

**FINAL REPORT**  
**COLLISIONS INVOLVING MOTOR VEHICLES AND LARGE ANIMALS IN**  
**CANADA**

**TO**  
**TRANSPORT CANADA ROAD SAFETY DIRECTORATE**

**BY**  
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## Executive Summary

In Canada the issue of collisions between large animals and motor vehicles poses particular challenges in view of the number of national and provincial parks and much of the land bordering roadways is wilderness and open range where large animal crossings are common and unpredictable.

Many of the stakeholders involved in this issue believe that the issue of collisions between motor vehicles and large animals is posing a threat to road safety and to our wildlife population. Generally speaking, they also agree that there is an underestimation of the number of collisions between animals and motor vehicles. This report addresses this claim.

Mitigation measures are generally designed to prevent animals from crossing at particular points or to inform motorists that animals are occupying the roadway. Clearly there is no quick and easy fix to this particular type of collisions and they are on the rise. When accounting for the underreporting phenomena they may cost society in general more than \$200,000,000 annually. In fact, the problem may be far greater than is publicly known.

With the development of new technologies there is potential for reducing these collisions. This, however, will take some time since these new technologies are not proven yet and, as reported above, it is important that a more rigorous validation of technologies be established when it comes to mitigation measures. Furthermore, necessary funding to support expensive new technologies will be needed. The fact that probably between **4 to 8 large animal-vehicle collisions take place every hour in Canada** is a clear signal that something has to be done to reassure the public since the issue can be emotional.

Key findings of this research are as follows:

- As suspected, the phenomena of underreporting exists
- A balanced approach between motorist safety and wildlife protection should be used for the development of mitigation measures.
- Awareness campaigns are more or less necessary and should be a part of any mitigation policy
- The use of Wildlife Accident Reporting System (WARS) should be promoted nationally to report wildlife animal-vehicle collisions.
- There is a need to establish a National Research Clearing-House to provide up-to-date, accurate and validated information on mitigation measures
- The case of moose-vehicle collisions is probably as problematic but not as widespread as deer-vehicle collisions. It could be a focus for our Canadian research
- In view of the underreporting phenomena, there is a need to establish simple benchmarks and predictive tools on this issue.
- It is worrying for many that motor vehicles may be the number one predator for deer and other wildlife. If it is the case, the number of animal-vehicle collisions can only go up.

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## **1. INTRODUCTION**

The issue of collisions between motor vehicles and large wild animals such as deer and moose has been attracting attention for many years. In fact, the literature on this issue goes as far back as the late 1920s'. In Canada the issue of collisions between large animals and motor vehicles poses challenges in view of the number of national and provincial parks and much of the land bordering roadways is wilderness and open range where large animal crossings are common and unpredictable. This issue is, however, not unique to Canada. Therefore there are lessons to be learned and experience to be gained from other countries experiencing a similar problem.

The issue of collisions between motor vehicles and large animals has been addressed using traditional and technological mitigation measures. Many provinces have been active on this issue for many years. Parks Canada has also been looking for solutions for many years; most notably in the areas of the Kootenay National Park, Jasper and Banff National Parks.

Mitigation measures are generally designed to prevent animals from crossing at particular points or to inform motorists that animals are occupying the roadway. These measures may focus on the infrastructure and also include driver awareness. But there has been a range of other measures developed over the years ranging from ultra sound technology to scare animals away and to the use of natural techniques to discourage animals from crossing. Lately we have seen motor vehicle manufacturers developing new visual systems to alert drivers of the presence of animals on the roadways.

This project also identifies some of the stakeholders at the federal/provincial and in some cases, municipal levels interested in this issue. These stakeholders believe that the issue of collisions between motor vehicles and large animals is posing a threat to road safety. They also believe that these collisions are posing a threat to our wildlife population. Generally speaking, they also agree that there is an underestimation of the number of collisions between animals and motor vehicles. This report will address this claim.

The report includes a conclusion and provides some recommendations and a possible role for Transport Canada Road Safety Directorate on this national issue.

## **2. SCOPE**

This project will focus more particularly on motor vehicle collisions involving the following animals: deer and moose. The case of other animals such as bighorn sheep may also be stated; particularly as they relate to specific situations in our National Parks. This project will not deal with large domestic animals such as cows and also, will not deal with smaller wild animals such as raccoons and skunks.

This project will investigate the issue as it pertains to motor vehicles but will not include off-road vehicles. Inasmuch as possible the data will show the period 1996 to 2000.

### **3. OBJECTIVES**

This project has the following objectives:

- Determine the magnitude and nature of the issue by confirming the collisions involving fatalities, serious injuries and property damage counts by province
- Establish current provincial policies and practices with regards to the measurement of collisions involving motor vehicles and large animals
- Look at possible mitigation measures (vehicle and infrastructure measures, driver awareness) put into place to address the issue at the national level
- Establish a list of contacts at the federal/provincial/municipal levels of persons and organizations interested and active in this issue
- Determine the level of interest in this issue at international levels and report on their actions taken

### **4. METHODOLOGY**

This project reviewed the existing Transport Canada database and attempted to collect data from each provincial government. Contacts were made by phone or electronically with all provincial and territorial governments to confirm the data contained in the national database and collect other sources of data if possible. Contacts were also established with wildlife officials in some Provinces and at the national level as well with Parks Canada officials.

The review of the literature was performed using the Internet and library sources.

### **5. REVIEW OF LITERATURE**

A review of the literature on the subject of collisions involving motor vehicles and large animals has been conducted as part of this project. As can be noted from the bibliography attached to this report, there is a large body of literature on the subject and some even goes back to the 1920s'. It seems therefore that the issue of motor vehicles colliding with animals has been identified as an issue some time ago. (Devos 1949, Dickerson 1939, Jahn 1959, Stoner 1925 and Washburn 1927). In fact, wildlife mortality associated with roadways has continually increased during the 20<sup>th</sup> century as vehicle speed and traffic volumes have increased. (Danielson & Hubbard, 1998).

The only national statistics available in Canada confirms that deer-vehicle collisions have increased significantly since 1996. These statistics are often deemed to be conservative since numerous hits may not be recorded. (Romin & Bissonnette, 1996) A few research attempts have been made to estimate the gap between the official statistics and the real number of collisions. (Damas & Smith, 1982) Determining the cause of these accidents have also proven difficult (Danielson & Hubbard, 1998).

Thus, it has long been recognized that transportation corridors have an effect on wildlife population throughout North America. (Damas & Smith 1982, Romin & Bissonnette 1996). It has also been recognized that the same collisions pose a serious threat to human

life and can be considered a major safety problem (Bertwistle 2002, Danielson & Hubbard, 1998). Furthermore, and probably equally important, these collisions have an economic consequence that may be considered significant (property damage and animal loss) (Adamowicz 1991, Bertwistle 2002, Conover 1995, Decker 1990, Erie Insurance 2001, Hansen 1983, Krohm, 1999, Langford 1978, Romin & Bissonette 1996 and Transportation Research Board 1997).

A few studies provide an estimate of the costs involved as a result of collisions between motor vehicles and deer:

- Average cost of a collision between an automobile and a deer is estimated to be around \$ 2 800 Cdn (Erie Insurance 2001, ICBC, 2000, Krohm, 1999, Romin & Bissonette, 1996)
- The estimated value of a deer in 1996 was estimated at approximately \$ 1 700 Cdn (ICBC, 2000, NCHRP, 2002, Romin & Bissonette 1996)

Mitigation measures to reduce collisions involving motor vehicles and wildlife has been on-going for many years and these measures have been scientifically evaluated. (Alberta Transportation 1982, Dillon Consulting 1997, Falk 1978, Feldhamer 1986, Farrell, 2002, Ford 1993, Gilbert 1982, Gladfelter 1982, Green 1997, Lo 2003, Robinson 2001, Romin 1992, 1996) The review of the literature shows that there is no “magic bullet” when it comes to deterring wildlife-vehicle collisions. In fact the reasons for the poor results derived from these studies are numerous, but often they are the result of a lack of monetary input sufficient to provide adequate replication. (Danielson & Hubbard, 1998).

The literature review also identified conferences and gatherings on this specific issue. Some of these gatherings include: Roads, Rails and the Environment Workshops, Parks Canada, Southeast Deer Study Group, Oklahoma Department of Wildlife Conversation, Transportation Research Board in Washington and Western Transportation Institute. Some specific web sites now exist in the United States and provides comprehensive information. An example of such a web address is [www.deercrash.com](http://www.deercrash.com).

On the data side, Transport Canada provides data identifying collisions where a vehicle hits an animal in Canada. Few national databases differentiate between large wildlife animals and domestic animals. Parks Canada also maintained a database for the parks they administer such as Banff and Jasper National Park. In the latter case, they can provide data going back to 1951. (Bertwistle, 2002)

Provincial databases also exist and are generally provided by Provincial Ministries of Transportation and Highways and by Provincial Ministries of Natural Resources or Environment. In Provinces with public insurance coverage (Saskatchewan and British Columbia) data are also gathered for all vehicle collisions because the Province provides coverage for all accidents and generally insure the vast majority of car owners. What the latest databases show is that, with the increase in motor vehicle population, we can notice a sizeable increase in the number of collisions between motor vehicles and large animals such as elk, bighorn sheep and deer. (Danielson & Hubbard, 1998, ICBC, 2000,).

Generally speaking, it has been estimated that the total number of collisions involving motor vehicles and large animals has been underestimated by 20 to 30%. (Damas and Smith 1982) Some of the provincial and wildlife officials go as far as evaluating this underestimation by as much as 50%. (Miller, 1985)

The question of data correlation between the national database and provincial databases will be reviewed in the next chapter and corroborates the underestimation statements.

The issue of predictability or benchmarking of collisions between large animals and motor vehicles has also been raised and identified in the literature. However, most of the literature on the issue of predictability and benchmarking has been focused on the wildlife population and very little on human fatalities and injuries and even less on the question of property damage. (Danielson & Hubbard, 1998, Jahn 1959, Lintalk 1987, NCHRP, 2002 and Siegler 1949) So far, limited research has led to the establishment of benchmarks or predictive tools for risk analysis or risk containment on this issue (Danielson & Hubbard, 1998)

As stated in the opening paragraph of this chapter the body of literature on this issue is vast and research on this issue has been undertaken for many years and in many countries.

## **6. REVIEW OF DATA SOURCES**

Motor vehicle collisions in Canada must be reported when they involve a fatality, an injury or property damage exceeding a certain amount of dollars. This amount is constant from Province to Province and is established at \$1,000. In all these cases, a police report is usually filed and collision causes are reported. Where private insurance companies cover the damage to property, it is perceived by many that the level of underreporting may be greater than estimated. In the case of British Columbia, Saskatchewan and Manitoba, public insurance organizations cover the cost of property damage resulting from a motor vehicle accident for most of the collisions. This should make it possible to evaluate the size of underreported collisions for these three provinces and validate an earlier claim that there might be as much as 30% of underreporting on this issue.

According to tabulated statistics by Transport Canada, in 2000 there were over 30 000 collisions involving motor vehicles and animals in Canada. The data does not allow a differentiation between wild animals and domestic animals or between large animals and smaller animals. Nevertheless, of these collisions 23 were fatal collisions, 1 887 were collisions with injuries and 28 826 of those collisions resulted in property damage only. The Transport Canada statistics for the period 1996 to 2000 are as follows:



**Exhibit 6.1**  
**Collisions where a vehicle hits an animal – Canada**

Province	Fatal Collisions				
	1996	1997	1998	1999	2000
Alberta	0	0	0	2	1
British Columbia	1	0	1	2	0
Manitoba	1	1	0	0	0
New Brunswick	3	1	3	4	4
Newfoundland	3	0	1	0	3
Nova Scotia	0	0	2	1	0
N.W.T	0	0	0	0	0
Ontario	5	5	4	5	7
P.E.I.	0	0	0	0	1
Quebec	6	2	1	6	5
Saskatchewan	1	2	2	1	2
Yukon	0	0	0	0	0
<b>TOTAL</b>	<b>20</b>	<b>11</b>	<b>14</b>	<b>21</b>	<b>23</b>

Source: Transport Canada, Road Safety Directorate

**Exhibit 6.2**  
**Collisions where a vehicle hits an animal – Canada**

Province	Collisions with Non-Fatal Injury				
	1996	1997	1998	1999	2000
Alberta	0	0	0	150	160
British Columbia	225	193	201	185	236
Manitoba	124	108	127	158	160
New Brunswick	88	91	124	125	117
Newfoundland	56	48	50	78	62
Nova Scotia	2	72	84	79	105
N.W.T	2	3	2	4	3
Ontario	438	496	498	562	585
P.E.I.	6	4	13	12	9
Quebec	225	231	328	275	330
Saskatchewan	88	119	111	129	117
Yukon	8	7	5	4	3
<b>TOTAL</b>	<b>1,262</b>	<b>1,372</b>	<b>1,543</b>	<b>1,761</b>	<b>1,887</b>

Source: Transport Canada, Road Safety Directorate

**Exhibit 6.3**  
**Collisions where a vehicle hits an animal – Canada**  
**Collisions with Property Damage Only**

Province	1996	1997	1998	1999	2000
Alberta	0	0	0	4430	4672
British Columbia	1123	659	682	709	931
Manitoba	2101	2179	2361	2755	2658
New Brunswick	784	795	876	948	876
Newfoundland	276	263	273	295	336
Nova Scotia	10	743	799	798	770
N.W.T	8	9	11	13	10
Ontario	7766	8014	8515	9026	10503
P.E.I.	13	12	16	12	23
Quebec	5476	5959	6215	5978	6082
Saskatchewan	2536	1914	1879	1987	1936
Yukon	29	26	25	26	29
<b>TOTAL</b>	<b>20,122</b>	<b>20,573</b>	<b>21,652</b>	<b>26,977</b>	<b>28,826</b>

Source: Transport Canada, Road Safety Directorate

Note: Data exclude Alberta from 1996 to 1998.

The data shows that collisions between motor vehicles and animals are on the increase and by as much as 40% depending on what consequence is being looked at. In terms of collisions with fatalities, even though there was a huge increase from 1997 to 2000 in percentages, we are still looking at a relatively small number of fatalities per year when taken into a context of total fatalities as a result of collisions involving motor vehicles.

But since the total number of collisions between large animals and motor vehicles is very high and, could be even higher provided we can substantiate the claim that there might be as much as 30% of unreported collisions, these collisions are not rare events in Canada.

Even though Provincial Governments supply Transport Canada with data, the project surveyed Provincial governments to confirm the Transport Canada database and see if other databases may exist. Hereunder are the Provincial databases obtained in the course of this investigation.

**Exhibit 6.4**  
**Moose /Vehicle Collisions in Newfoundland 1996 –2001**

Year	Total Collisions	Collisions With Injuries	Collisions With Fatalities
2000	378	76	2
1999	356	99	0
1998	310	61	2
1997	292	66	0
1996	326	61	2

Source: Department of Public Works, Services and Transportation

The Province of Newfoundland & Labrador is concerned specifically with the safety consequences of collisions involving moose and motor vehicles. The number of collisions

average 335 over a 5-year period. No specific upward or downward trend seems to emerge from the Newfoundland & Labrador statistics and more or less confirm Transport Canada's database.

#### **Exhibit 6.5**

##### **Number of Deer-Vehicle Collisions in Nova Scotia 1996 –2000**

Year	Total Collisions	Collisions With Injuries	Collisions With Fatalities	Collisions With Property Damage
2000	825	99	0	726
1999	847	76	0	771
1998	812	74	2	736
1997	764	66	0	697
1996	657	63	0	594

Source: Nova Scotia Department of Transportation and Public Works –Highway Engineering Services – Asset Management

In the case of Nova Scotia, their focus is on deer-vehicle collisions. On this issue, Nova Scotia is showing a significant increase from 1996 to 2000 in their number of collisions and in their number of collisions with injury. The number of collisions with fatalities is still very small and in some years, non-existing. Nova Scotia also records collisions between vehicles and other wild animals and domestic animals

#### **Exhibit 6.6**

##### **Number of Other Wild Animal-Vehicle Collisions in Nova Scotia 1996 –2000**

Year	Total Collisions	Collisions With Injuries	Collisions With Fatalities	Collisions With Property Damage
2000	70	28	1	41
1999	65	19	0	46
1998	59	18	1	40
1997	48	12	0	36
1996	51	22	0	29

#### **Exhibit 6.7**

##### **Number of Domestic Animal-Vehicles Collisions in Nova Scotia 1996 –2000**

Year	Total Collisions	Collisions With Injuries	Collisions With Fatalities	Collisions With Property Damage
2000	75	26	0	49
1999	72	21	1	50
1998	76	24	2	52
1997	76	10	0	66
1996	69	19	0	50

Source: Nova Scotia Department of Transportation and Public Works –Highway Engineering Services – Asset Management

In the case of Nova Scotia, once we add together the three categories of animals and compare with the Transport Canada data, the Transport Canada database seems to underreport the number of collisions by a factor of 5% only.

**Exhibit 6.8**  
**Number of Animal\* - Vehicle Collisions in Alberta 1996 –2000**

Year	Total Collisions	Collisions With Injuries	Collisions With Injuries Fatalities	Collisions With Injuries Property Damage Only
2000	9 868	262	2	9 604
1999	9 077	273	5	8 799
1998	9 371	261	6	9 104
1997	7 919	258	3	7 658
1996	7 525	199	4	7 322

\* Includes wild and domestic animals

Source: Alberta Transportation

The statistics for Alberta shows an increase of 30% from 1996 to 2000 in the number animal-vehicle collisions. Again, as per other data shown before, the number of collisions with fatalities is rather small. This is the first set of data that shows such a wide discrepancy between the Transport Canada data and Provincial data. In this case the difference is as big as 100%. The gap between the two databases could not be explained during the course of this investigation.

These three Provinces represent good examples of Provinces where private insurance companies alone are providing insurance coverage for collisions. So far, only the Province of Alberta is showing that the problem of underreporting could be in fact as serious as believed by most experts. However, in the case of both Newfoundland and Nova Scotia the federal and provincial databases seem to concur in their outcome.

In order to carry this investigation further, we contacted public provincial insurance organizations such as the Saskatchewan General Insurance (SGI) and the Insurance Corporation of British Columbia (ICBC). The two organizations provide almost 95% insurance coverage in their respective Provinces and cover both property damage as well as bodily injuries. Furthermore, wild animals-vehicle collisions, such as deer and moose, are fully covered under their insurance plans.

**Exhibit 6.9**  
**Comparison of Wildlife-Vehicle Collisions in Saskatchewan According to:**  
**Traffic Accident Information System and SGI claims 1996-2000**

Year	Total Collisions	Collisions With Injuries	Collisions With Fatalities	Collisions With Property Damage Only	SGI Claims related to Animal Collisions
2000	2 205	196	2	2 007	10 645
1999	2 228	190	1	2 037	9 998
1998	2 112	156	0	1 956	9 566
1997	2 158	188	2	1 968	10 174
1996	2 683	132	3	2 683	10 120

Source: Saskatchewan General Insurance

First of all, the statistics for Saskatchewan shows a fairly steady number of collisions but most importantly it shows that looking back at the Transport Canada statistics and their own traffic information system, underreporting of collisions with large animals may reach an amazing rate of 400%. In the case of Saskatchewan, deer-vehicle collisions represent more than 80% of all collisions involving a motor vehicle and an animal.

In British Columbia, the Insurance Corporation of British Columbia (ICBC) is the primary insurance company for close to 95% of British Columbia residents. ICBC provided the following statistics:

**Exhibit 6.10**  
**Number of Animal-Vehicle Collision Claims for British Columbia 1997-2001**

Year	Claim Count		Injured Participant Count
	Number	Amount	Number
2001	9 789	\$27,384,820	386
2000	8 546	\$23,665,065	282
1999	8 506	\$20,872,119	233
1998	8 156	\$18,276,328	215
1997	7 267	\$15,970,890.	218
Total	42 264	\$106,169,223	1 234

Source: Insurance Corporation of British Columbia

The number of claims related to animal collisions is on the rise in British Columbia by as much as 34% over a five-year period and the number of injuries rose by as much as 70% over the same 5-year period. The ICBC data also provided us with an average dollar amount per claim. For 2001, the average claim amounted to \$2,800. This would seem to correspond with previous estimates seen in the literature review. (Krohm, 1999, Erie Insurance, 2001)

As for the underreporting issue, British Columbia figures confirm the SGI differences between traffic reporting and claims reporting. Although the phenomenon is not found anywhere in the scientific literature, it is however possible for these two Provinces the no-fault approach may lead to an overestimate of the collisions. We know for instance

that in those Provinces, motor vehicle collisions with domestic animals are not covered under the public insurance plan whereas collisions involving wild animal are covered.

The present investigation may have substantiated what most always believed that there is a major underreporting of animal-vehicle collisions. The data collected show the problem as follows:

**Exhibit 6.11**  
**Possible Level of Underreporting of Collisions Involving a Motor Vehicle and an Animal 1999 -2000**

Year	Total Number of Collisions									
	TC	Nfld*	TC	NS	TC	Sask*	TC	Alb	TC	BC*
1999	373	356	878	984	2,117	9,998	4,582	9,077	896	8,506
2000	401	378	875	970	2,055	10,645	4,833	9,868	1,167	8,546

**\*Newfoundland: moose only statistics \* Sask: SGI claims \* BC: ICBC claims**

Other statistics collected during the course of this project dealt with other issues perhaps not as well identified in the literature. One has to do with the percentage of deer-related collisions versus other animals involved and another issue deals with the types of motor vehicles involved in those collisions.

Provincial data from Nova Scotia provided some details on that issue. The region of Ottawa Carleton, also recognized as a major area for those collisions, provided us with a breakdown of collisions involving wild and domestic animals.

**Exhibit 6.12**  
**Collisions Involving an Animal and a Motor Vehicle –Ottawa- Carleton Area 1996-2000**

	1996	1997	1998	1999	2000
Total Collisions Animal-Vehicle	390	493	520	551	685
Wild Animals	363	476	493	536	671
Deer-Vehicle Collisions	355	469	479	502	628
Moose-Vehicle Collisions	8	5	7	1	4
Domestic Animal-Vehicle Collisions	27	17	27	15	14

Source: City of Ottawa

The data from the City of Ottawa shows clearly that collisions with wild animals are the main types of animals collisions with motor vehicles. In this case, deer-vehicle collisions are the number one problem for the City of Ottawa.

Another valuable information covered by this investigation is the type of motor vehicles involved in those collisions.

**Exhibit 6.13**  
**Types of Vehicles Involved in Collisions With Animals and with a Fatality**  
**Canada 1996- 2000**

	Autos	LTVs'	Buses	Straight Trucks	Tractor-Trailers
1996	13	5	0	0	1
1997	8	3	0	0	0
1998	7	3	0	0	0
1999	15	6	0	0	1
2000	19	2	0	1	0

**Exhibit 6.14**  
**Types of Vehicles Involved in Collisions with Animals and with Injuries**  
**Canada 1996- 2000**

	Autos	LTVs'	Buses	Straight Trucks	Tractor-Trailers
1996	884	257	4	14	10
1997	961	281	2	15	17
1998	1059	354	3	10	10
1999	1148	442	3	10	22
2000	1265	432	5	10	19

**Exhibit 6.15**  
**Types of Vehicles Involved - Collisions with Property Damage Only 1996- 2000**

	Autos	LTVs'	Buses	Straight Trucks	Tractor-Trailers
1996	13,021	6,213	30	220	534
1997	13,423	6,316	17	186	523
1998	13,990	6,688	27	219	588
1999	15,959	9,807	27	295	749
2000	17,140	10,337	35	331	800

Source: Transport Canada Road Safety Directorate

**Exhibit 6.16**  
**Types of Motor Vehicles Involved in Animal-Vehicle Collisions Nova Scotia 2000**

<b>Vehicle Type</b>	<b>Collisions With Property Damage Only</b>	<b>Collisions With Personal Injury</b>	<b>Collisions With Fatality</b>	<b>Total</b>
Automobile	511	71	0	582
Pick up Truck	129	13	0	142
Van <5 000kg	68	4	0	72
Trucks > 5000kg	3	1	0	4
Tractor Trailers	1	2	0	3
Motorcycle	0	9	0	9
Emergency vehicle	1	0	0	1
Not stated	19	2	0	21
<b>Total</b>	<b>732</b>	<b>103</b>	<b>0</b>	<b>835</b>

Source: Nova Scotia Department of Transportation and Public Works –Highway Engineering Services – Asset Management

These statistics confirm that the automobiles and the pick up trucks are the motor vehicles most involved in animal-vehicle collisions. This is to be expected given that they are likely the most registered type of vehicles.

At least one Provincial Ministry of Transportation, British Columbia, collects data by region, by district, by highway segment number, by kilometer and by species involved in these collisions. This data collection system is called the Wildlife Accident Reporting System (WARS). The WARS system was implemented in the late 1980s and, in some cases, may contain data dating back to 1978. In British Columbia, WARS reports are available to the public. WARS reports are extremely useful to Highway authorities to decide on the posting of highway signs to signal to the motoring public the presence of deer for instance or moose. Other Provinces collect similar data as those collected under WARS but generally speaking these data are not available to the public.

Wars data come from contracted Highways Maintenance personnel. In some cases, this source of information has become less reliable with the privatization of these services. For this reason, in the case of Provinces with a public insurance plan like ICBC, the claims data probably remains the safest data source in those Provinces for establishing the total number of collisions and the total costs of those collisions. It is, however, less accurate to provide the exact location of those collisions and makes it more difficult to plan mitigation measures.

The data collected by the Provinces is also useful in establishing the patterns of those collisions. For instance, some provinces collect data on the time of day the collisions take place and also the time of the year. Nova Scotia keeps excellent statistics on these characteristics.

**Exhibit 6.17**  
**Time of Year Animal-Vehicle Collisions Nova Scotia 1998-2000**

<b>Month</b>	<b>Total Collisions 98</b>	<b>Total Collisions 99</b>	<b>Total Collisions 00</b>
January	37	33	27
February	42	24	30
March	36	30	28
April	42	39	34
May	56	72	58
June	85	83	115
July	75	87	83
August	67	69	41
September	37	78	83
October	96	108	114
November	<b>178</b>	<b>143</b>	<b>156</b>
December	61	81	56
<b>Total</b>	<b>812</b>	<b>847</b>	<b>825</b>

Source: Nova Scotia Department of Transportation and Public Works –Highway Engineering Services – Asset Management



Consistently, October and November are the months with the most collisions in Nova Scotia. On average, 30% of all animal-vehicle collisions take place during those two months alone.

**Exhibit 6.18**  
**Time of Day Animal-Vehicle Collisions Nova Scotia 1998-2000**

<b>Time of Day</b>	<b>Total Collisions 98</b>	<b>Total Collisions 99</b>	<b>Total Collisions 00</b>
<b>a.m.</b> 12:00 to 1:00	18	27	17
1:00 to 2:00	27	24	15
2:00 to 3:00	20	20	22
3:00 to 4:00	13	15	14
4:00 to 5:00	16	19	14
5:00 to 6:00	27	30	22
6:00 to 7:00	26	32	40
7:00 to 8:00	48	50	40
8:00 to 9:00	37	29	33
9:00 to 10:00	23	16	28
10:00 to 11:00	24	31	36
11:00 to 12:00	22	24	24
<b>p.m.</b> 12:00 to 13:00	12	16	26
13:00 to 14:00	10	15	16
14:00 to 15:00	12	13	14
15:00 to 16:00	14	9	18
16:00 to 17:00	23	15	17
17:00 to 18:00	53	55	44
18:00 to 19:00	58	59	57
19:00 to 20:00	70	70	58
20:00 to 21:00	60	71	72
21:00 to 22:00	<b>83</b>	69	<b>83</b>
22:00 to 23:00	64	56	50
23:00 to 24:00	37	<b>75</b>	47
Not stated	15	7	18
<b>Total</b>	<b>812</b>	<b>847</b>	<b>825</b>

Source: Nova Scotia Department of Transportation and Public Works –Highway Engineering Services – Asset Management

Exhibit 6.18 shows that, in Nova Scotia, the time of day most dangerous for animal-vehicle collisions seems to be consistently early evening. It should be noted however that animal-vehicle collisions take place at all time during a 24-hour period. For instance, in 2000, 50% of all collisions took place between 7:00 a.m. and 8:00 p.m.

To summarize the points covered in this chapter:

- These references indicate that the number of collisions involving large animals and motor vehicles is very significant and appears to confirm the scientific literature on the underreporting phenomena. Although, in some Provinces, some of the data shows an underestimation as high as 100%, the real number is probably somewhere between this very high percentage and the evidence found in the literature. It is in fact

possible, and probably safe to say, that the underreporting phenomenon may be as high as 40 to 50% and, consequently, the national statistics underestimate the number of animal-vehicle collisions.

- Since there is no consistent tracking of the disposal of animal carcasses, it is impossible to establish a true number of collisions. Furthermore, in some instances an animal like a deer may have been hit but still manage to run away. In some Provinces this type of collision would be reported because a vehicle damage would ensue but in other Provinces it would probably not be reported
- Having established the underreporting phenomena, it is however essential to state that this phenomena is more pronounced for collisions involving property damage only and, to a certain extent, personal injuries. In the case of collisions with a fatality the discrepancies between the national database and provincial databases appear to be very small.
- Although there may be some valid hypothesis one can put forward to explain the underreporting of collisions with property damage, in the case of a collision with injuries the differences between some of the Provincial databases and the national database are difficult to explain.
- On the basis of a 50% underreporting phenomena, the total collisions involving motor vehicles and animals for Canada is more in the order of 45 000 per year and probably growing at an alarming rate of 10 to 15% per year.
- With such a high number of animal-vehicle collisions, it is almost a miracle that we register so few fatalities. The fact that over 80% of the accidents involve deer may explain this relationship. In fact, the greatest impact of those collisions is monetary and is absorbed by society in one form or another.
- Statistics both nationally and provincially confirmed that the automobiles are the leading types of vehicles involved in those collisions.
- Data collection at Provincial levels varies from Province to Province. In some cases, it can be very elaborate and in existence for many years. In other cases, it may have eroded with recent administrative and policy changes. The adoption of the WARS system by British Columbia is a good step in the right direction and a good example of a data collection effort at a North American scale.

National and provincial data show that the most serious effect of animal-vehicle collisions is the property damage resulting from such collisions. And, although federal and provincial databases differ on the number of collisions with property damage only, the problem remains: these collisions represent a significant economic cost to Canadian society in general.

Using a revised total of 45,000 animal-vehicle collisions per year, with an average cost of \$4,500(including the vehicle and the wildlife animal), the minimum economic yearly cost to Canada can be estimated in the order of \$200,000,000. This does not take into account the cost associated with fatalities and personal injuries. This cost estimate only covers the property damage resulting from these collisions.

It is then understandable that with so many collisions and combined to the economic consequence of these collisions, and the destruction of the wildlife, several mitigation

measures have been designed to address this issue over the years. The next chapter will review these mitigation measures.

## **7. REVIEW OF MITIGATION MEASURES**

As part of their data collection, the Provinces generally do a good job at identifying where collisions involving motor vehicles and animals have taken place and the severity of the collision is also noted. This data gathering is usually the first step towards the implementation of mitigation measures. It is far from perfect because in some Provinces many collisions go unreported. It does however provide good information to highway and environmental authorities planning to address this issue in their respective areas.

Mitigation measures can probably be divided into four categories:

- Warning and Awareness of Drivers
- Deterring the Wildlife
- Infrastructure Adaptation
- In-Vehicle Information Systems

The measures designed to mitigate road mortality consist of either changing the behavior of motorists (warning, calming, improving visibility, managing traffic) or animals (modifying movements or access by fencing, gates, passages, altering habitat quality). (Clevenger, 2002)

### *7.1 Warning Signs*

As a standard part of highway design, engineers are required to provide information to motorists about dangerous sections of a roadway. This is done by using warning signs of specified minimum sizes and located at specified maximum intervals with a symbol and/or legible statement describing the nature of the hazard. For example, the "jumping deer" sign is used to warn drivers of areas where concentration of the deer population pose a potential hazard to motorists. This sign may be complemented by another suggesting or, in some cases requesting, drivers to reduce their speed. Deer-crossing warning signs could be effective if motorists reduced their speed; (Bertwistle, 2002, Danielson & Hubbard, 1988) or if these static signs could inform the drivers when and where an animal will appear. (Lo, 2003)

Another approach has been to install non-standard over-sized signs especially for large wild animals such as moose or caribou. This experience was tested in Newfoundland and the same results as with regular signs seem to have taken place. Newfoundland statistics are still showing a significant increase over a 10-year period even after the larger signs were installed.

Highway signs tend to be so common; often for such long stretches of road, that drivers become complacent to the warnings unless the warning on the sign is reinforced by actual experience and drivers see deer in the area. (Danielson & Hubbard, 1998)

Signs probably remain the least expensive and easiest to install and maintain mitigation measure. (ICBC, 2000) The availability of Changeable Message Sign (CMS) opens new possibilities not yet explored. (Sielecki, 2001)

### *7.2 Lower Speed Limits*

This involves lowering the legal speed limit in areas where there is a high deer population and/or a high frequency of wildlife related accidents. The possibility of regulating speed limits between warning signs, especially for night driving, has been explored and used before. Parks Canada has reduced speed limits to 70 km/h in some areas. Parks Canada studies suggest a diminution of the number of collisions for some animals and none for others. (Bertwistle, 2002 and Lo, 2003) It is however difficult to transfer the National Parks experience to other roads because those Parks are well known for its habitat and the roads are in controlled areas. (Lo, 2003) Generally speaking, reduced speed is not always appropriate for open rural highways. (Lo, 2003)

### *7.3 Public Awareness Programs*

Public awareness programs are aimed at educating drivers about the need to take safety precautions in zones that are clearly marked as high wildlife/vehicle accident zones. Such awareness programs stress the unpredictability of animal behavior, the fact that the presence of one animal along the roadside is indicative of the high probability of several more in the vicinity, the need to practice defensive driving, etc. The public is usually informed with a brochure depicting the risks and sometimes showing a collision involving a major animal-vehicle collision. These brochures also identify methods of spotting wildlife along the roads.

There is little research available on the effectiveness of such programs and some of the research published thus far, came from Sweden and shows that the effect of those campaign was marginal. (Miller, 1985).

In spite of inconclusive results, educating motorists of the risk of a large animal-vehicle collision remains a fundamental recommendation of several authors. (Farrell, 2002)

### *7.4 Reflectors or Mirrors*

In this case, reflectors or mirrors are prisms mounted on poles along the road and are designed to redirect vehicle headlight beams and transform this into a "light barrier" along the road. Unlike fencing, they provide a "barrier" only when vehicles are present. In theory, this barrier will be visible to the deer and deter them from crossing the road when a car is approaching that section of the road at night. In the absence of light, the reflectors are inactive and do not interfere with deer movement. Many studies have been done on the effectiveness of these reflectors. The results vary from ineffective (Danielson & Hubbard, 1998) to moderately successful (Sielecki, 2001) to very successful when evaluated by studies cited by the manufacturers (Swareflex, 2001). Their

cost is also quite significant at approximately \$ 10 000 along both sides of a highway (Sielecki 2001, Danielson & Hubbard, 1998)

### *7.5 Ultrasonic Warning Whistles*

The ultrasonic warning whistle is a small device that can be attached to the hood or bumper of a vehicle. At speeds above 50 km/h, air forced through an opening in the device allegedly emits an ultrasonic sound wave audible to animals, but inaudible to humans or animals within the vehicle. The frequency of this sound signal is such that animals are repelled and stay away from the roadway. Extensive research has been conducted on the effectiveness of ultrasonic whistles and, for the most part, the research found the whistles to be ineffective (Alberta Transportation, 1986, Romin & Dalton, 1992) or moderately effective (Child & Foubister, 1986, Scheifele, P.M., Browning, D.G. & Collins-Scheifele, L.M., 2002) Some also say that some of the whistles on the market emit a sound outside the hearing range for deer. (Romin & Dalton, 1992) The only supporting evidence of the whistles has been in the case of moose. (Child & Foubister, 1986 Miller, 1985)

### *7.6 Highway Lighting*

This approach involves providing lighting along the sections of road with high frequency wildlife/vehicle accidents occurring under dark conditions. Statistics generally show that animal-vehicle collisions occur from sunset to sunrise. (Danielson & Hubbard, 1998) The rationale here is that providing such lighting should increase driver visibility and thus reduce the number of wildlife/vehicle conflicts. Research conducted on this method for mitigating accidents has shown it to be also ineffective and expensive. Miller, 1985). To date, many road authorities have not used this mitigation measure across North America, but when it has been used it was found to be ineffective. (Danielson & Hubbard, 1998, Farrell, 2002)

### *7.7 Habitat Alteration*

Two basic approaches to habitat modification have been explored. The first involves making roadways unattractive to animals and the second requires the creation of a prime quality habitat in areas away from transportation corridors. One way to make the roadway less attractive to animals is to plant a less palatable grass along the corridor. Another approach is to treat existing grasses with chemical deterrents that would discourage consumption. If either method is used in conjunction with a habitat development program elsewhere, it is suggested that deer would be less likely to come into contact with the highway corridor. Other alternatives to planting grass on the highway "right of way" (ROW) include planting unpalatable shrubs, or covering the right-of-way with an asphalt, concrete, or thick gravel layer. (Danielson & Hubbard, 1998, Farrell, 2002, ICBC, 2000, Rea, 2000)

Scents appears to be another deterrent for some animals. So far, the research has shown that scents may have some effect in reducing moose-vehicle collisions in Sweden. However, because the substances tend to deteriorate over time, it tends to lose its effectiveness. (Farrell, 2002)

The use of salt in the winter in Canada also brings particular problems. In some areas road salt attracts deer and moose to the right-of-way. Some new research is on-going using certain volatile compounds (isobutyric acid and creosote or CaMg-acetate) in repelling moose for instance from salty roadside. (Danielson & Hubbard, 1998, Farrell, 2002,)

### *7.8 Exclusion Fencing*

Fences erected on both sides of the road have been used to either prevent animals from wandering onto the road or to lead them to an underpass or overpass. Fences are generally believed to be an effective method. (Sielecki, 2001, Danielson and Hubbard, 1998) It has, however, been found that the use of fences is very site specific, and each location needs to be carefully examined to determine if a fence will deter deer from the roadway. (Sielecki, 2001) In British Columbia, over 450 kilometers of fencing have been installed and at those locations animal-vehicle collisions have reduced significantly. In some cases, they have been eliminated.

Biological knowledge on movements, distribution, and behavior of the species in question is required before a fencing program can be implemented. In some instances, deer will want to cross the road badly enough that they will walk many hundred meters to go around a fence if they cannot jump over it or in some cases, will crawl underneath the fence at erosion gaps. Other problems associated with the use of fences include high cost, maintenance, interruption of migratory patterns of all wildlife, unnatural appearance, trapping of animals who get onto the highway, and a high snow buildup adjacent to the fence may allow deer to easily jump over a fence. (Danielson & Hubbard, 1998)

Even though fencing may be an effective mitigation method for reducing animal-vehicle collisions, the cost of construction and maintenance may be prohibitive in some areas. (Danielson & Hubbard, 1998)

### *7.9 Underpasses and Overpasses*

Underpasses and overpasses have been found to be effective especially when used in conjunction with fences. These structures provide a type of grade separation between motor vehicle traffic and wildlife traffic. In this case too, the high costs and location requirements (i.e., topography etc.) limit the use of this method. (Danielson & Hubbard, 1998) To reduce the cost of this measure, it should be integrated in the planning of new infrastructure. (Farrell, 2002)

A recent study from Alberta that looked at ways of reducing the adverse impact of a new highway section in the Canmore area, recommended the use of an underpass as the most

preferred option for ensuring the safe passage of ungulates and carnivores. The initial construction cost for this underpass and the fencing needed to channel the animals came to the total sum of \$1.3 million. (Lo, 2003)

### *7.10 Intelligent Transportation Systems*

Some transportation agencies are now turning to advanced technology solutions implemented as Intelligent Transportation Systems (ITS). ITS pilot systems have focused on two aspects so far (Farrell, 2002):

- The ability to detect ungulate presence on or approaching the roadway, and
- The driver's response to the dynamic warning signs.

Animal detection can be accomplished through a variety of methods including: microwave radar, passive and active infrared images, fiber-optic grating, seismic sensors and thermal imaging technologies. A disadvantage of complex systems of these types is the need to use advanced software packages. (Farrell, 2002)

Recently there have been several pilot animal-detection, driver warning systems installed, including: (1) Wildlife Warning System, Saskatchewan; (2) Wildlife Protection System, British Columbia; (3) Moose Warning System, Finland; (4) FLASH System, Wyoming; (5) Laser Detection System, Washington; (6) Dynamic Elk Crossing, Washington; (7) Roadway Animal Sensors, Arizona; and (8) Xccelerated Advance Warning Device, Minnesota. (Farrell, 2002, Western Transportation Institute, 2002)

Infrared technology is also adapted as a driver's aid in a vehicle. This in-car technology gives drivers an advanced warning of objects on the roads, including animals, during darkness. In the case of Nova Scotia for instance, this would affect 50% of all deer-vehicle collisions in the Province in 2000. (Nova Scotia Department of Transportation and Public Works, 2002) The same percentage is similar in American data. (Erie Insurance, 2001). The range of these systems can vary between 50 to 450 meters depending on the product. Their costs can vary between \$500 to \$5000. per vehicle. (Lo, 2002 and [www.deercarsh.com](http://www.deercarsh.com))

Although there is significant interest and potential in ITS systems, many technical issues must be addressed before they are ready for general use. False detection, mean-failure rate between cycle times, fail-safe parameters and warranty/availability of parts are only four of the technical issues to be addressed. The issue of liability in case of failure is another issue that should not be pushed aside quickly. (Farrell, 2002)

In summary, we note that properly maintained fencing appears to be the most effective way to reduce deer-vehicle collisions. (Clevenger, 2002) However, not much is known about the effect of this mitigation measure on moose-vehicle accidents. In instances where fencing costs are prohibitive, as on secondary roads, animal detection-driver warning systems appear more efficient. (Farrel, 2002) Regulating speed also appears to have benefits but mostly in some particular locations (Lo, 2003). New ITS technologies

appear promising but remain largely unproven. (Danielson & Hubbard, 1998, Farrell, 2002, Lo, 2003)

Other particular points on the measures include:

- The relative effectiveness and cost of different deterrent methods is poorly understood (Danielson & Hubbard, 1998, Farrell, 2002)
- There are many unknowns regarding the effectiveness of mitigation measures and few performance criteria have been developed. (Clevenger, 2002)
- Published literature is limited and often non-peer reviewed (Danielson & Hubbard, 1998)
- Techniques selected to reduce animal-vehicle collisions are often arbitrary without any follow-up rigorous analysis of their effectiveness (Danielson & Hubbard, 1998, Farrell, 2002, Romin & Bissonnette, 1996)
- In some cases, there is also a lack of biological understanding of the collisions (Danielson & Hubbard, 1998, Farrell, 2002)

Some conclude that the surest way to make large animal-vehicle collision studies more rigorous is to more effectively monitor the statistics on those collisions and preferably on a national level. (Farrell, 2002)

## **8. INTERNATIONAL INTEREST**

The issue of large animal-vehicle collisions also attracts attention at the international level as well. In the United States, it is estimated that 750 000 deer-vehicle collisions alone take place every year. These result in 120 fatalities per year, 30 000 injuries and a cost of \$1.2 billion (U.S.) in property damage annually. In some states, the number of collisions is as high as 67 000 per year (Michigan) (Danielson & Hubbard, 2002, Romin & Bissonnette, 1996) In the case of Alaska, the problem is with moose-vehicle collisions. They report over 50 moose-vehicle collision per year (Garrett & Conway, 1999)

There is a clear mobilization on this issue in the United States. Groups such as the Western Transportation Institute at Montana State University, and the Transportation Research Board are involved acting as clearing-house on this issue. Some States are also particularly active: Illinois, Iowa, Michigan, Minnesota, Oregon, Pennsylvania, Utah, and Wisconsin. Some insurance companies such as Erie Insurance and American Family Insurance Company are also realizing the cost involved in animal-vehicle collisions.

New funding initiatives in the United States under the Transportation Equity Act for the 21<sup>st</sup> Century presents good opportunities for funding of projects and more importantly, for increased implementation of rigorous testing of mitigation techniques for reducing animal-vehicle collisions

Animal-vehicle collisions are also considered a major safety problem in both Japan and Europe. In Europe alone (excluding Russia), it is estimated that over 500 000 collisions take place every year. These collisions result in more than 300 fatalities and well over \$1 billion (U.S.) in property damage alone (Danielson & Hubbard, 1998)



The European countries most active on this issue include: Finland, France, Germany, Slovenia, Sweden, Switzerland and The Netherlands.

Sweden was probably one of the countries taking an interest on this issue earlier than most other countries in the world. Their work can be traced back as early as the 1960s. (Miller, 1985)

Different techniques are used in different countries:

- Fencing (France, Germany, Slovenia, The Netherlands)
- Geographic Information Systems (GIS) (Switzerland)
- Landscape planning (France, Germany, Switzerland)
- Overpasses (France, Switzerland), and
- Underpasses (France, Germany, The Netherlands).

In France for instance, fencing is required on all federal highways. France's primary objective is to increase motorist safety. (U.S. DOT, 2002)

## **9. PREDICTIVE APPROACH**

Very few research projects have focused on predictive or benchmarking tools regarding large animal-vehicle collisions. Widespread use of national and North American databases by transportation agencies, such as WARS, would help to develop these tools. (NCHRP, 2002)

A few benchmarks have emerged from existing research:

- It is estimated that 0.029% of the deer-vehicle collisions will result in human fatality (NCHRP, 2002)
- 20% of moose-vehicle collisions result in injuries and 0.5% result in human fatality (Garrett & Conway, 1999)<sup>1</sup>
- The total claims for animal-vehicle collisions represent 1.5% of all collision claims for property damage in British Columbia. For all claims (fatality and injury), the percentage drops to 0.12% (Koganow, 1997)
- The average property damage resulting from an animal-vehicle collision is estimated at \$2 800 Cdn (ICBC, 2000) and the average wildlife cost is estimated at \$1 700 Cdn (NCHRP, 2002)
- In almost all Canadian provincial and American state statistics on animal-vehicle collisions, deer represents 80% and more of the wildlife involved and domestic animals are involved in 5% of all animal-vehicle collisions
- The issue of underreporting is confirmed by Provincial and Public Insurance Corporations' databases and can be safely established at a range of 50%; and in the case of collisions with property damage, it may be more in the range of 100%.

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<sup>1</sup> This estimate seems to be validated by the statistics from Newfoundland & Labrador

It has been suggested as well that a ratio of animal-vehicle collisions per 100,000 registered vehicles should be used to record these collisions for every road authority in North America. (Garrett & Conway, 1999)

On the other side, some attempts have been made to look at the animal side as a predictive tool for those collisions. In general, these attempts have proved very difficult if not impossible. In fact, studies have shown that deer-vehicle collision count can be used as reliable indicators of deer population trend. (Lintack, Maintosh & Voigt, 1987) This approach has however proven extremely difficult in practice. The case of Michigan and Wisconsin data exemplifies this problem:

**Exhibit 9.1**  
**Developing a Predicting Tool using Animal-Vehicle Collisions**

U.S. State	Pre-Hunt Numbers in Deer Herd		Deer-Vehicle Crashes	
	2000	2001	2000	2001
Michigan	1 900 000	1 800 000	65 000	67 000
Wisconsin	1 600 000	1 500 000	20 000	19 900

Source: [www.deercrash.com](http://www.deercrash.com)

The above-data shows, in the case of Michigan, a decrease in the deer herd but an increase in collisions. On the other hand, Wisconsin data shows a decrease in the deer herd and a corresponding decrease in the number of collisions.

More effort is needed on the predictability and benchmarking methods, especially in view of the underreporting issue which always force a questioning of the existing databases.

## 10. CONCLUSION

Clearly there is no quick and easy fix to the problem of large animal-vehicle collisions. Existing data shows that when accounting for the underreporting phenomena, these collisions are on the rise and may cost society in general more than \$200,000,000 annually. This study shows that the problem may be far greater than is publicly known.

With the development of new technologies there is potential for reducing these collisions. This, however, will take some time since these new technologies are not proven yet and, as reported above, it is important that a more rigorous validation of technologies be established when it comes to mitigation measures. Furthermore, necessary funding to support expensive new technologies will be needed. Unfortunately, the case for additional funding is not easily made in view of the moderate impact of these collisions on fatalities and injuries. Although property damage represents a staggering cost to society in general, it may have to reach a proportion high enough to make the case for more funding and more sustained attention to this issue. No research has been done yet on this critical threshold approach.

However, the fact that probably between **4 to 8 large animal-vehicle collisions take place every hour in Canada** is a clear signal that something has to be done to reassure the public since the issue can be emotional as it involves both humans and a large number of killed animals. (Koganow, 1997)

The research conducted for this project led to the following observations:

- As suspected, the phenomena of underreporting exists and may be as high as 50% in the case of collisions with injury and probably even higher in the case of animal-vehicle collisions with property damage only.
- A balanced approach between motorist safety and wildlife protection should be used for the development of mitigation measures. The new terminology used now for this balanced approach is: *Road Ecology*<sup>1</sup>
- Although not proven effective in all places, awareness campaigns are more or less necessary and should be a part of any mitigation policy on the issue of large animal-vehicle collisions. Solid data on when and where collisions occur become necessary to support such a campaign
- The use of WARS (Wildlife Accident Reporting System) should be promoted nationally to report wildlife animal-vehicle collisions in all Provinces /Territories. This would provide for more accurate data and would greatly facilitate the evaluation of expensive and sometimes unproven mitigation measures.
- There is a need to establish a National Research Clearing-House to provide up-to-date, accurate and validated information on large animal-vehicle collisions in Canada, the United States and other countries as well. This could also include new developments on ITS technologies both for infrastructure and for in-vehicle related developments.
- Although most of the mitigation measures are developed for all wildlife, the vast majority of these measures address the problem of deer-vehicle collisions. These collisions represent probably more than 80% of all animal-vehicle collisions. The case of moose-vehicle collisions is probably as problematic but not as widespread and not as “international” an issue. There may be a need to focus our Canadian research on this particular issue as the payback in terms of reduced fatalities and injuries may be greater.
- In view of the underreporting phenomena, there is a need to establish simple benchmarks and predictive tools on this issue. So far, none of the research has attempted to calibrate existing estimates and develop an accepted approach.

The question remains, knowing what we know today, and in view of the vast body of literature covering this problem for many years, what can be done to improve the situation and make a difference. It is worrying for many that motor vehicles may be the number one predator for deer and other wildlife. If it is the case, the number of animal-vehicle collisions can only go up. In the case of Ottawa-Carleton area, near Ottawa, the specialists are now predicting a doubling of animal-vehicle collisions every five years.

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<sup>1</sup> *Road Ecology: Science and Solutions* by Richard T. T. Forman (Editor), Daniel Sperling (Editor), Frederick J. Swanson (Editor), Island Press, 2002

This project has attempted to focus on what has been done in Canada, and to some extent, abroad. It has specifically focused on documenting the underestimation of the number of animal-vehicle collisions in Canada and provided some observations for future developments that can hopefully assist in that regard.

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**APPENDIX A**

**EXAMPLE OF WILDLIFE ACCIDENT REPORT**

# MONTHLY WILDLIFE ACCIDENT REPORT

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.

## Time Animal Type

of Kill Location of Killed Animal Deer Deer Please Specify Sex (Male / Female / Unknown)

**D** 1 = Dawn RFI = Road Features Inventory (optional) **Sign Rflctr** Please Use "Y" to indicate if Yearling or Younger

## Comments

**a** 2 = Day **LKI** = Landmark Kilometre Index (must be completed) within (Other: Sheep, Caribou, Coyote, Porcupine, etc)

**y** 3 = Dusk Hwy RFI LKI Nearest 100m Deer Moose Elk Bear Other

4 = Dark No. Landmark Offset Segment Km Town Y/N Y/N M F U M F U M F U M F U (please specify)

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

Maintenance Contractor Contact (Please Print) Telephone

Ministry District Contact (Please Print) Telephone

*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.*

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## Ministry of Transportation

#Killed

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

**Leonard Sielecki, WARS Manager**

**Wildlife Accident Reporting System (WARS)**

**British Columbia Ministry of Transportation**

**4B - 940 Blanshard Street, PO Box 9850 STN PROV GOVT**

**Victoria BC V8W 9T5**

**Phone: (250) 356-2255 / Email: leonard.sielecki@gems9.gov.bc.ca**

*Enter the day of the month (e.g. 1,*

*2, 3, ... etc.) in the "Day" column*

*below.*

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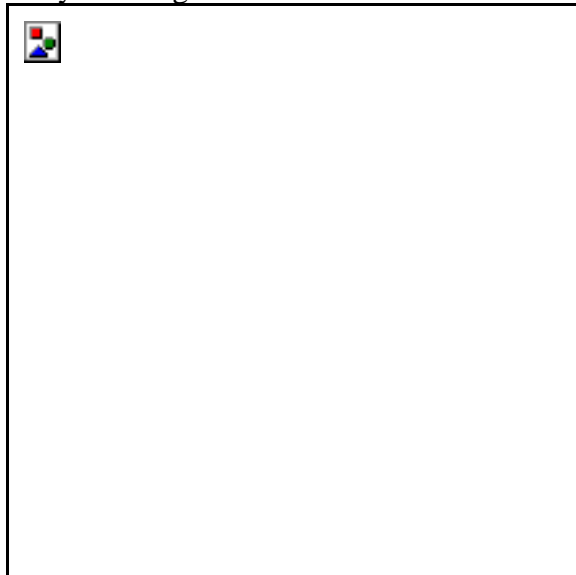
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