INTEGRATING WILDLIFE CROSSINGS into TxDOT’S PLANNING and DESIGN PROCESS

RTI 0-6971
Stirling Robertson, Ph.D. and John Young, Jr., Ph.D.
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Project Management Team

- **Project Manager:** Chris Glancy

- **PMC Members:**
  - Stirling Robertson, Ph.D.  
    *Environmental Specialist, ENV*
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    *Environmental Coordinator, PHR*
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    *Environmental Specialist, ENV*
  - Greg Turco, P.E.  
    *Bridge Design Group Leader, BRG*
  - Jane Lundquist, P.E.  
    *Transportation Engineer, DES*
  - Ken Merritt  
    *Environmental Specialist, PHR*
  - Edward Paradise Jr  
    *Environmental Specialist, PHR*
  - Tom Pickering  
    *Environmental Specialist, BRY*
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    *Lead Traffic Engineer-South, AUS*
## Research Team

- **Project Lead:** Nan Jiang, P.E., Ph.D.  
  *CTR Research Associate*

- **Research Team:**
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    *Independent Wildlife and Transportation Researcher*
  - Lisa Loftus Otway, Esq.  
    *CTR Research Scientist*
  - Kara Kockelman, P.E., Ph.D.  
    *UT Professor*
  - Mike Murphy, P.E., Ph.D.  
    *CTR Deputy Director*
  - Noah Oaks  
    *(graduated)*  
    *Graduate Research Assistant*
  - Devin Wilkins  
    *Undergraduate Research Assistant*
Challenge

• Every year on average 7,585 collisions involving animals
• Every year on average 160 human deaths
• Many more injuries and property damage
• Habitat fragmentation and animal mortality
• Wildlife crossing consideration not integrated into TxDOT planning/design process
1. Literature Synthesis and State of the Practice
State-of-Practice Review

- Commonalities among western states
- Recommendations for TxDOT to adopt progressive approach
Data

- Crash
- Carcass
- Traffic
- Animal location
- Habitat maps
- Known population locations
- Existing telemetry
- Standardized, transparent process
- Early in planning process
- Map wildlife linkages
- Planning and prioritization

**Planning**

- **Planning**
  - Baseline Data and Determination of Species (including monitoring plan)
  - Agency consultation
  - Program Funding

- **Programming**
  - Fund and complete environmental studies
  - Coordination with engineering
  - Complete conceptual engineering needs and costs

- **Assessments**
  - Completed crossing assessment
  - Consider design alternatives, avoidance, minimization, mitigations
  - Continue agency coordination

- **Final Design**
  - Design and coordinate with agencies
  - Determine if monitoring is required and develop plan, if needed
  - Identify maintenance needs

- **Monitoring**
  - Determine if post construction monitoring is needed
  - Perform monitoring

- **Maintenance**
  - Plan and conduct maintenance
  - Identify adaptive management or maintenance
  - Conduct adaptive management strategies
- Standardized designs
- Incorporate examples of designs, plans, and schematics from other states
- Standardized designs
- Adaptive management during construction
- Monitoring
Maintenance

- Maintenance staff need to be involved early
- Maintenance adaptive management
- Carcass collection
Literature Review

- Reviewed of 90 papers
  - Planning for wildlife mitigation.
  - Effectiveness of wildlife crossing structures and other mitigation.
  - State conservation plans and connectivity analyses.
  - Cost-effective designs and retrofits.
  - Guidelines to decide when to mitigate for wildlife.
2. Texas Needs Assessment
- Correlate
- Synthesize
- Gain insights
Approach

- TxDOT personnel interviews
  - In-person
  - By phone
  - By email
- Major findings from interviews
Survey Targets

- TxDOT District Environmental Coordinator Staff
- TxDOT District Landscape Architects
- TxDOT District Area Engineers/District Engineers/District Directors of Planning and Development/Transportation Planning and Programming Division Director/Director of Project Planning and Development/Director of District Operations
- TxDOT District Director of Maintenance
- TxDOT Headquarters Bridge Division
- TxDOT Headquarters Traffic Operations Division
- TxDOT Headquarters Roadway Design Section, Design Division
Major Findings from Survey

- Top-down
- Regular data collection
- Plan early
- Establish best practices
- Educate employees
- Partner with resource agencies
3. Crash Data and Hot Spot Analysis

- Descriptive Statistics
- Hot Spot Analysis
- Regression Analysis
Descriptive Statistics

**Number of Crashes by Light Condition**

- Dark, Lighted
- Dark, Not Lighted
- Dark, Unknown Lighting
- Dawn
- Daylight
- Dusk
- Other

**Number of Fatal or Injurious Crash Reports by Vehicle Type**

- Motorcycle
- Pickup
- SUV
- Truck
- Passenger Car
- Van
- Other
Regression Analysis

- Identify variables
- OLS regression all counties
- VMT/capita
- Lane miles
- Density
- Rural/urban
- Non-linearity
Heat Maps

Based on crash data 2010-2016

Wild

Domestic
Hot Spot Analysis

Legend
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence
4. Benefit-Cost Analysis
Types of Mitigation Strategies

- Culverts
- Bridges
- Fencing
- Animal detection systems
Benefit-Cost Analysis Assumptions

- Only obvious monetary benefits and costs
- Analysis separate for each link
- 20 year lifetime
- 7% discount rate
Results

Benefit/Cost Ratios:

- Overpass with fencing: 1.32-2.82
- Underpass with fencing: 1.46-2.97
- Fencing with cattle guards and detection: 7.16-14.55
High B/CR Locations
5. Legal Review

- Case law
- NEPA Assignment
- State laws
6. Recommended Manual Language Modification
Other DOT's Manuals

- Utah
- Arizona
- Montana
- Idaho
- Nevada

- Florida
- California
- North Carolina
- Washington
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<td>- Access Management Manual</td>
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<td>- Bridge Project Development Manual</td>
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<tr>
<td>- Construction Contract Administration Manual</td>
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<tr>
<td>- Highway Safety Improvement Program Manual</td>
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<td>- Landscape and Aesthetics Manual</td>
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<td>- Maintenance Operations Manual</td>
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<tr>
<td>- Plans, Specifications and Estimate Development Manual</td>
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<td>- Procedure for Establishing Speed Zones Manual</td>
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<td>- Project Development Process Manual</td>
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<td>- Roadside Vegetation Management Manual</td>
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<td>- Roadway Design Manual</td>
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<td>- Transportation Planning</td>
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<td>- Transportation Programming and Scheduling Manual</td>
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<td>- Manual of Uniform Traffic Control Devices</td>
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7. Guidelines for Reducing Wildlife-Vehicle-Conflicts and Promoting Wildlife Connectivity
<table>
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<tr>
<td>1</td>
<td>Collect &amp; Map Data</td>
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<td>2</td>
<td>Establish if There Is a Need for Mitigation</td>
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<td>Choose Mitigation Options</td>
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<td>Evaluate Retrofit Opportunities</td>
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<td>Locate Placement of Wildlife Crossing Structures</td>
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<td>Select Designs for Wildlife Crossing Structures</td>
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<td>Select Fence &amp; Other Mitigation Designs</td>
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<td>Determine Maintenance Needs</td>
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<td>Determine Monitoring, Adaptive Management, Performance Measures</td>
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<td>Build Structures, Evaluate, Communicate</td>
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8. The White Paper

White Paper: The Incorporation of Wildlife Crossing Structures into TxDOT's Projects and Operations

Nan Jiang, Ph.D.
Patrice Cramer, Ph.D.
Lisa Loftus-Otway

February 2019; Published June 2019
Chapter 1. Introduction to Animal-Vehicle Conflict

Chapter 2. Why and When to Consider Wildlife Crossing Structures and Mitigation Strategies
   - 2.1 Data Analysis
   - 2.2 Economic Savings to Motorists

Chapter 3. How Can We Do This?
   - 3.1 TxDOT’s Recent Research
   - 3.2 TxDOT’s Inclusion of Animal-Vehicle Conflict Mitigation into the Planning Process
     - 3.2.1 Pharr District: Box Culverts for Ocelot
     - 3.2.2 Lufkin District: Bridge Replacement Leads to Longer Span
   - 3.3 Example Costs
   - 3.4 Choosing Options to Mitigate Animal-Vehicle Collisions
Chapter 4. Procedures for Developing Animal-Vehicle Conflict Mitigation with Examples

- 4.1 Data
  - 4.1.1 Crash, Carcass, and Wildlife Locational Data
  - 4.1.2 Data Mapping and Analysis
- 4.2 Planning
- 4.3 Design
- 4.4 Construction
- 4.5 Maintenance

Chapter 5. Conclusions
The Final Report

Available at:
http://ctr.utexas.edu/library/reports/
Conclusions

- WVC mitigation strategies can be cost-effective
- Mitigation can improve safety and habitat connectivity
- Demonstrated high benefit/cost ratios
- Developed standardized process
- Several districts are already demonstrating success
Take Home

- Stuff is hard, but if you work with others you can get amazing results.
- TxDOT has what it takes to be a leader in wildlife crossings.

Crossing on FM 106 at Ted Hunt Drainage Ditch

FM 106 Wildlife Crossing Box Culvert (with Ledges Increasing Access for Animals to Structure)

Ocelot looking into a crossing on SH 100
Contact Info

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TxDOT districts