc	1000	VT 100	1.5	1.5	TWO BULLS AND A
Moose	Moose	RCARRIER	11/29/2005	11/30/2005	1321	1321	Whiting	1000	VT 100	9.9	9.9	ADULT COW MOOS
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	Hartlanc	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									✓
162.6 I-81-N									Turkey
164. I-81-N				✓					
178.4 I-81-S	✓								
166.9 I-81-N	✓								
Rt. 11		✓							✓

FORM M-73

WILDLIFE HIGHWAY MORTALITY FORM

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	W S	MD	F	A	C	A					
2-13	US 26	119.4	W	MD	F	A	C	F					
2-13	US 26	103.4	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	107.7	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	Reference	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	HWY 789	109.2	E	MD	M	A	C	B					
3-22	133	5.2	E	MD	F	T	C	U					
3-22	HWY 34	20.9	S	MD	F	A	C	F					
3-23	789	112.8	E	MD	[illegible]	J	C	B					
3-23	789	107.5	W	MD	M	A	C	A					

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

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.*

APPENDIX E: NCHRP PANEL MEMBERS

NCHRP Project 20-05/Topic 37-12, FY 2005

Animal - Vehicle Collision Data Collection

Members

Ms. Debbie Bauman
Environmental Analyst and Public Involvement Coordinator
New Mexico DOT
1120 Cerrillos Road--Joe M. Anaya Building
PO Box 1149
Santa Fe, NM 87504-1149
Phone: 505/827-0703
Fax: 505/490-1128
Email: debra.bauman@state.nm.us

Mr. William Branch
Environmental Analyst
Maryland State Highway Administration
Phone: 515/239-1428

Baltimore, MD 21202
Phone: 410/545-8626
Fax: 410/209-5003
Email: wbranch@sha.state.md.us

Mr. Duane Brunell
Safety Performance Analysis Manager
Maine DOT
16 State House Station
Safety Office, 3rd level-Child St. side
Augusta, ME 04333-0016
Phone: 207/624-3278
Fax: 207/624-3301
Email: Duane.Brunell@maine.gov

Dr. James H. Hedlund
Highway Safety North
110 Homestead Road
Ithaca, NY 14850
Phone: 607/273-5645
Fax: 607/277-1426
Email: jhedlund@sprynet.com

Dr. Keith K. Knapp
Assistant Professor
University of Wisconsin - Madison
College of Engineering, Department of Engineering Professional Development
432 North Lake Street, Room 713
Madison, WI 53706
Phone: 608/263-6314
Fax: 608/263-3160
Email: knapp@epd.engr.wisc.edu

Dr. Michael Pawlovich
Iowa DOT
Office of Traffic and Safety
800 Lincoln Way
Ames, IA 50010
444 N. Capitol Street, NW, Suite 249
Fax: 515/239-1891
Email:
michael.pawlovich@dot.iowa.gov

Mr. Greg Placy
District Engineer-District 1
New Hampshire DOT
641 Main St
Lancaster, NH 03584
Phone: 603/788-4641
Fax: 603/788-4260
Email: gplacy@dot.state.nh.us

FHWA Liaison

Mr. Dennis Durbin
Federal Highway Administration
Office of Natural and Human Environment, HEPN-30
400 Seventh St SW
Washington, DC 20590
Phone: 202/366-5045
Fax: 202/366-3409
Email: dennis.durbin@fhwa.dot.gov

Ms. Carol Tan
Highway Research Engineer
Federal Highway Administration
Turner-Fairbank Highway Research Center, HRDS-06
6300 Georgetown Pike
McLean, VA 22101-2296
Phone: 202/493-3315
Fax: 202/493-3374
Email: carol.tan@fhwa.dot.gov

Other Liaison

Mr. Keith Sinclair
FHWA Liaison to AASHTO, Highway Safety Programs Manager
AASHTO
707 N Calvert St, C-306
Washington, DC 20001
Phone: 202/624-3648
Fax: 202/624-5469
Email: KSinclair@aashto.org
Cell Phone: 443-538-7318
FHWA Baltimore Office: 410-962-3742

TRB Liaison

Dr. Richard Pain
Transportation Safety Coordinator
Transportation Research Board
Technical Activities (Div. A)
500 Fifth Street NW, 4th Floor
Washington, DC 20001-2721
Phone: 202/334-2964
Fax: 202/334-2003
Email: rpain@nas.edu

Synthesis Staff

Ms. Donna Vlasak

Senior Program Officer
Transportation Research Board
Studies and Information Services (Div. B)
500 Fifth Street NW, K-326
Washington, DC 20001-2721
Phone: 202/334-2974
Fax: 202/334-2081
Email: dvlasak@nas.edu

Interested Observer

Mr. Leonard Sielecki
WARS Manager
Ministry of Transportation-Eng.
Branch, Environmental Mgmt.
4B-940 Blannnshard St.
PO Box 9850 Stn Prov Govt
Victoria, BC V8W9T5 Canada
Phone: 250/357-7768
Fax: 250/387-7735
Email: leonard.sielecki@gov.bc.ca

APPENDIX F: RESPONSES TO THE 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 G: RESPONSES TO THE AVC SURVEY

Table G1. 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 G1 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 G2. 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 G2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 1: <u>DATE</u>**	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: <u>TIME</u>	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: <u>DISTRICT or UNIT</u>	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: <u>NAME of OBSERVER</u>	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: <u>ROAD/ROUTE ID</u>	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: <u>COLLISION LOCATION</u>	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: <u>FATALITIES</u>	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 G2 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 G2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 15: <u>REMOVAL OF CARCASS</u>**	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: <u>GPS</u>**	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: <u>MAP</u>	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: <u>REFERENCE or MILE POST</u>	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: <u>ROAD SECTION</u>	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: <u>OTHER</u>	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 G2 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 YARD 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 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	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 G2 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 G2 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 Sp. 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 G3. 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 G4. 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 G4 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 G4 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 G5. 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 H: RESPONSES TO THE AC SURVEY

Table H1. 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 H1 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 H2. 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%
		Montly	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 H2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 1: <u>DATE</u>**	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: <u>TIME</u>	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: <u>DISTRICT or UNIT</u>	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: <u>NAME of OBSERVER</u>	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: <u>ROAD/ROUTE ID</u>	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: <u>CARCASS LOCATION</u>	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: <u>FATALITIES</u>	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 H2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 8: <u>INJURIES</u>**	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: <u>TYPE OF INJURY</u>	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: <u>PROPERTY DAMAGE</u>	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: <u>AMOUNT OF PROPERTY DAMAGE</u>	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: <u>ANIMAL SPECIES</u>	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: <u>SEX OF ANIMAL</u>	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: <u>AGE OF ANIMAL</u>	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 H2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 15	**Do you record one or more of the following parameters? Part 15: <u>REMOVAL OF CARCASS</u>**	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: <u>GPS</u>**	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: <u>MAP</u>	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: <u>REFERENCE or MILE POST</u>	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: <u>ROAD SECTION</u>	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: <u>OTHER</u>	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 H2 Continued

#	QUESTION	RESPONSE	DOT		DNR	
Q. 17	**How precise is the carcass information? Part 1: <u>WITHIN 1 YARD OR METER</u>**	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: <u>WITHIN 15 YARD OR METERS</u>	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: <u>WITHIN 30 YARDS OR METERS</u>	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: <u>WITHIN 0.1 MILE OR KILOMETER</u>	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: <u>WITHIN 1 MILE OR KILOMETER</u>	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: <u>OTHER</u>	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 H2 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 H2 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 H2 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 Sp. 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 H3. 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 H4. 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 H4 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 H4 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 H5. 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%