Ament, R., D. Galarus, D. Richter, K. Bateman, M. Huijser, and J. Begley. *Roadkill Observation Collection System (ROCS): Phase III Development*. Report No. FHWA-CFL/TD-12-001. United States Department of Transportation, Federal Highway Administration, Washington, D.C., January 2012.

The proper identification and description of wildlife-vehicle collisions (WVCs) and their locations along roadways is an important aspect to understanding this safety problem. The Roadkill Observation Collection System (ROCS) project was a three phase effort to create an easy to use and locationally accurate WVC data collection system that takes advantage of personal digital assistant (PDA) hardware and global positioning system (GPS) capabilities. The ability to summarize and evaluate the data collected with the system was also an objective of the ROCS project. Phase 3 of ROCs project was partially funded by the Deer-Vehicle Crash Information and Research Center Pooled Fund.

As noted above, the ROCS project had multiple phases. Phase 1 of the project focused on the development of a "Proof of Concept" system. The features of the tool developed included a user-friendly interface, rapid data entry, standard text-based storage, and two modes of data collection (continuous and incidental). The device was demonstrated and worked well as a data collector. Unfortunately, the equipment designed was too easy to damage in the field. It was also concluded that some desktop applications needed to be developed to more easily evaluate and analyze the data collected.

Phase 2 of the ROCs project included various upgrades to the "proof of concept" created during Phase 1. A PDA that was better suited for the field was selected for consideration. Some of its attributes included a resistance to immersion and drops. It was also sealed from dust and sand, able to operate in temperatures from -22 to 140 degrees Fahrenheit, and had a 12 to 15 hour battery life per charge. It was determined that the PDAs might be able to collect data for two weeks or more. The PDA also had an integrated GPS capability with a latitude and longitudinal accuracy of 16.4 to 32.8 feet (5 to 10 meters). Phase II of the project used the field device noted above and incorporated a design to allow individuals the ability to upload data to their personal computers. The device and system also appeared to be easier to learn how to use. These characteristics allowed ROCS to improve the effectiveness and efficiency of collecting WVC data.

Phase 3 continued the development of ROCS. As noted above, this phase of the project was partially funded by the Deer-Vehicle Crash Information and Research (DVCIR) Center. The objective of Phase 3 was to produce systems that would allow more widespread collection, analysis, and sharing of the data collected with the system that was field-tested and developed in Phases 1 and 2. More specifically, the activities and tasks completed in Phase 3 were designed to develop and investigate processes that allow ROCS users the ability to view the carcass data collected on visualization software and also access centrally stored, but secure, data for analysis purposes. This phase of the ROCS project also included tasks to collect data in the field and to show how the system can be used to analyze spatial characteristics and complete cost-benefit mitigation analysis. In addition, funds were available to train potential data collectors in the use of ROCS.

From a technical point of view, Phase 3 included the development of software that was compatible with the system created previously and allowed the automatic transfer of data collected to a central repository (when the PDA was connected to the user's personal computer). The new system also required the registration of each data collection device so that the repository only accepted data from approved users. Phase 3 of ROCS also developed software that allowed data to be displayed (e.g., plotted on a map), summarized, and analyzed through a variety of means. The result was a ROCS "Roadkill Report" website. The data available included all the information collected for each carcass observation (e.g., location, species, etc.). A server was also developed to store and distribute the information (with appropriate security protocols and firewalls).

Iowa and New York (two DVCIR Center pooled fund states) agreed to test the ROCS system in the field as part of the Phase 3 project. Data were collected in one area of Iowa and two areas of New York. First, Department of Transportation maintenance personnel in the areas of interest from the Iowa and New York state transportation agencies were trained in the use of the devices. Then, each state received two of ROCS devices along with a User's Manual. Offsite support was also provided by the research team through the internet and telephone.

As part of Phase 3, the research team also successfully tested all the ROCS components (e.g., field data collection, transfer software, central database storage, retrieval of data, and data export). In addition, illustrative spatial and cost–benefit analyses of the data were completed with the carcass data collected in Iowa from March to December 2010. First, the temporal data collected were plotted and showed the typical and expected spring and fall peaking for DVCs. Then, a spatial or cluster analysis was completed on the data from five roadway segments ranging from 8.3 to 16.2 miles in length. Each carcass data point was assigned to the nearest 328 feet (100 meter) segment for analysis and the research team developed and applied spatial analyses that focused on the combinations of 328 feet (100 meter) segments and a measure they created that they called the "deer road morality value". The details of these analysis results are explained in the report and a visual representation provided. In general, however, there are many methods that can be applied to complete a data cluster analysis and this example was provided as an illustration of how the data collected with ROCS could be used. A mitigation measure benefit-cost analysis was also completed as part of this project, and is also described in the report and an article by Huijser, et al. (*1*). This task was also completed to show the usefulness of ROCs. The research team generally suggested that more data could be collected to further evaluate the system, that carcass locations are not always the same as locations where animals cross successfully, and that data in addition to carcass locations be used in decision-making. IN addition, it was suggested that cost-benefit analysis results be used as only one factor to support decisions related to DVC mitigation.

Overall, it was concluded that ROCS was generally complete and ready to use over a larger area. In addition, it was noted that the data collection device, central repository, and analysis capability were considered viable and effective. It was believed that the system could improve the efficiency of DVC and DVC mitigation evaluation activities. The research team also recommended some additional improvements to ROCS. First, the development of applications to accomplish ROCS data collection tasks with smart phones was recommended. In addition, more visualization functions were proposed and it was suggested that the "Roadkill Report" website could include specific analysis algorithms. The research project also included the development of a ROCS User's Guide (which is included as Appendix A of the referenced report).

1. Huijser, M.P., J.W. Duffield, A.P. Clevenger, R.J. Ament, and P.T. McGowen. Cost-Benefit Analyses of Mitigation Measures Aimed at Reducing Collisions with Large Ungulates in the United States and Canada: A Decision Support Tool. *Ecology and Society*, Volume 14, Number 2, 2009.