

Report 26-R41: Developing a Road Risk Model for Large Animal Crashes in Virginia: A Safe System Approach to Cost-Effective Safety Improvements

Background

In 2020, the Virginia General Assembly enacted the Virginia Wildlife Corridor Action Plan, directing agencies to identify wildlife corridors and high-risk wildlife crash areas to prioritize projects that improve safety and habitat connectivity. This plan aligns with VDOT's Safe System Approach, which emphasizes proactive road design and management. However, meeting these goals requires reliable tools because police-reported crash data significantly underrepresent large animal crashes and overlook key road and landscape factors that influence crash risk.

Research Objectives

The purpose of this study was to develop a predictive model to identify road segments in Virginia at high risk of white-tailed deer- or black bear-vehicle collisions. A related objective was to develop a benefit-cost methodology that complements the predictive model and supports consistent and defensible benefit-cost analyses for large animal-vehicle collision safety improvements in Virginia.

Approach

The model integrates police-reported crash data with road characteristics, traffic volumes, land cover, and other variables to estimate crash risk across the road network. To address underreporting, correction factors were developed using additional data sources and incorporated into model outputs and subsequent benefit-cost analyses. A benefit-cost calculator spreadsheet was created to support these analyses and inform appropriate investment levels for countermeasures based on expected safety benefits.

Outcomes

Crash probability was estimated for each 0.5-mile road segment across the state and converted into a predicted number of crashes, with correction factors applied to account for underreporting, whereby police-reported crashes are multiplied by 5 for deer and 2 for bear.

The benefit-cost approach can estimate the safety benefits of reducing deer and bear crashes along a road segment and compare them with countermeasure costs, using average factored crash costs of \$23,759.43 for deer and \$56,169.04 for bear.

Research Benefits

The large animal road risk model and supporting benefit-cost approach will contribute to the Wildlife Corridor Action Plan prioritization process and will supplement VDOT safety efforts by improving the evaluation of large animal crash risk, cost-effectiveness of safety countermeasures, and decision-making that is consistent with VDOT safety evaluation practices.

Principal Research Scientists

Ian Hamilton

Transportation Planner, VHB

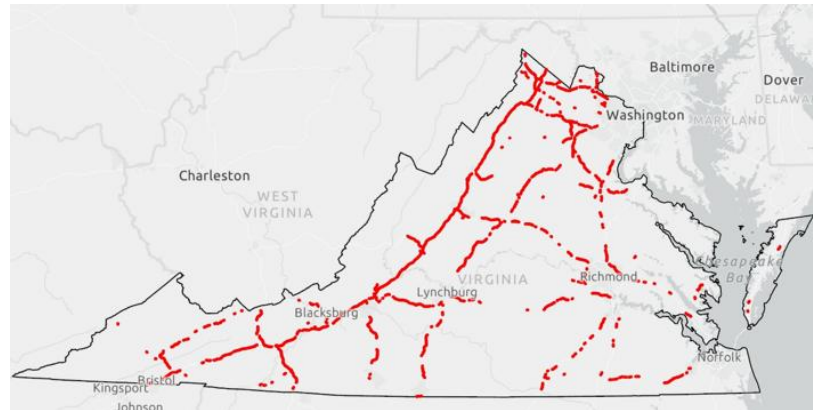
Bridget Donaldson

Associate Principal Research Scientist, VTRC

Research Findings

Top 0.5% Deer and Bear Risk Road Segments

The research team conducted separate deer and bear analyses to determine crash risk and combined the deer and bear analyses to provide an additional display option. It was determined that highlighting the top 0.5% highest risk road segments is an effective approach.



Case Study Application: Model Validation and Benefits

The model and benefit-cost approach were applied to a case study on I-64, where an existing underpass used by wildlife was enhanced with wildlife fencing. The case study showed that the model accurately identified a high-risk segment and improved crash frequency estimates relative to police-reported data, with estimated benefits of approximately \$1.6 million from the fencing project.

