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Wildlife Watch App for Improved Road Safety in Alberta

Project Team: Tetra Tech EBA, Prime Consultant

Alberta Transportation, Client

Break Point Creative Inc., APP Developer

Red Deer College, Wildlife Technical Advisor

DenBar Systems Inc., Business Analyst

PROJECT DESCRIPTION

Alberta Transportation (AT) is enhancing roadway safety by twinning Highway 63 from Atmore to Fort McMurray (240 km study area), one of Alberta's most important transportation corridors. As part of this commitment to safety, AT recognizes the opportunity to better understand wildlife-vehicle collisions to help address the resultant property damage and risk to human life. The media have coined Highway 63 as "Alberta's Deadliest Highway", with wildlife-vehicle collisions representing about 45% of all reported vehicle accidents, and the frequency of wildlife-vehicle collisions are expected to increase with rising traffic volumes, white-tailed deer range expansions, and abundant deer and moose populations.

Alberta Transportation retained Tetra Tech EBA Inc. (Tetra Tech EBA) to carry out long-term construction monitoring covering a wide range of physical and biological attributes associated with the twinning works, including studies to gain an understanding of wildlife movement zones, locations prone to wildlife-vehicle collisions, and the magnitude of the issue along this route. This led to the development of the Alberta Wildlife Watch (AWW) smartphone application (app) by the project team (Figure 1) to address AT's challenging commitment, and is incorporated into the long-term monitoring plan for highway mitigations.

SCOPE AND OBJECTIVES

Alberta Transportation's ultimate goal is to improve motorist safety by best mitigating for wildlife-vehicle collisions at collision prone locations that are determined from accurate and more complete datasets. By improving motorist safety, AT also mitigates for wildlife mortality and movement barrier effects of the roadway. Using Highway 63 as a trial roadway (Figure 2), the overall team objectives are to identify the locations and magnitude of wildlife-vehicle collisions along Highway 63 at: 1) a fine spatial scale appropriate to facilitate site-specific mitigation, and 2) a species-specific level to effectively mitigate for species that pose the most risk of motorists.

Moose and deer are involved in over 70% of all reported wildlife-vehicle collisions on Highway 63, and in all reported incidents involving human fatalities and major accidents (AT TIMS data 1993-2011). Consequently, moose and deer were the project's primary focus.

To meet objectives, Tetra Tech EBA, Break Point Creative Inc., Red Deer College (Ms. Sandra MacDougall), and DenBar Systems Inc. (Figure 1) developed AWW to easily collect and map fine-scale positioning data at the species level. This app accounts for both carcasses and live animals encountered within the Highway 63 right-of-way.

PROJECT CHALLENGES

The Highway 63 study section is 240 km in length; a considerable distance to locate and monitor wildlife movements and highway crossing success by conventional survey methods since wildlife move across the length of the highway year round. Therefore, it is prohibitively expensive to consistently collect year round wildlife observation and vehicle-related carcass data that would of any value for determining solutions. Additively, the existing wildlife-vehicle collision data collected from police reports (data available from 1993 to 2012) is inadequate for our needs due to multiple inherent challenges with the data.

The conventional police reporting wildlife-vehicle collision system currently applied across Alberta (and much of Canada) is not adequate to isolate wildlife data for collision prone locations and to plan and design wildlife-vehicle collision mitigation strategies for key species. To better understand the challenges with the conventional wildlife-vehicle collision reporting system, AT hosted a workshop in 2008 that brought together both local and international transportation and wildlife professionals. From this workshop, six main challenges were identified with the conventional reporting system:

1. under reporting of wildlife-vehicle collisions,

2. inaccuracies in the collision location data,

3. under reporting or inaccuracies in the species involved,

4. inefficiencies with manual data entry,

5. timeliness to access the consolidated data, and

6. overall low public awareness of the magnitude of wildlife-vehicle collisions in Alberta.

Transportation departments across North America face these similar challenges. To meet the project goal, all six main challenges identified by these professionals were carefully considered.

Effective remedial measures cannot be considered and implemented without accurate and valid data. From the start, our team understood the enormity of this project and the complexities that Canadian transportation departments have faced trying to find preventative solutions to this problem. To identify the locations and magnitude of wildlife-vehicle collisions at appropriate scales, the largest challenges encountered were the chronic spatial inaccuracies, under reporting, and timeliness of the conventional wildlife-vehicle collision data.

The structure from which the conventional data collection system operates fails to collect accurate wildlife-vehicle collision data. The conventional system relies on motorists, who had been involved in a wildlife-vehicle collision resulting in property damage of $2,000 or more, to report the incident to the police (sometimes many days or weeks following the collision). Additionally, police fill out an incident report in the case of serious human injury or fatality. The actual reporting of the wildlife-vehicle collision most often happens off location, and relies on the motorists' ability to pinpoint the incident location. Once pinpointed, the reported incident is commonly estimated to the nearest highway kilometer marker, if known or reported at all. Across other highways using this same reporting structure, the reported wildlife-vehicle collision locations have been found to be on average two kilometres off. This simply does not provide reliable and specific enough information for effective mitigation planning and design.

Owing to the $2,000 property damage threshold, 50% or more of the wildlife-vehicle collisions occurring in Alberta seemingly go unreported. Augmenting to this issue, many of the commercial transport trucks driving Highway 63 are equipped with grill and bumper guards that are designed specifically to protect against wildlife-related collision damage. Thus, the number of wildlife-related collisions that are actually reported, specifically along Highway 63, is expected to be only a fraction of the total collisions occurring. This under reporting conceals the true magnitude of the issue, and effectively delays the application of any mitigation.

Similarly, the wildlife species involved in the collision is reported at the discretion of the reporting officer or from the motorists' memory of the incident. Approximately 25% of the reported wildlife-vehicle collisions along Highway 63 (data 1993 – 2012) do not include the species involved. Species interact with roadways differently and at various spatial and temporal scales, and respond differently to mitigation options available. Therefore, it is important that the design of effective mitigation considers the predominant species involved, and their life history traits are identified and understood.

Lastly, the conventional reporting system requires that wildlife-vehicle collision data be entered into a database. In Alberta, this process often takes one to two years for the wildlife-vehicle collision data to be accessible for further analyses.

Therefore, the team required a novel data collection and management solution to meet the overall objectives by effectively surveying the entire Highway 63 length, year round, in a cost-effective manner, and solving the challenges identified previously by transportation and wildlife professionals in 2008.

INNOVATION AND TECHNOLOGICAL ADVANCEMENT

The AWW app is a milestone achievement in Canada. It is the first known use of smartphone app technology by a provincial transportation department to monitor wildlife use and wildlife-vehicle collisions along its highways. AWW has wide-ranging applications and may be used in the transportation and fish and wildlife departments, and can be easily transferable to other jurisdictions.

As part of its user friendly design (Figure 3), the app was built in three different platforms: iPhone, Android, and Blackberry, and access to the app is via the Apple's App Store, Google Play, and through direct download from the AWW website.

Designed specifically with the previous reporting system challenges in mind (Figure 4), the app allows for:

A. Greater Participant Use and Public Awareness

Alberta Wildlife Watch was developed to provide a consistent, more efficient, and effective means of reporting wildlife observations for multiple users. By late May 2014, the application was deployed to all highway maintenance staff with a contract to maintain the Highway 63 study area, as well as AT, regional Alberta Environment and Parks (AEP) staff, and Tetra Tech EBA staff.

The app is designed to be user friendly, and has a step by step training video that can be viewed on the app in the absence of a network connection. In the event that some participants were unfamiliar using app technology, an initial in-person training session was also held, and a second in-person follow up session was completed to gather their opinions, suggestions going forward, and to answer any questions relating to the app workings. Follow-up consultations occur at least

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bi-annually to maintain the working relationship and confirm that the application services meet their needs.

A public awareness wall poster is presented annually to each maintenance shop which summarizes the application data collected to date, including the locations of the wildlife and carcass observations reported, a selection of photos submitted, and an analyses of the data.

B. Increase in Spatial Accuracy

The app provides spatial accuracy by using the mobile phones GPS function with offline functionality. In the conventional reporting system, the location of the wildlife-vehicle collision was reported as the nearest highway kilometer marker, if it was even known.

Using the AWW app, the internal GPS pinpoints its current location on a google-based map, and if the user is standing directly at the carcass or collision site, this GPS location can be selected to enter automatically into the report form or saved so that the user can finish entering the full report later at a safer location. If the user is not at the location of the animal or carcass (perhaps a location safer to park) the user can also go into the map mode and drop a new pin on the map that more closely fits with the location of the animal. Satellite view, standard, or hybrid map options are available to help the user locate local landmarks. Once the GPS location or new pin location is selected or saved, it is automatically entered into the AWW report form along with the county and highway name.

C. Growth in the Amount of Data Being Collected

The highway service contractors travel along the highway daily carrying out their routine duties and collect animal observations. This system of data collection inherently increases the amount of data collected on a regular basis, in the most cost-effective way. This approach is no longer dependent upon the motorist reporting the collision to police, and no longer contingent on property damages exceeding $2,000.

With the app, both live animals and carcasses (indicative of wildlife-vehicle collisions), observation date, time of day, the number of animals observed, gender, collision type (e.g., human fatality, injury, property damage) is recorded for each observation. The user also has the ability to enter additional information they deem important, as well as to submit up to three photographs of the animal.

The current user groups have readily adopted the app. After 21 months of operation, over 200 wildlife carcasses and live animals (including 14 different species, e.g., boreal caribou) have been reported. Notably these wildlife observations occurred during a time when highway twinning construction was in full operation (locale specific) and the propensity for wildlife to occupy the highway right-of-way or cross the construction zone may have been reduced. Nonetheless, zones with high wildlife and carcass observations are already emerging that will allow for implementation of a range of mitigation measures to improve highway safety in an efficient and effective way.

D. Significant Improvement in Species Reporting

Alberta Wildlife Watch allows for easy reporting of species. The app has a quick select button to select the species name, whereby eliminating spelling errors in the database and improving efficiency during analysis. To improve the accuracy of the user's species identification, the app includes a species guide embedded within, and hardcopy versions of the guide were given out during the information sessions (Figure 5). The species guide includes descriptive text and

numerous species photographs indicating characteristic features for quick species identification and confirmation. The team purposely developed the guide specifying hard-body features, body features that are maintained in the event of a motor-vehicle collision, as keys to identification.

Up to three photos of the animal or carcass may be submitted with each report, which is particularly useful if the user is unable to identify the species. This provides a tool for the app administrators to verify the species reported and to monitor species reporting accuracies.

With the introduction of AWW, reports of birds and small mammal carcasses are increasing; species groups not conventionally reported. Although these species and species groups are not the primary focus along Highway 63, these data can be used to recognize impacts to wildlife communities in the region, identify possible movement zones, and is of interest to AEP.

E. Easy Data Storage and Data Management

Using the quick select buttons on the app, wildlife observation reports are stored until a network connection is available. Once available, the app data is automatically transferred to a database (Figure 6), whereby eliminating common data entry problems. Data collected using the three different iPhone, Android, and Blackberry devices are stored together in the same database.

Administrators, can also login to the AWW website to access the excel database for data quality control purposes. Tetra Tech EBA has a designated biologist that quality controls the data on a monthly basis, including the verification of species reported based on their associated photos. Quality control can also be completed at an app user level. Since each user is required to register when first accessing the app, the data he/she reports is directly linked to their unique user identification. This registration allows administrators to monitor participant reporting statistics and, if necessary, target quality control efforts and or follow-up training to specific individuals.

F. Timeliness to the Data for Analysis

The AWW app also allows for effectively real-time data entry and access to the data. In comparison, the conventional reporting system needs to be entered by hand directly into a database well after the wildlife-vehicle collision occurred. In Alberta, this process often takes well over a year. For the purposes of Highway 63, quick access to the data allows for the analysis of wildlife observations to determine collision prone locations requiring mitigation within the timeframe set by the construction and post-construction schedule, and ongoing development activity in the region.

BENEFITS TO SOCIETY

The media have coined Highway 63 as "Alberta's Deadliest Highway", with wildlife-vehicle collisions representing nearly half of all reported accidents (Figure 7). Information collected through AWW will save lives along this critical roadway where increased wildlife populations and range expansions are becoming a more significant risk to motorists.

Data collected using the app provides a substantial improvement to the conventional wildlife-vehicle collision reporting system, and allows AT to more easily recognize that a wildlife-vehicle collision issue exists, determine and prioritize these collision prone locations requiring mitigation using accurate and reliable information, and design mitigation most effectively for the unique site location and species involved. By mitigating collision prone locations, AT minimizes the negative effects on the local wildlife populations and their movements.

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ADDED VALUE AND UPCOMING DEVELOPMENTS

Smartphone app technology was a relatively easy fit for the Highway 63 project, and is the future for wildlife-vehicle collision mitigation and monitoring across Alberta. For Highway 63, app technology greatly benefitted the quality and quantity of data collected, at low overall project cost, by engaging user groups beyond our initial expectations, and facilitating an easy extension across larger geographical area and regulatory jurisdictions/agencies.

Based on the initial success of AWW along Highway 63, AT is expanding this new wildlife reporting system across Alberta, and is designed to be easily deployed across other provincial, federal, and municipal highways. The value of AWW data also extends well beyond AT's current purpose, and AEP have been a supportive stakeholder and have suggested how AWW and its data could also be directly used for their specific wildlife management purposes. Data from AWW has been formatted to transition easily into AT's existing Information Management System (TIMS) and AEP's existing Fish and Wildlife Management Information System (FWMIS) database.

In addition, the value of AWW extends well into the future across Alberta's road network. Once mitigation is in place, the app continues to provide a relatively cost free approach to monitoring the success of any wildlife-vehicle collision mitigation implemented, and track wildlife-vehicle collision trends over time.

With the success of AWW and with wildlife-vehicle collision prone locations emerging on Highway 63, an interactive mapping website is currently in development (scheduled release April 1, 2016) to house the AWW data. This interactive website provides:

- secure access to the apps database by designated system administrators (administrators can be easily added upon request);

- mapping capability to depict the data collected to reveal the magnitude of wildlife-vehicle collisions across the province;

- appropriate data filters and search functions,

- improved data management functionality for simpler data quality control to increase the reliability of the data;

- straightforward and automatic data summaries for quick analysis to accelerate the application of any mitigation;

- programmed mapping of high collision frequency zones to quickly reveal and prioritize mitigation zones;

- additional analysis tools visible at multiple scales that may be worthy for multiple user groups; and

- promotes data sharing across departments or user groups in a convenient format, and facilitates complex data analysis outside the AWW website platform.

Overall, the AWW app and website provides consistently reliable data available to additional user groups for repeatable and efficient complex analyses at low costs. With the AWW app and website developed (or nearing completion), these low cost tools are simply transferrable to other provincial transportation departments to provide a consistent reporting system among users.

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Alberta Wildlife Watch app was first introduced at the fall 2015 TAC conference, and AT hopes to continue sharing our success in the future.

COST EFFECTIVE SOLUTION

In 2015, AT estimated wildlife-vehicle collisions in Alberta costs society approximately $280 million (both direct and indirect costs) a year. As a demonstration, $2.8 million would be saved each year, as well as possibly a life (human and wildlife), if mitigation were to effectively reduce wildlife-vehicle collisions by only 1% across the province. This alone is a significant savings, but AT strives to do much better.

The design, development, implementation, and stakeholder engagements for the AWW app and website have totalled $310,000 (including preliminary habitat mapping and modelling and empirical field data collection along Highway 63). Once implementation across the provincial road network is complete, AT will assume all management and quality control tasks in house. Thus, AT conservatively estimates the annual operating, external hosting, and contingency troubleshooting costs at $100,000 for the entire provincial road network.

Once operating, AWW app and website provides the ability for data to be indefinitely collected and automatically analyzed across the provincial road network, a total of 3,300 km. This equates to reliable data being collected and analyzed across the province for approximately $30 per km per year.

Alternatively, it is cost prohibitive to survey the provincial road network using traditional biological methods to assess where wildlife are crossing the highway, and then attempting to connect this data with the existing unreliable police reported wildlife-vehicle collisions. As a trial, winter driving surveys were completed along a 104 km portion of Highway 63, every two weeks throughout the winter, as recommended by AEP. These winter driving surveys are considered a rapid survey, designed to locate and identify species tracks while slowly driving along the highway, to provide a snapshot in time. Trial costs reached $70 per km per individual survey, which included consulting fees, travel and other disbursements (not including data entry and analyses). Overall, costs reached $490 per km for the entire winter, and additional costs are still required to connect this data with the existing unreliable police wildlife-vehicle collision reports, as not all wildlife that cross the highway are involved in vehicle collisions. To expand this trial field survey program across the provincial road network, costs would exceed well over $1.5 million per winter per year.
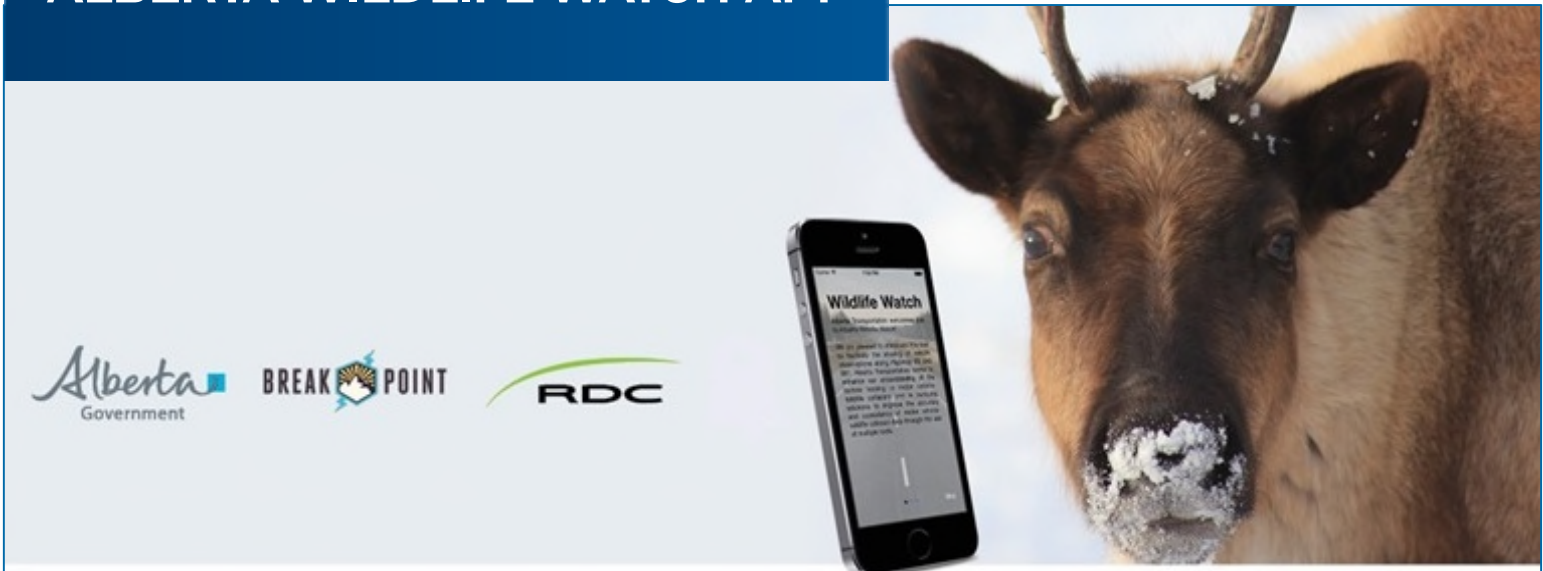
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Figure 1: Tetra Tech EBA's Alberta Wildlife Watch Client and Partners

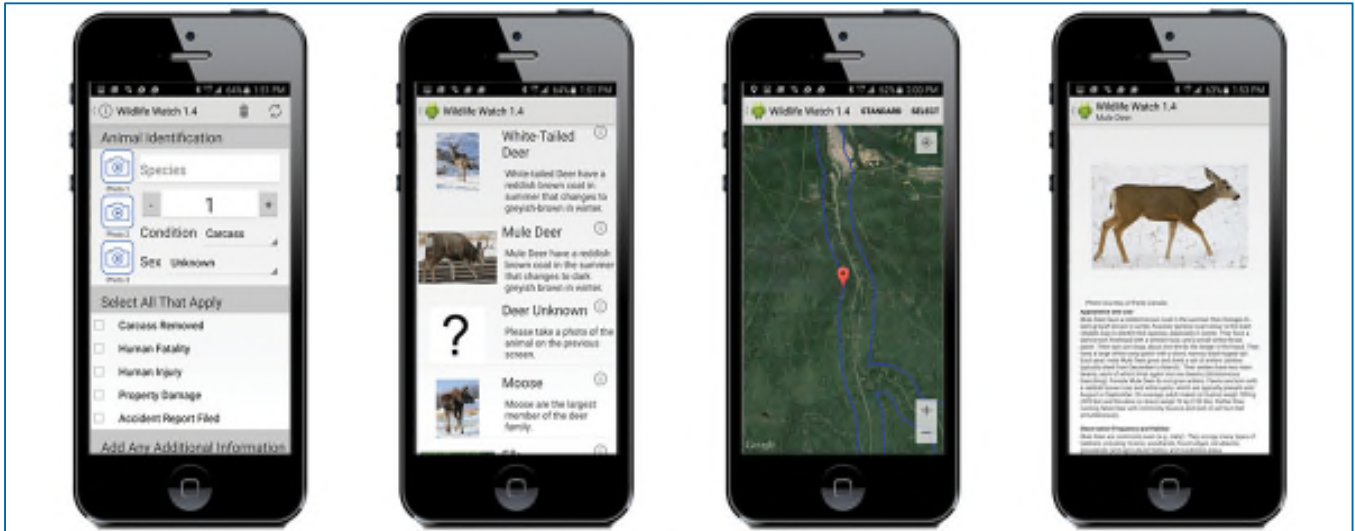**Figure 2: Aerial View of Newly Twinned Section of Highway 63**

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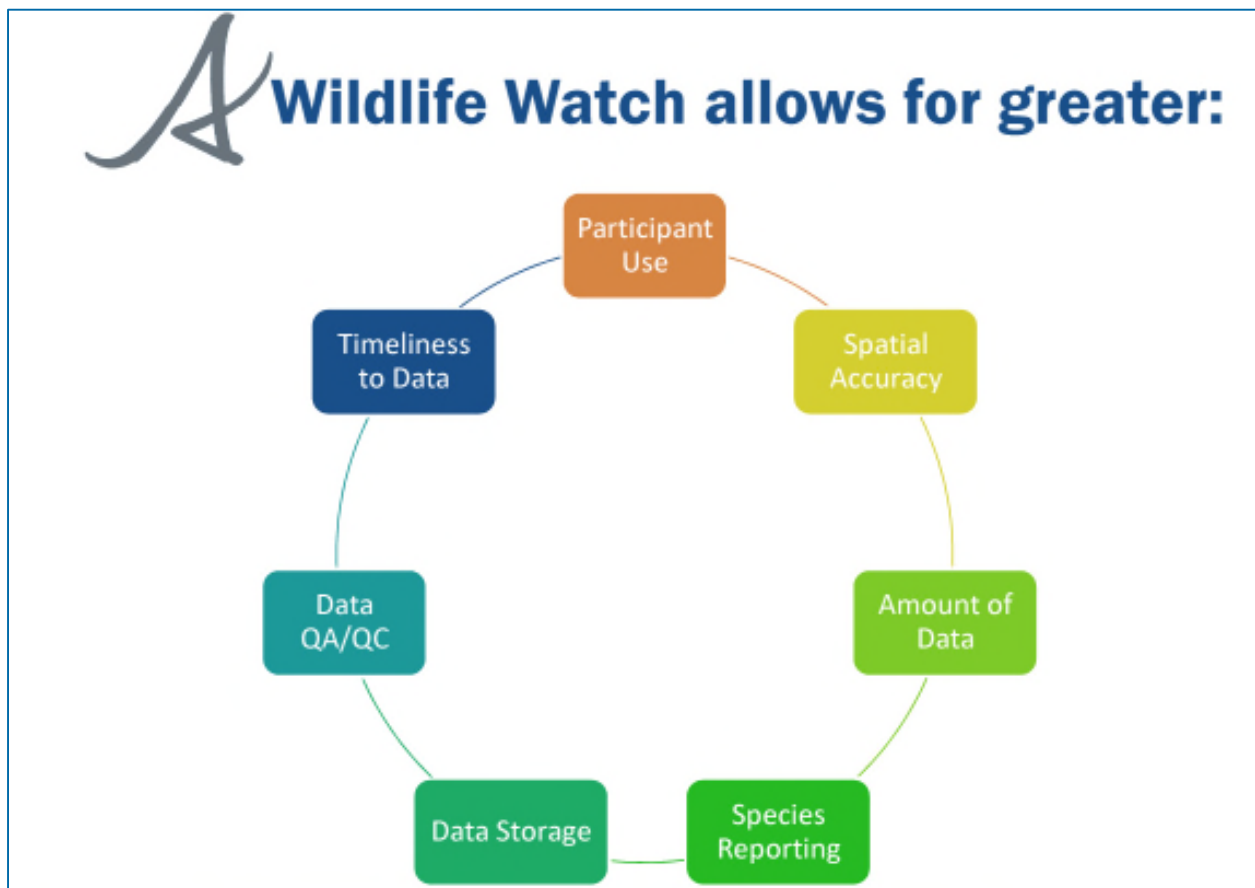Figure 3: The Simplistic Layout is User Friendly for All User Groups

Figure 4: Alberta Wildlife Watch Program Goals

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Figure 5: Improved Species Reporting with Pre-defined Categories to Populate

Adapted from Break Point Creative Inc. 1

Note: the arrows show data flow.
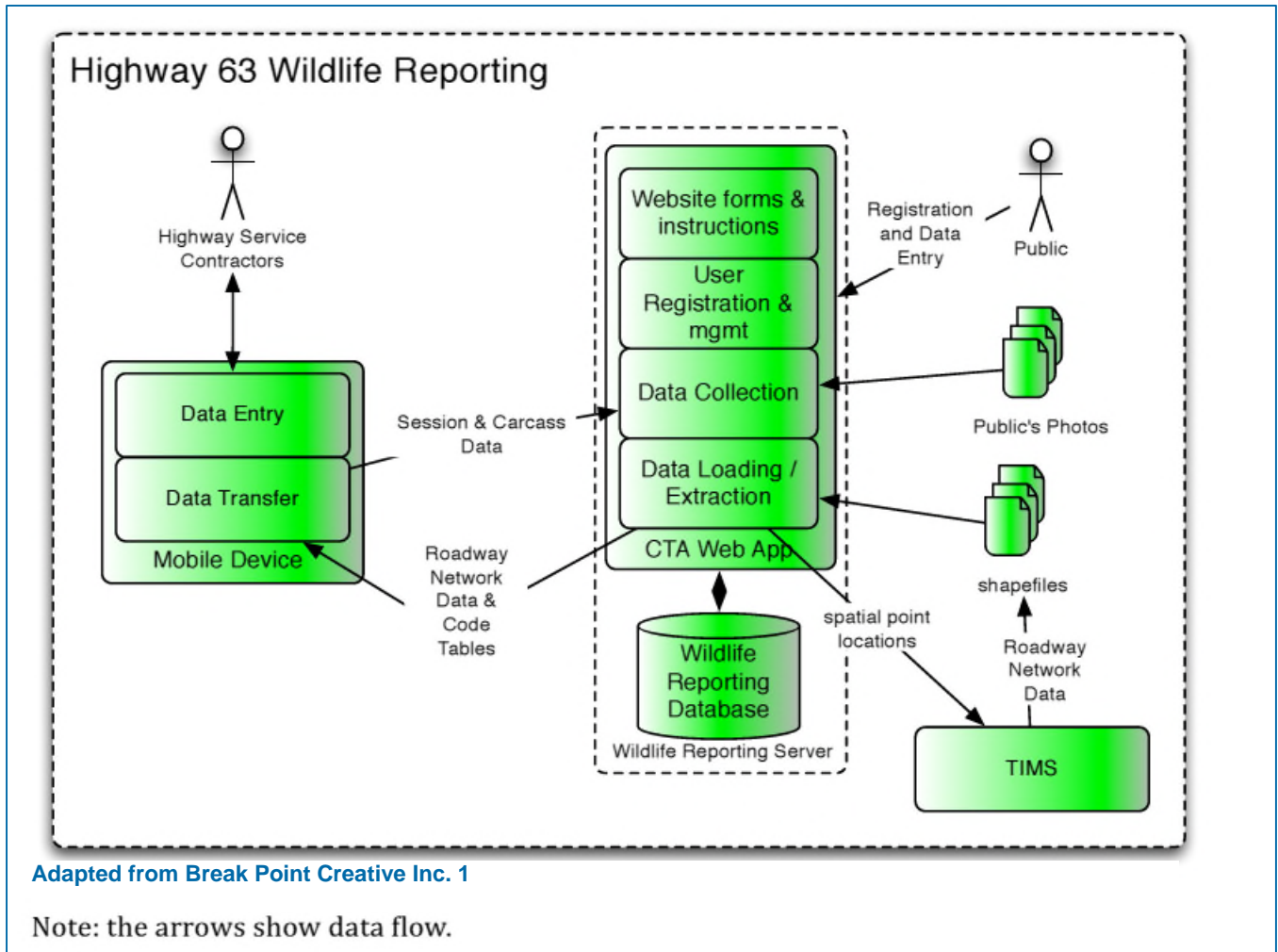
Figure 6: Collection Flow Chart for Data Storage and Transfer

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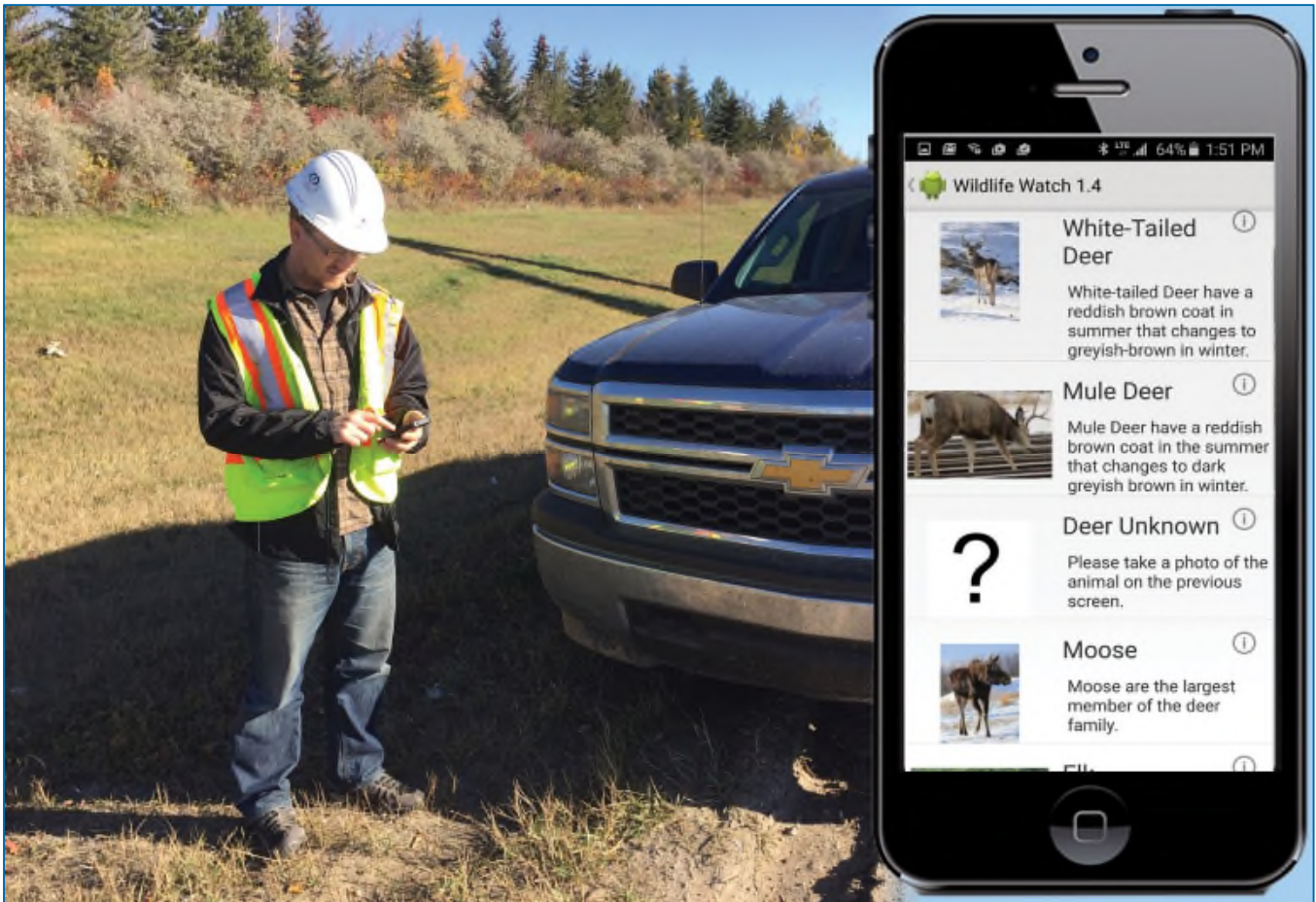
Figures 7 and 8: Using the App on Highway 63 to Report an Incident

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