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INDIANA DEPARTMENT OF TRANSPORTATION
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Identify Bridge Design Guidelines for Wildlife Crossings



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16. Abstract Annual vehicle miles driven in the United States doubled, from 1.6 trillion to 3.2 trillion in the 40 years between 1983 and 2023. Unfortunately, one side effect of the increase in vehicle miles driven has been the prevalence of Animal-Vehicle Collisions (AVCs). As early as 1975, efforts began in some Western states to create safe animal passages such as the wildlife overpass over I-15 in Beaver, Utah. Wildlife passages increased in popularity from the 1970s through the 1990s, but they were mainly being designed and constructed in the Western United States. Today, there is increasing and broader interest in safe wildlife passages across the United States with major coalitions forming in different areas to promote the adoption of wildlife passages for both animal and human safety. This study examines what other Midwestern states are doing regarding designing animal passages into new and reconstruction bridge projects. In this area, Indiana is a leader in making accommodations for small wildlife passages as states such as Michigan and Tennessee have not yet incorporated wildlife crossing into their bridge design process. Ohio has integrated input from their Department of Natural Resources into its bridge design process, but it is not frequently used and the input is essentially only suggestion rather than requirement. This study also examines the root cause of delays and increased costs on some INDOT bridge designs related to rework caused by not having timely input from DNR regarding wildlife crossings. This study has identified two key recommendations where making minor changes in INDOT's New Project Development Process could ensure the timely flow of information to and from DNR to prevent late changes in bridge projects.			
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EXECUTIVE SUMMARY

Background

Under the current Indiana Department of Transportation (INDOT) bridge design process for new or replacement bridges and culverts, there are sometimes communication problems that result in input from Indiana Department of Natural Resources (DNR) regarding animal crossings not being received in time and/or in enough detail to be incorporated into the original bridge design. When the information is received later than needed, it often requires modification of the bridge design which results in both schedule delays and increased cost.

Wildlife crossing structures can have a significant fiscal impact to a state; it is estimated that every wildlife crossing structure yields between \$235,000 and \$443,000 in annual benefit (in 2021 dollars; Sugiarto, 2022). The fiscal impact will vary depending on the effectiveness of the crossing structure and the type of animal-vehicle collisions prevented with larger animals (elk, moose, deer, etc.) being responsible for many more human injuries/deaths and property damage than smaller animals.

The purpose of this project is to determine what information DNR needs to make recommendations about wildlife crossings and how best to ensure that information is reliably communicated to them early enough in the bridge design process that they can provide meaningful and timely input about animal crossing into the initial bridge design and avoid having to make modifications to the design later.

Objectives

- 1) Research other states to learn how they handle bridge design processes related to wildlife crossings.
- 2) Work with representatives from INDOT and DNR to map the current INDOT Bridge Design process so both organizations can better understand the process and see how wildlife crossing information impacts the overall cost and timing of a new or replacement bridge or culvert.
- 3) Work with INDOT and DNR representatives to develop an improved process that will provide the needed wildlife crossing information earlier in the process to avoid bridge design modifications.
- 4) Develop policies and procedures within INDOT and DNR to add wildlife crossing guidelines to the INDOT Bridge Design Manual.

Results 1: Indiana is Ahead of Other Midwestern States Regarding Wildlife Crossings Requirements

The Michigan Department of Transportation (MDOT) has built a snake barrier to keep endangered rattlesnakes off a bridge on M13 that crosses the Flint River just South of Saginaw, Michigan. MDOT has also decommissioned an old, single-lane

tunnel that crosses under I-96 and turned it into a wildlife crossing. However, MDOT does not actively build wildlife crossing features into their new or replacement bridges or culverts.

The Tennessee Department of Transportation (TDOT) only accommodates aquatic wildlife (as opposed to mammalian wildlife) crossing features into their new and replacement bridge designs. The exception to this rule is the I-40 Pigeon River Gorge Project Area which is a 28-mi section of I-40 (8 mi in Eastern Tennessee and 20 mi in Western North Carolina; Safe Passage, n.d.a). A series of wildlife crossing are being implemented by the Safe Passage Wildlife Crossing Project to reduce wildlife mortality of elk, bear, bobcat, deer, red fox, coyote, and many other species of mammals, reptiles, and birds (Safe Passage, n.d.b). This project is led by a coalition of “local, state, tribal, and federal agencies, land managers, conservation organizations, nonprofit park partners and other invested community members” (Safe Passage, n.d.b).

Both Ohio and Kentucky are actively studying ways to reduce animal-vehicle collisions, but both seem focused on deer rather than animal crossings for smaller mammals which are causing most of the disruption with INDOT’s bridge design process. Both INDOT and DNR subject matter experts agree that small animal crossing features for approximately 10’ diameter culverts seem to generate the most issues.

Results 2

While there have been instances of design rework required because of animal crossing recommendations, that does not always happen. The process does work smoothly on some projects, and it appears that, in those instances, it is because the consulting engineering firms are initiating contact with DNR shortly after being awarded a contract for design work. Based upon numerous discussions with DNR and INDOT stakeholders, it appears that immediately after the consulting engineering firm is awarded a contract is the ideal time to draw DNR into the bridge design process

Recommendations

- 1) During the hydraulics field visit, a standard set of photographs should be taken including “through pipe” photos of culverts. These photos should be documented in the hydraulics report. In addition, it is recommended that trail cameras be installed on both sides of the road for a period of time near the culvert to determine what types of animals may be using the present in the area. These cameras are very inexpensive with some on Amazon being available for as little as \$40 each.
- 2) Following the hydraulics visit, the INDOT hydraulics team (or INDOT consulting engineering firm) should contact DNR to share the hydraulics report and photos. This step should be explicitly added to the bridge design process to ensure DNR is pulled into the bridge or culvert design process in time to provide meaningful and timely input into the bridge or culvert design.

- 3) DNR should provide clear guidance on their recommendations for any desired wildlife passage including what wildlife they are attempting to accommodate and the dimensions of any accommodations they are requesting such as animal shelves in culverts or the diameter of any secondary culvert above the primary culvert that may be intended primarily for accommodating wildlife passage.
- 4) The proposed INDOT Wildlife Crossing Guidelines shown in the Appendix are adapted from a document published by the Florida Department of Transportation. While most of the guidelines may be considered “common sense” they are useful as a checklist to help ensure proper decisions are made about the design and implementation wildlife crossings,- and it is recommended that these guidelines be formally adopted by INDOT in the next revision to the INDOT State Project Development Process Manual.

Implementation

- 1) Update the work instructions for the hydraulic field visit to include a standard set of photos to be taken which includes through pipe photos.
- 2) Update the bridge design process manual to include a meeting between the hydraulics team (either INDOT or consulting engineering firm) and DNR to review the hydraulics report and photos.
- 3) Input from DNR should be listed as an input in the engineering assessment that follows the hydraulics study (or the hydraulics study could include input from DNR that results from the meeting describe in #2 above).
- 4) The proposed INDOT Wildlife Crossing Guidelines in Appendix A should be formally adopted into the next revision of the INDOT State Project Development Process Manual.

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1. INTRODUCTION

According to data from the Federal Highway Administration (Huijser et al., 2008), between 1990 and 2004, the total number of vehicle crashes in the United States dropped slightly while the number of wildlife–vehicle collisions (WVCs) increased by approximately 50% (Figure 1.1).

The Center for Large Landscape Conservation (n.d.) found that WVCs “are a growing problem and represent an increasing percentage of accidents on our roads” with a 50% increase from 200,000 to 300,000 between 1990 and 2004. According to that same report, collisions between motorists and wildlife cause more than 200 human fatalities and over 26,000 injuries per year at an annual cost to Americans of more than \$8 billion (vehicle, medical, towing, law enforcement, value of animal, and carcass removal). In addition, an estimated 1–2 million large animals are killed by motorists every year (Center for Large Landscape Conservation, n.d.).

To help reduce these issues, on December 20, 2024, FHWA (2024) announced \$125 million in grants for 16 new wildlife crossing projects in 16 states, including one Indigenous Tribe.

At the state level, according to the Indiana Department of Natural Resources (DNR, n.d.), more than 14,000 deer–vehicle collisions are reported annually in Indiana. According to Indiana State Police data, in 2023 there were 16,448 vehicle collisions with deer resulting in 497 human injuries and seven deaths (Reynolds, 2024).

However, a 2021 study commissioned by the Ohio Department of Transportation found that police reports may underestimate the real number of vehicle collisions with deer by as much as 50% because many collisions go unreported

(Stone Environmental Engineering and Science, Inc, 2021). This 41-page report was specifically focused on evaluating various methods of collecting animal–vehicle collision (AVC) data.

The report noted that the majority of AVC data are collected via “opportunistic means” (without special effort being made to collect the data) using existing data such as crash reports, carcass removal, salvage reports and insurance claims (Stone Environmental Engineering and Science, Inc, 2021). These opportunistic methods are convenient but raise issues related to data quality. The data collected by “intentional means” (i.e., a study that monitors road segments for roadkill on a daily or weekly basis) generally produces higher quality data but the data are usually very limited in scope (how many road miles are covered) and duration (weeks or months of data are collected versus the years of data often collected via “opportunistic means”).

Assessing vehicle collisions with smaller animals (raccoon, opossum, etc.) is even more challenging as those collisions are rarely reported. A 28-year study, published by the Ohio Department of Natural Resources (2016), found small mammal deaths from vehicle collisions, in just March and April of each year, averaged 47 raccoon, 54 opossum, 23 skunk, and 12 woodchucks per 1,000 miles of road (Figure 1.2). Due to the small size of the animals involved, these collisions rarely result human injuries/death or significant property damage.

The reduction in woodchuck, skunk, and opossum deaths between 1989 and 2016 is believed to be related to a general decline in population of those species in Ohio during that time

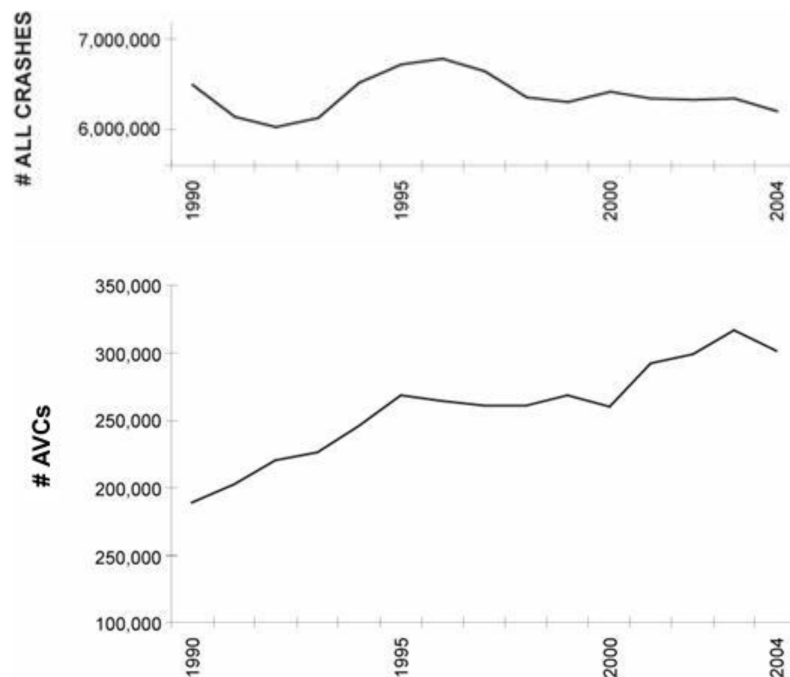


Figure 1.1 Data from FHWA Regarding Wildlife–Vehicle Collisions. Source: Huijser et al. (2008).

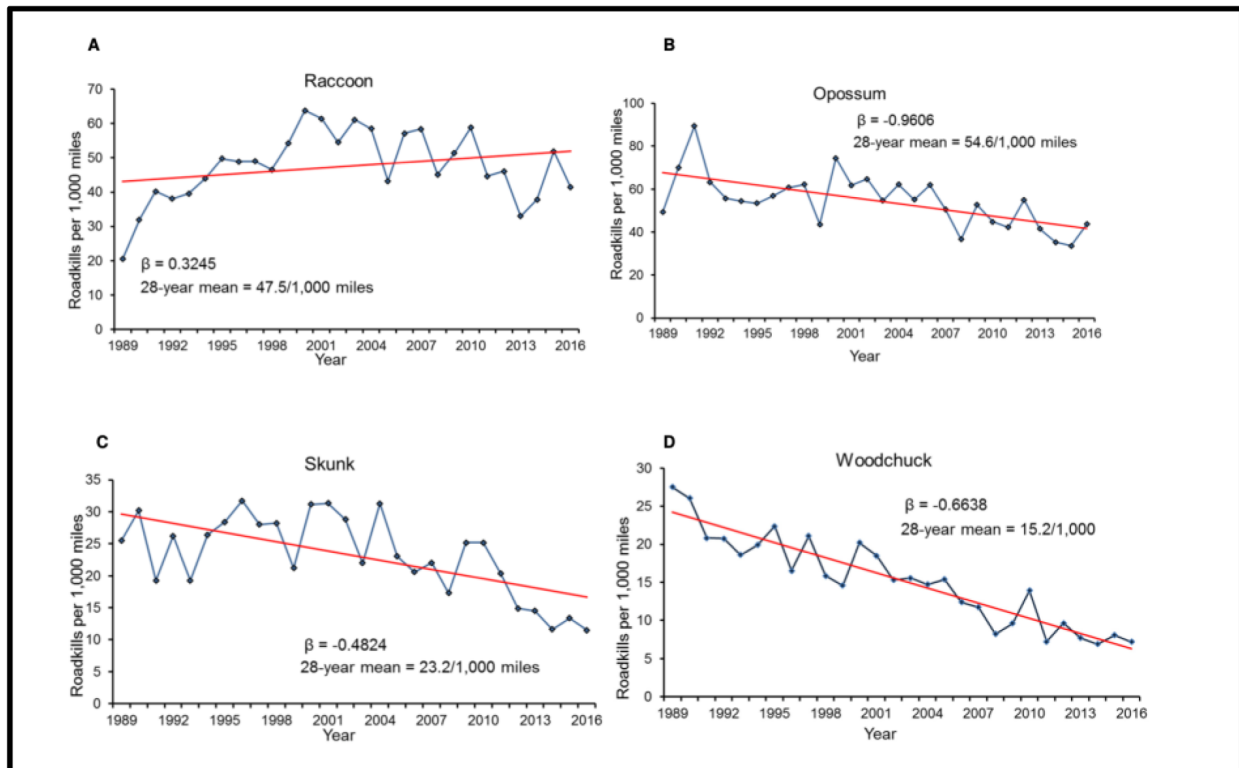


Figure 1.2 Roadkill Rates (Road Kills/1,000 mi) in Ohio During March and April. Source: Ohio Department of Natural Resources (2016).

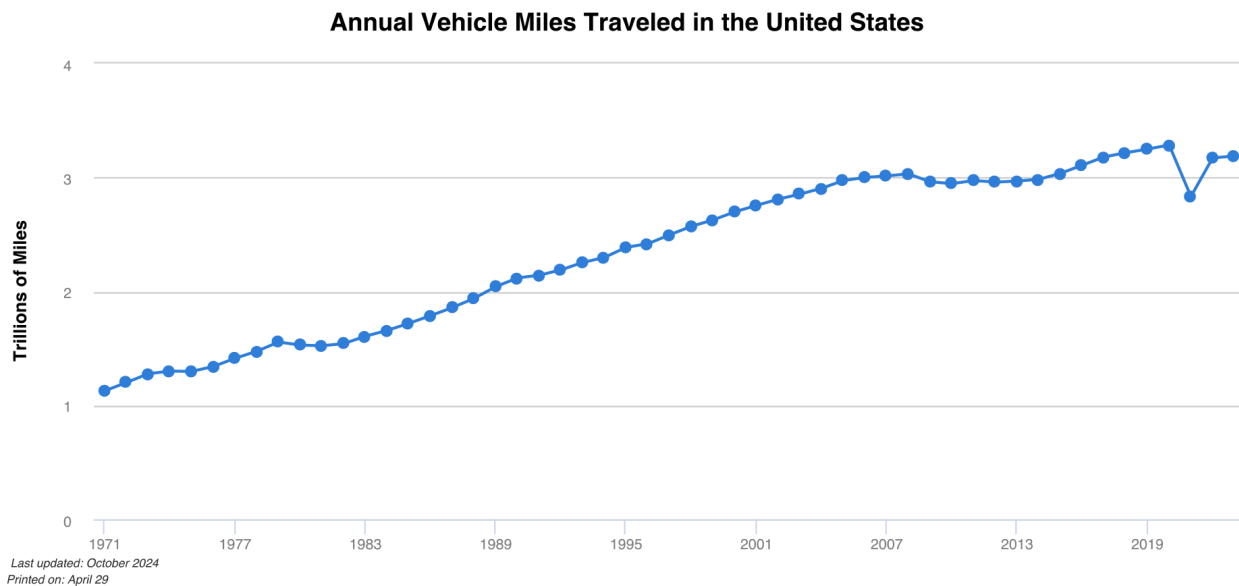


Figure 1.3 Annual Vehicle Miles Driven in the U.S. by Year. Source: Alternative Fuels Data Center (2024).

(Ohio Department of Natural Resources, 2016). However, the overall problem of animal-vehicle collisions is believed to be getting worse each year as the number of vehicle miles traveled in the United States each year has doubled from 1.6 trillion mi in 1983 to 3.2 trillion mi in 2023 (Figure 1.3; Office of Highway Policy Information, n.d.).

2. PROBLEM STATEMENT

The concept of wildlife crossings is not new. They were pioneered in France in the 1950s, and the first wildlife overpass in the United States was built in Beaver, Utah, in 1975 (Barringer, 2022).

However, wildlife crossings did not start becoming common until the 1990s, and, even then, they were predominantly limited to the western United States. The first major federal legislation to fund wildlife crossing was the Bipartisan Infrastructure Law of 2021 which created the Wildlife Crossings Pilot Program.

Large crossing structures, used in conjunction with wildlife fencing, have proven to reduce WVCs by 86–97% (Figure 2.1).

Sugiarto (2022) estimated that every wildlife crossing structure yields between \$235,000 and \$443,000 in annual benefit (in 2021 dollars).

Canada has experienced similar success in reducing wildlife vehicle collisions. According to the World Wildlife Fund (2023), six bridges and 38 underpasses along the Trans-Canada Highway in Banff National Park have led to an 80% drop in incidents between wildlife and vehicles.

Because wildlife crossings are new to many states, especially in the Midwest, state agencies are having to adjust mature design details to accommodate the interest/requirements to incorporate wildlife passages in bridge design to reduce animal-vehicle collisions.

A lot of the early focus has been on designing and building animal crossings to reduce vehicle collisions with large

mammals (elk, deer, etc.) due to the property damage and human injuries associated with such collisions. However, there is growing interest in protecting smaller mammals and reptiles as well by incorporating animal passage features into smaller bridges and culvert projects.

In Indiana, the DNR makes recommendations about the wildlife passage features they would like to have incorporated into new and replacement bridge or culvert projects. These recommendations are then taken into consideration and evaluated for both cost and feasibility (i.e., would the inclusion of the recommended wildlife crossing feature cause potential hydraulic issues or potential property damage elsewhere?).

The Indiana Department of Transportation (INDOT) standardized bridge design practices in the mid-20th century and has regularly updated them based on engineering standards, national standards, and material specifications. The addition of wildlife crossing features is one of the latest changes that need to be researched, understood, and integrated into the bridge design process.

The primary issue at this time is understanding the flow of information to and from DNR so they can provide meaningful and timely input to INDOT to find the best solution for animal crossings in new and replacement bridge and culvert projects.

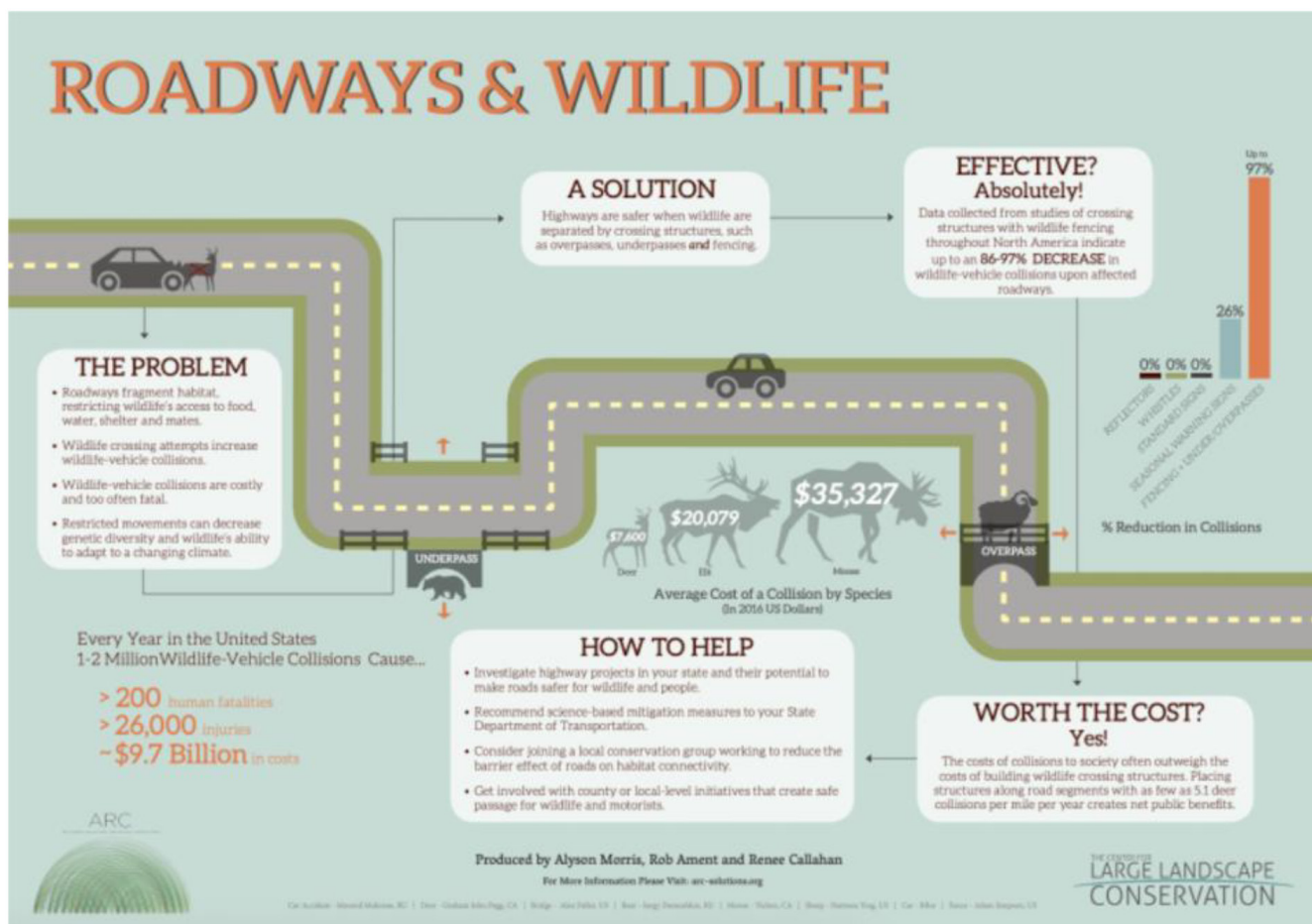


Figure 2.1 Effectiveness of Wildlife Crossing Structures.

3. OBJECTIVES

- 1) Research other states to learn how they handle bridge and culvert design processes related to wildlife crossings.
- 2) Work with representatives from INDOT and DNR to map the current INDOT Bridge Design process so both organizations can better understand the process and see how wildlife crossing information impacts the overall cost and timing of a new or replacement bridge or culvert.
- 3) Work with INDOT and DNR representatives to develop an improved process that will provide the needed wildlife crossing information earlier in the process to avoid bridge design modifications.
- 4) Develop policies and procedures within INDOT and DNR to add wildlife crossing guidelines to the INDOT Bridge Design Manual.

4. METHODOLOGY

Because wildlife passages are relatively new, especially in the midwestern United States, this project began by looking at what other states have done and are doing related to wildlife passages. This work was accomplished by a combination of a literature review related to wildlife crossings/passages as well as interviews with department of transportation (DOT) employees in other states.

In addition to understanding what other states are doing, time was spent reviewing and analyzing both INDOT's current bridge and culvert design process and DNR's process for determining wildlife crossing recommendations. Insights from both processes were cross shared between INDOT and DNR to find areas of common ground where small changes in the existing process could greatly improve coordination and the overall flow of information without creating an additional burden on either process.

5. ANIMAL CROSSINGS IN OTHER STATES

While the need for animal crossings exists in all states, the local wildlife and local characteristics on any given road segment (speed limits, daily volume of traffic, number of lanes, presence of hills and curves, proximity to fields, rivers and forests, etc.) play a major role in determining what features are most appropriate. In Indiana the largest animal typically seen on the roads are deer, but other states must also consider elk, moose, bear, mountain lions, and bighorn sheep.

5.1 Washington State

In 2019, the I-90 Wildlife Bridge near Snoqualmie Pass in Washington State was completed (Figure 5.1). This \$6.2 million overpass is 150 ft wide, 215 ft long, and has 8-ft walls on either side reduce traffic noise (Bush, 2018).

The wildlife bridge shown in Figure 5.2 is just one of more than two dozen wildlife crossings planned or completed along a 15-mi stretch of I-90 between Hyak and Easton.

However, these large-scale projects are still mainly confined to Western states. In the Midwest, Michigan has built or repurposed a couple of structures for wildlife, but they are not currently designing wildlife crossings features into new or replacement bridge designs.



Figure 5.1 I-90 Wildlife Bridge Near Snoqualmie Pass in Washington State. Source: Geoquest USA (n.d.).

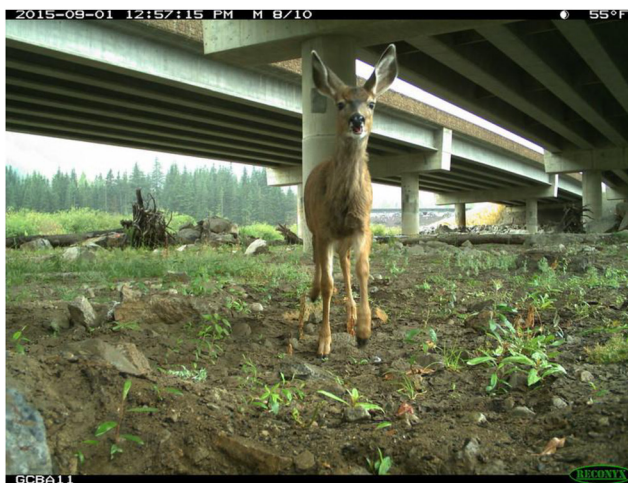


Figure 5.2 I-90 Wildlife Underpass Near Snoqualmie Pass in Washington State. Source: Washington State Dept of Transportation (2015), CC BY-NC-ND 2.0.

5.2 Michigan

Brad Wagner, the Chief Structure Design Engineer for Michigan Department of Transportation discussed two recent animal crossing related projects. One project was a snake barrier to keep endangered rattlesnakes from getting hit by vehicles on a bridge over the Flint River on M13, just South of Saginaw, Michigan (Figure 5.3). The barrier was made by splitting 36-in. corrugated pipe lengthwise then burying it 18-in deep outside of the guardrails to prevent snakes from crawling under the guardrails onto the bridge or road. Instead, the snakes move toward the water and cross under the bridge. As seen in Figure 5.4, this barrier appears to be difficult for maintenance teams to maintain. The animal crossing was turning a one-lane tunnel under I-96 a few miles East of Grand Rapids, Michigan, into an animal passage (Figure 5.5 and Figure 5.6). This was an existing structure, so no real design or construction work was required.



Figure 5.3 Location of Snake Barrier South of Saginaw, Michigan.



Figure 5.4 Snake Barrier Made from 36-in. Corrugated Pipe.

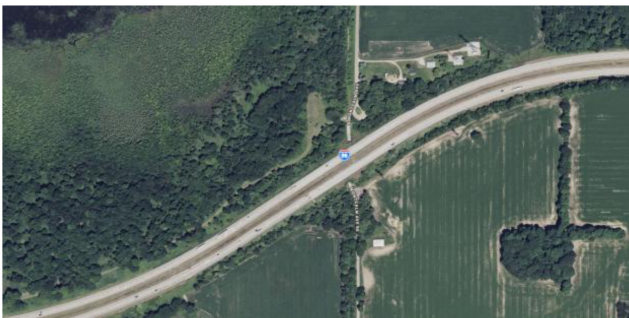


Figure 5.5 Location of Large Mammal Crossing Under I-96.



Figure 5.6 Large Mammal Crossing Under I-96.

5.3 Ohio

Ohio has been studying AVCs for several years and developing a comprehensive strategy to reduce AVCs. They began with a study to assess the quality of their data and realized they only had usable data related to deer collisions because collisions with smaller animals are rarely reported.

Ohio has created “hot spot” maps indicating problematic areas where deer strikes have occurred most frequently over the past 11 years. They then developed an AVC “Mitigation Matrix” describing options such as fencing, road underpasses, and so on, and the situations where each mitigation would be most appropriate (Ohio Department of Transportation, n.d.).

Ohio has installed some animal crossings such as concrete tunnels covered by metal grates to allow amphibians to safely cross a road at Battelle Darby Creek Metro Park (Figure 5.7; (Biegler, 2022)).

According to Matt Perlik, Assistant Environmental Administrator at the Ohio Department of Transportation (ODOT), ODOT and Ohio Department of Natural Resources (ODNR) have a written agreement on communication between the agencies (included in Appendix B) that describes their coordination process. ODNR has the opportunity to comment early in the ODOT project development process regarding animal crossings, but they do not receive comments very often and, even when they do, they are only suggestions as opposed to requirements.

5.4 Kentucky

On December 5, 2023, FHWA awarded Kentucky’s Transportation Cabinet (KYTC) \$1.2 million to study WVCs (Commonwealth of Kentucky Transportation Cabinet, 2023). Lochner won a project contract from KYTC to conduct a two-part study, starting with a small pilot of the I-64/US-60 parallel corridors between Louisville and Frankfort, Kentucky



Figure 5.7 Grated Amphibian Tunnel at Battelle Darby Creek Metro Park. Source: Biegler (2022).

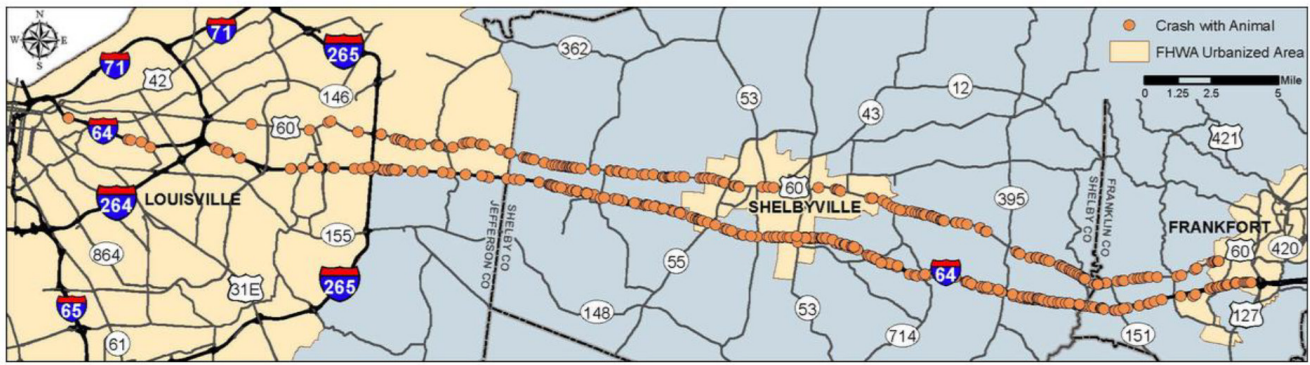


Figure 5.8 The I-64/US-40 Parallel Corridor Between Louisville and Frankfort.

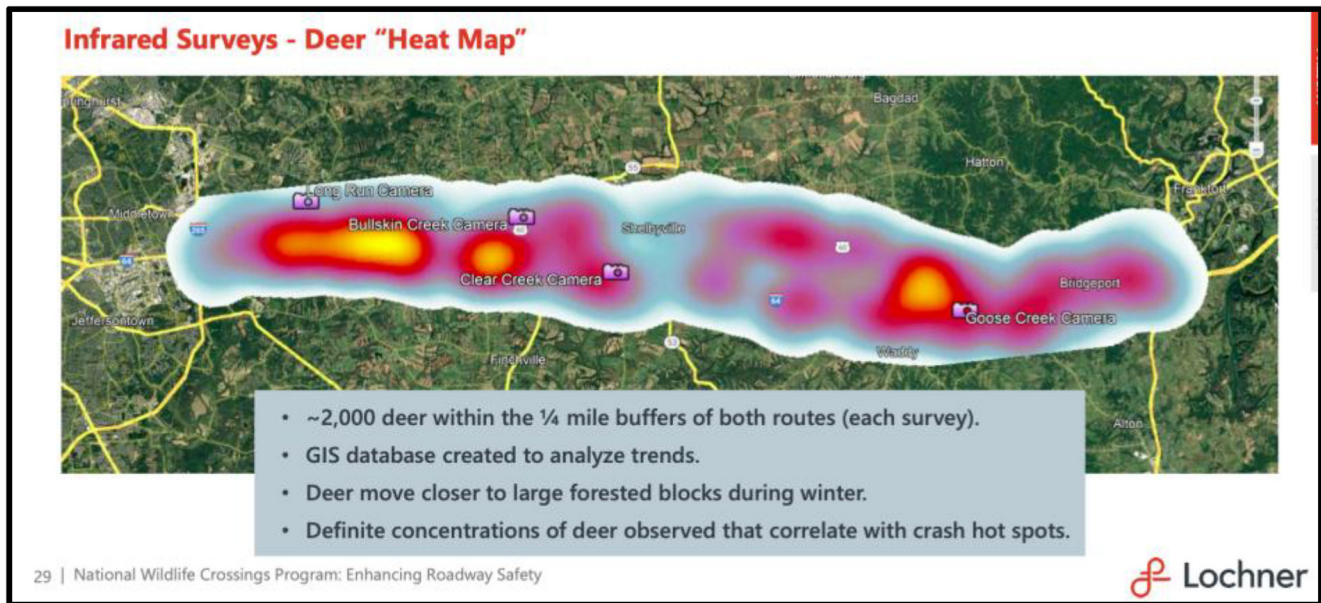


Figure 5.9 Heat Map of White-Tailed Deer Activity Along I-64/US-40 Corridors. Source: Vale et al. (2025).

(Figure 5.8), then a follow-on statewide study. The pilot study was to develop statewide methods for investigating wildlife movements and WVCs.

The goal of the KYTC WVC Reduction Pilot Study was to improve both driver safety and roadway ecology. The study focused on determining how white-tailed deer interact with highways, how KYTC can help them cross without conflict, and developing methods that could be extrapolated to the entire state. Lochner used a variety of techniques to understand white-tailed deer movements near highways including drone-based infrared surveys, habitat and infrastructure surveys, game camera surveys, and Global Positioning System (GPS) collar surveys. Combined, these techniques allowed Lochner to create heat maps, such as the one shown in Figure 5.9, showing white-tailed deer activity near the corridor.

Understanding where and when white-tailed deer cross the corridor led to discovering insights and forming the recommendations shown in Figure 5.10.

KYTC's WVC efforts are primarily focused deer rather than smaller mammals.

5.5 Tennessee

Ted Kniqzewycz, the Director of the Structures Division at Tennessee Department of Transportation (TDOT) reported that TDOT only incorporates aquatic wildlife (as opposed to mammalian wildlife) crossing features in their new and replacement bridge designs.

However, TDOT is a part of the Safe Passage Wildlife Crossing Project. This project involves a coalition of "local, state, tribal, and federal agencies, land managers, conservation organizations, nonprofit park partners and other invested community members" (Safe Passage, n.d.b). The coalition has planned a series of wildlife passages along the I-40 Pigeon River Gorge Project Area which consists of a 28-mi section of I-40 (8 mi in Eastern Tennessee and 20 mi in Western North Carolina).

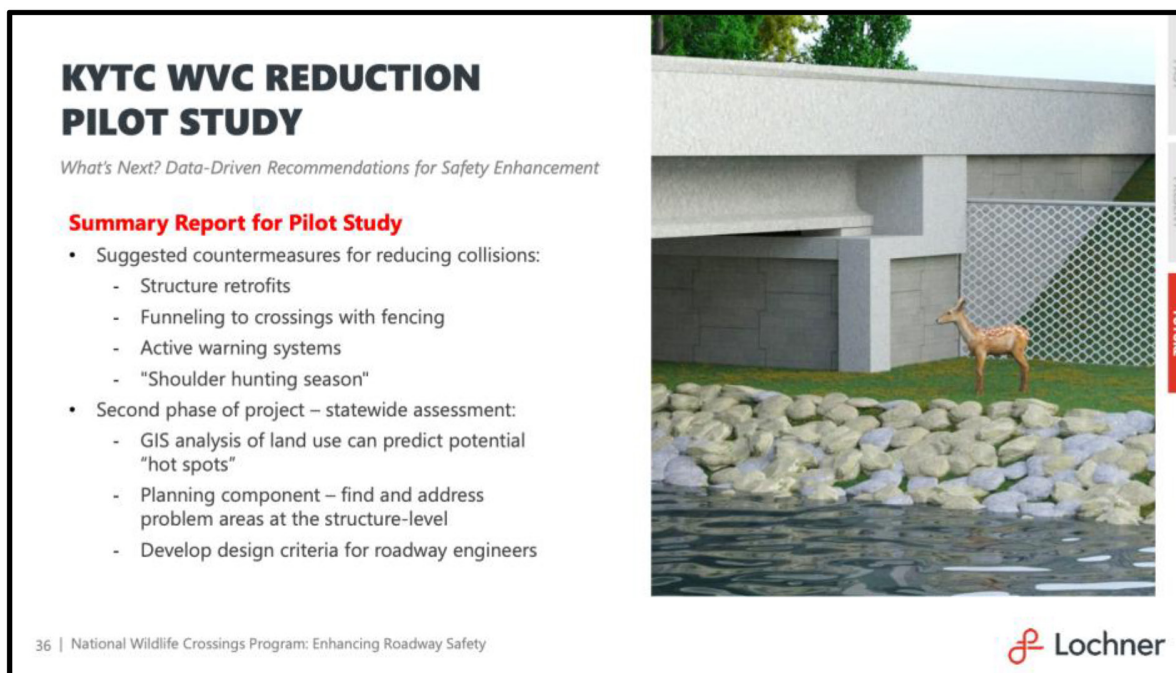


Figure 5.10 Locher’s KYTC WVC Reduction Recommendations. Source: Vale et al. (2025).

These crossings are intended to reduce wildlife mortality of elk, bear, bobcat, deer, red fox, coyote, and many other species of mammals, reptiles, and birds. This is a long-term project and a few of the crossings on the North Carolina end of the Pigeon River Gorge have already been completed.

5.6 North Carolina

Twenty (20) of the 28 mi of the Pigeon River Gorge Project Area is in North Carolina. North Carolina has already completed several animal crossing projects, including those shown in Figure 5.11 and Figure 5.12 near Waynesville, North Carolina. This area used fencing to prevent mammals from crossing getting onto the road and provided tunnels for small



Figure 5.11 Wildlife Passages for Small Mammals Near Waynesville, NC.



Figure 5.12 Flat Gravel Path Under Road for Larger Mammals.

mammals as well as flat, gravel paths under the road for large mammals to be able to safely walk while avoiding walking on riprap.

6. INDOT’S PROJECT DEVELOPMENT PROCESS

INDOT has mature, well documented processes for bridge design. The flowchart, shown in Figure 6.1, illustrates a high-level overview of the activities involved in developing a project including the environmental, right-of-way, utilities, and geo-tech/pavement work that must be orchestrated for a successful project. Figure 6.2 was added to zoom into the relevant part of Figure 6.1 for ease of reading.

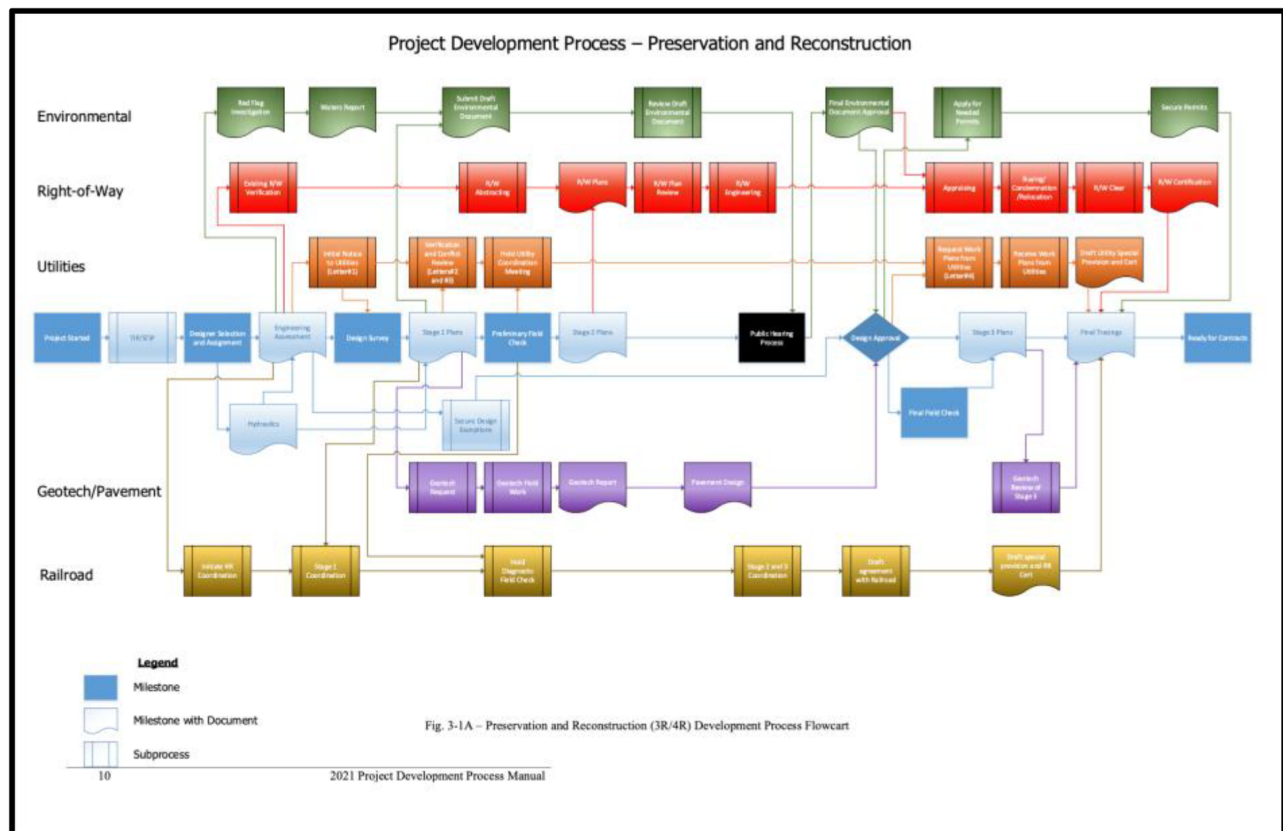


Figure 6.1 INDOT Project Development Process. Source: INDOT (2021).

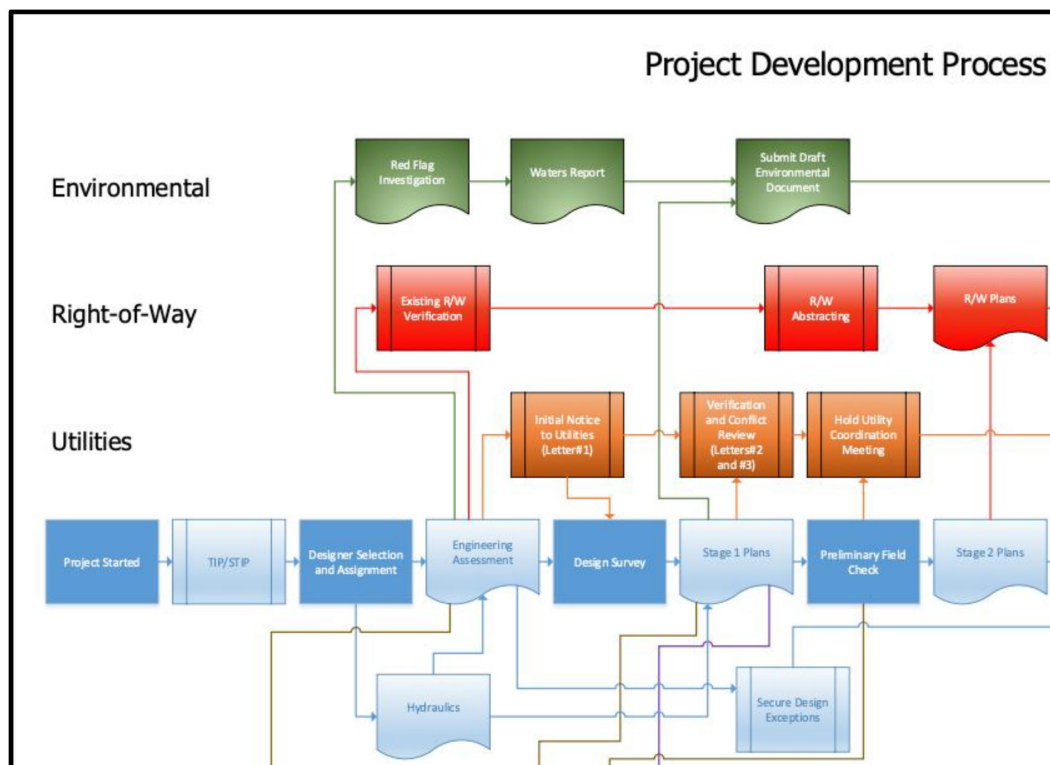


Figure 6.2 INDOT Project Development Process Zoomed In. Source: INDOT (2021).

This flowchart was created prior to animal crossings becoming a regular consideration in the development of a new project. While environmental permits are shown on this flowchart, DNR needs to be involved in the process much earlier to ensure they can provide meaningful and timely input to the design process. Even involving DNR during the red flag investigation may not always be early enough in the process.

Based on numerous conversations with both INDOT and DNR stakeholders, it appears the best time to involve DNR is when the hydraulics analysis is being completed. Currently this happens in some projects, but it needs to be formally added as a design process step to ensure it happens for every bridge or culvert project.

7. DNR'S WILDLIFE CROSSING PRIORITIES

While the Indiana DNR would like to see animal crossing accommodations made a part of every new and replacement bridge or culvert project, they realize that is not always physically and/or financially feasible. DNR's priority for animal crossings is summarized in Table 7.1.

It is important to note that not all existing animal passages were necessarily designed by INDOT. A structure may have been designed and constructed decades ago without any intentional animal passage features. For instance, riprap may have been used to cover the banks of a river under a bridge. But over time, erosion may have dislodged enough riprap that deer may have started crossing under the bridge on exposed dirt. If that structure is being replaced, the existing animal passage must somehow be maintained. Even backfilling riprap with smaller stone would be helpful by making it easier for animals to cross under the structure.

DNR's recommendations for wildlife passages are based on at least maintaining the existing wildlife passages whether those passages were intentionally designed into the bridge or culvert or whether animals began using a passage that formed by accident, such as a partially clogged culvert creating a convenient way for small mammals to cross under a road. Any changes to a structure that would increase the volume or speed of water flowing through a pipe could prevent wildlife from using paths they were accustomed to following and could lead to an increase in AVCs as animals seek alternative routes. An example of this might include small mammals accustomed to using a partially blocked culvert. After the culvert has been cleared, the volume and speed of water flowing through it may make it unusable by the mammals who now must cross over the road.

This is why DNR has requested a standard set of photographs be taken during the hydraulics field visit, including through-pipe



Figure 7.1 Box Culvert for Amphibian Crossing. Source: MCON (n.d.).

photos, so they can assess whether an unintended wildlife passage has formed over time that needs to be maintained.

Many options exist for wildlife passages including dedicated tunnels as shown in Figure 5.11 or “animal shelves” in culverts as shown in Figure 7.1.

Note: Figure 7.1 is only shown for illustration of an animal shelf. Depending upon the type of wildlife being accommodated, this type of shelf may or may not be appropriate as some wildlife would be able to access and use the shelf while other wildlife would not be able to use it.

8. SUMMARY

Wildlife passages are a growing concern, as demonstrated by FHWA funding and by a growing number of conferences such as the International Conference on Ecology and Transportation, held in Denver, Colorado, from May 11–15, 2025. The conference brought together transportation thought leaders, state DOTs, consultants, and wildlife advocacy groups from around the United States to discuss a wide variety of ecology/transportation related issues.

While, historically, the focus has been on avoiding large WVCs, there is a growing interest in also reducing small animal collisions. In the Midwest, Indiana appears to be a leader in this area as surrounding states are still largely focused on reducing large animal collisions.

9. RECOMMENDATIONS, BENEFITS, AND IMPLEMENTATION

9.1 Through-Pipe Photographs and Trail Cameras

During the hydraulics field visit, a standard set of photographs should be taken including “through-pipe” photographs of culverts. These photographs should be documented in the hydraulics report. In addition, it is recommended that trail cameras be installed on both sides of the road for a period of time near the culvert to determine what types of animals may be using the present in the area. These cameras are very inexpensive with some on Amazon being available for as little as \$40 each.

TABLE 7.1
DNR's Wildlife Crossing Priorities.

Type of Structure	Priority
New bridge or culvert	Must include animal passage
Replacement bridge or culvert w/ existing animal passage	Must maintain animal passage
Replacement bridge or culvert w/o existing animal passage	May include animal passage

Today INDOT often takes “upstream” and “downstream” photographs, but DNR needs the “through-pipe” photographs as well so they can assess whether animals are currently using a given culvert as a wildlife passage.

In the future, DNR would like a central repository of all the photographs taken during the hydraulics field visits so when a project comes up, they can look not only at the most recent photographs but at how the conditions have changed over time (how animals may have adapted to soil erosion or partial blockage of a culvert). Collecting and making these images available to DNR in a searchable database would greatly assist them in being able to better assess and make recommendations about wildlife crossing features.

Benefit: DNR will be better able to assess how animals are currently using the pipe and surrounding terrain so existing passages can be maintained.

Implementation: This is a request that can be accommodated by the person/people doing the hydraulics field visit. Photographs are already being taken but they often do not include through the through-pipe photos DNR would like to have. The description of the standard set of photos should be documented in the work instructions for the hydraulics field visit.

9.2 Sharing Hydraulic Report and Photographs

Following the hydraulics visit, the INDOT hydraulics team (or INDOT consulting engineering firm) should contact DNR to share the hydraulics report and photographs. This step should be explicitly added to the bridge design process to ensure DNR

is pulled into the bridge or culvert design process in time to provide meaningful and timely input into the bridge or culvert design.

Benefit: This recommendation helps ensure DNR has the information they need to provide meaningful and timely input into the design process to avoid late input and rework.

Implementation: Figure 9.1 highlights the “Hydraulics” step as outlined by INDOT (2021, p. 28). Specifically, page 28 of the manual (INDOT, 2021) describes the work performed during the Hydraulics Analysis including the creation of a hydraulics report and model. Figure 9.2 was added to zoom in on the most relevant portion of the process for ease of reading.

It is recommended this section be updated to include taking standard photos, including “through-pipe” photos, and meeting with the DNR to solicit their input on wildlife crossing features for the project. This will ensure DNR is engaged early enough in the project and engaged with the right subject matter experts to provide meaningful and timely input into the design process.

9.3 DNR Guidance on Recommendations

DNR should provide clear guidance on their recommendations for any desired wildlife passage including what wildlife they are attempting to accommodate and the dimensions of any accommodations they are requesting such as animal shelves in culverts or the diameter of any secondary culvert above the primary culvert that may be intended primarily for accommodating wildlife passage.

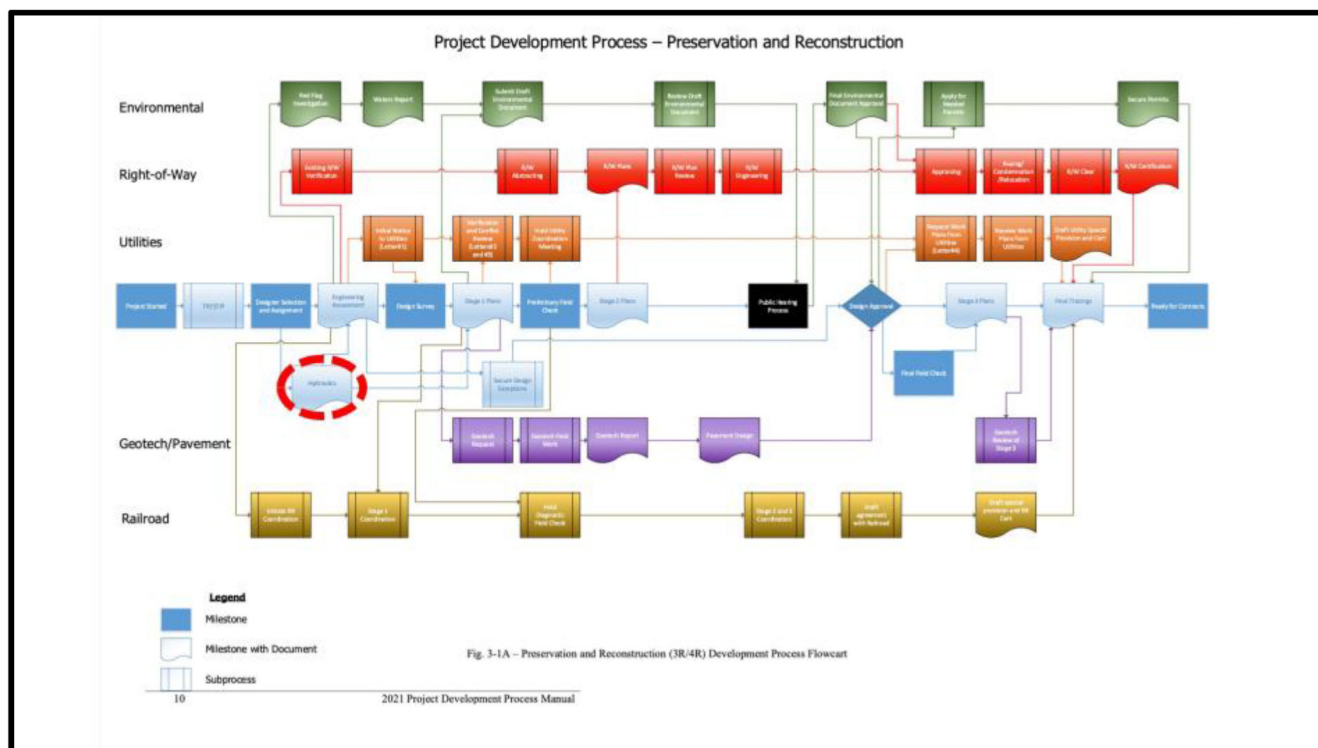


Figure 9.1 Project Development Process Showing DNR Engagement.

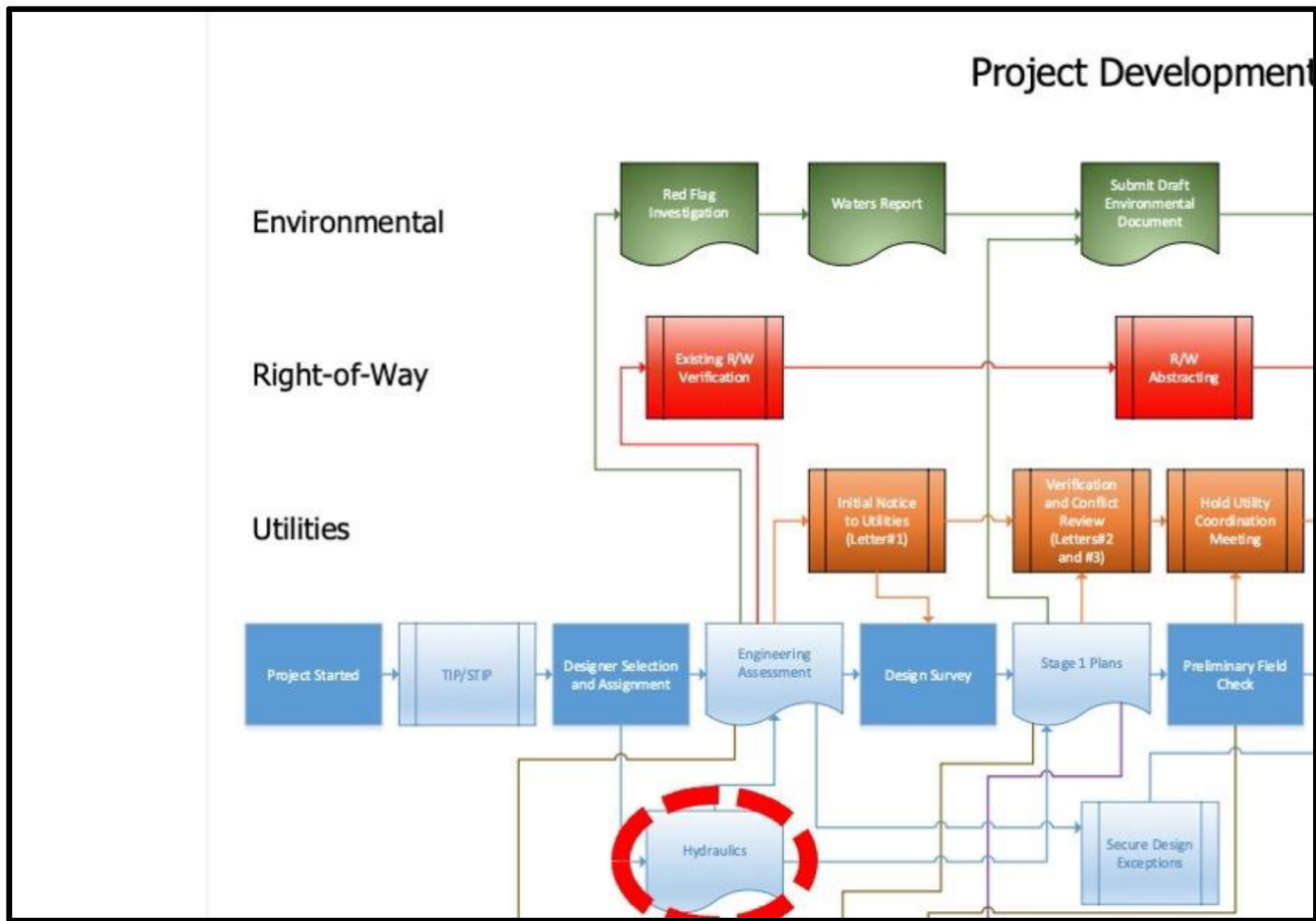


Figure 9.2 Project Development Process Showing DNR Engagement (Zoomed In).

Benefit: This input will assist INDOT in the cost-benefit analysis by better understanding exactly what is being requested so the cost can be calculated and weighed against the potential benefit such number and types of animals that are anticipated to use the requested feature(s).

Implementation: This guidance should be provided concurrently with the hydraulics study so it can be taken into consideration during the engineering assessment.

9.4 INDOT Wildlife Crossing Guidelines

The proposed INDOT Wildlife Crossing Guidelines shown in the Appendix A are adapted from a document published by the Florida Department of Transportation. While most of the guidelines may be considered “common sense” they are useful as a checklist to help ensure proper decisions are made about the design and implementation wildlife crossings and it is recommended that these guidelines be formally adopted by INDOT in the design manual, possibly as an introduction to Chapter 203.

Benefit: By formalizing these guidelines in design manual, they can serve as a checklist to help ensure they are not overlooked.

Implementation: These guidelines should be amended into the introduction of Chapter 203 of the INDOT design manual.

REFERENCES

- Alternative Fuels Data Center. (2024, October). *Total vehicle miles traveled in the United States* [Visualization]. <https://afdc.energy.gov/data/10315>
- Barringer, F. (2022, September 29). *Wildlife crossings seek to reconnect the animal West*. & the West. <https://andthewest.stanford.edu/2022/wildlife-crossings-seek-to-reconnect-the-animal-west/>
- Biegler, C. (2022, May 18). *Animal crossing: Road safety for wildlife*. Columbus and Franklin County Metro Parks. <https://www.metro-parks.net/blog/animal-crossing/>
- Bush, E. (2018, September 25). ‘It’s a long time coming’: \$6.2 million wildlife bridge over I-90 nears completion. *The Seattle Times*. <https://www.seattletimes.com/seattle-news/its-a-long-time-coming-6-2-million-wildlife-bridge-over-i-90-nears-completion/>
- Center for Large Landscape Conservation. (n.d.). *Reducing wildlife vehicle collisions by building crossings: General information, cost effectiveness, and case studies from the U.S.* The Pew Charitable Trusts. <https://www.pew.org/-/media/assets/2022/02/reducing-wildlife-vehicle-collisions-by-building-crossings.pdf>
- Commonwealth of Kentucky Transportation Cabinet. (2023, December 8). *Kentucky receives \$1.2 million grant to help reduce vehicle collisions involving wildlife* [Press release]. <https://transportation.ky.gov/NewsRoom/Wildlife%20Vehicle%20Crash%20Reduction%20Grant.pdf>

- Federal Highway Administration. (2024, December 20). *Investing in America: Biden-Harris administration awards \$125 million in grants to improve safety on America's roadways by preventing deadly wildlife-vehicle crashes*. <https://highways.dot.gov/newsroom/investing-america-biden-harris-administration-awards-125-million-grants-improve-safety>
- Geoquest USA. (n.d.). *I-90 Snoqualmie Pass East Phase 1*. <https://www.geoquest-group.us/reinforced-earth/i-90-snoqualmie-pass-east-phase-1/>
- Huijser, M. P., McGowen, P., Fuller, J., Hardy, A., Kociolek, A., Clevenger, A. P., Smith, D., & Ament, R. (2008). *Wildlife-Vehicle collision reduction study: Report to Congress* (Publication No. FHWA-HRT-08-034). <https://www.fhwa.dot.gov/publications/research/safety/08034/02.cfm>
- Indiana Department of Natural Resources. (n.d.). *Deer-vehicle collisions and you*. https://www.in.gov/dnr/fish-and-wildlife/files/fw-deer_collisions_and_you.pdf
- Indiana Department of Transportation. (2021). *INDOT project development process*. <https://www.in.gov/indot/files/2021-INDOT-State-Project-Development-Process.pdf>
- MCON. (n.d.). *Custom box culverts for amphibian's crossing*. <https://mconproducts.com/project/custom-box-culverts-for-amphibians-crossing/>
- Office of Highway Policy Information. (n.d.). *Travel monitoring*. https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm
- Ohio Department of Natural Resources. (2016). *Spring 2016 furbearer roadkill survey*. <https://dam.assets.ohio.gov/image/upload/ohiodnr.gov/documents/wildlife/wildlife-management/2016-roadkill-survey.pdf>
- Ohio Department of Transportation. (n.d.). *Wildlife crossings*. <https://www.transportation.ohio.gov/programs/ecological+resources/wildlife-crossings>
- Reynolds, R. (2024, October 14). *Deer are up and running. What are the odds you'll hit one?* Farmers' Advance. <https://www.farmersadvance.com/story/news/2024/10/16/what-happens-if-i-hit-a-deer-with-my-car/75705889007/>
- Safe Passage. (n.d.a). *I-40 Pigeon River Gorge project area*. <https://smokiessafepassage.org/learn-more-about-safe-passage/i40-pigeon-river-gorge-project-area/>
- Safe Passage. (n.d.b). *The coalition*. <https://smokiessafepassage.org/learn-more-about-safe-passage/coalition/>
- Stone Environmental Engineering and Science, Inc. (2021, June 30). *Animal-vehicle collision (AVC) reduction research report*. Ohio Department of Transportation. <https://www.transportation.ohio.gov/wps/wcm/connect/gov/e45fa026-5cd8-4254-96c3-420cf-475211b/2021-06-30+FINAL+ODOT+AVC+Research+Report+Phase+1.pdf?MOD=AJPERES>
- Sugiarto, W. (2022). Impact of wildlife crossing structures on wildlife-vehicle collisions. *Transportation Research Record*, 2677(2), 670-685. <https://doi.org/10.1177/03611981221108158>
- Vale, L., Miller, T., & Connor, K. (2025, March 18). *National wildlife crossings program: Enhancing roadway safety* (Conference session). Purdue Road School, West Lafayette, IN, United States. <https://docs.lib.purdue.edu/roadschool/2025/presentations/33/>
- Washington State Dept of Transportation. (2015). *Say cheese* [Photograph] (CC BY-NC-ND 2.0). <https://www.flickr.com/photos/wsdot/47379304821/in/album-72157705348373964>
- World Wildlife Fund. (2023). *Wildlife crossings help avoid roadway collisions*. <https://www.worldwildlife.org/news/magazine/fall-2023/wildlife-crossings-help-avoid-roadway-collisions/>

APPENDICES

Appendix A. Proposed Guidelines

Appendix B. Ohio DOT Agreement With Ohio DNR Regarding Wildlife Passages

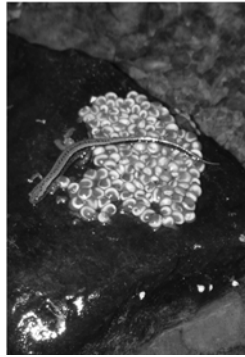
Appendix A. Proposed Guidelines

Proposed INDOT Wildlife Crossing Guidelines

A wildlife crossing feature design must take the following points into consideration:

1. The wildlife crossing feature cannot compromise any state or federal highway safety criteria.
2. The wildlife crossing feature cannot compromise INDOT design requirements. Should roadway or bridge design variations or exceptions be needed for the proposed wildlife crossing feature, proper and timely review by INDOT would be required. If not approved, the wildlife crossing feature would require redesign and further coordination with the agencies to determine whether it is feasible to provide the feature.
3. The wildlife crossing feature cannot restrict legal access to adjacent property owners without written approval from said property owners.
4. The wildlife crossing feature cannot negatively impact adjacent properties.
5. The wildlife crossing feature cannot negatively impact existing drainage patterns or flood right of way.
6. In the future, the placement of wildlife crossing features may be associated with wildlife mortality hotspots; however, the ultimate placement may be based on the most cost efficient and biologically effective design that meets the needs identified by USFWS and/or regulatory agencies as appropriate.
7. Upland and wetland habitat impacts should be avoided and minimized to the extent practicable by proper design.
8. The wildlife crossing feature must be accessible for proper maintenance to ensure the feature remains viable.

Appendix B. Ohio DOT Agreement With Ohio DNR Regarding Wildlife Passages



**Memorandum of Agreement
Between
The Ohio Department of Transportation,
The Ohio Department of Natural Resources, and
The United States Fish and Wildlife Service
For
Interagency Coordination
For
Projects Which Require Consultation Under the
Endangered Species Act, Impact State Listed
Species, and/or Modify Jurisdictional Waters
2016**



I. PREAMBLE

This Memorandum of Agreement (MOA) between the Ohio Department of Transportation (ODOT), the Ohio Department of Natural Resources (ODNR), and the U.S. Fish and Wildlife Service (USFWS) has been prepared to establish standardized coordination procedures for:

1. projects requiring consultation under the Endangered Species Act of 1973 (ESA) (as amended, 16 U.S.C. 1531 et seq.);
2. projects that will result in the modification of federally jurisdictional waters as required by the Fish and Wildlife Coordination Act (16 USC 662(a));
3. and projects with the potential to impact state endangered or threatened plant and animal species protected under Ohio Revised Code (ORC) Chapters 1518, 1531, and 1533 including, without limitation, projects that have the potential to harm mussels protected under ORC Section 1533.324.

Below is a brief recital of the acts and regulations pertaining to this Ecological Coordination MOA.

- The Endangered Species Act of 1973 (16 USC 1531-1534) prohibits the take of federally threatened or endangered species. Section 7 of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) when a project “may affect” a listed species to insure that any action authorized, funded or carried out by the Federal agency is not likely to jeopardize the continued existence of listed species or adversely modify their critical habitat.
- The Fish and Wildlife Coordination Act (16 USC 662(a)) enacted in 1946 and amendments require consultation with the USFWS and the fish and wildlife agencies of States where the “waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified” by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of “preventing loss of and damage to wildlife resources.”
- Laws and rules pertaining to listing and protection of State endangered plants as included in ORC Chapter 1518 and OAC 1501: 18-1 and prohibit the willful impact (“root up, injure, destroy, remove, or carry away”) “from public highways, public property, or waters of the state, or on or from the property of another, without the written permission of the owner, lessee, or other person entitled to possession, any endangered or threatened plant.”
- Laws and rules pertaining to the listing and protection of wildlife as included in ORC Chapters 1531, and 1533 and OAC 1501:31-23 and specifically restrict the take (which includes “killing,” “wounding,” or “attempt to kill or capture”) of wildlife “threatened with statewide extinction.”
- ORC Section 1533.324 prohibits the take (which includes “killing,” “wounding,” or “attempt to kill or capture”) of mussels within Ohio “or sale of mussels taken in Ohio.”

Under the Memorandum of Understanding between Federal Highway Administration (FHWA) and ODOT, signed December 11, 2015, ODOT is assigned FHWA’s responsibilities pursuant to the Surface Transportation Project Delivery Program, otherwise known as NEPA assignment. ODOT is responsible for all of FHWA’s actions and responsibilities under this agreement. This includes, but is not limited to, FHWA’s Endangered Species Act Section 7 responsibilities for both informal and formal consultations and compliance with the Fish and Wildlife Coordination Act. ODOT is not be responsible for FHWA’s responsibilities on projects that cross state or international borders, as those responsibilities will not be assigned to ODOT and remain with FHWA.

II. AGREEMENT

The purpose and intent of this MOA is to standardize and streamline the coordination and consultation processes between ODOT, USFWS, and ODNR for transportation infrastructure projects, thereby increasing the efficiency and timeliness of the process in a manner that is consistent and compliant with the applicable laws and regulations discussed in the Preamble. As such, the signatories to this ecological coordination MOA concur that the following actions, processes, and commitments should be followed during coordination and consultation efforts undertaken to meet the coordination requirements of informal and formal consultation under ESA section 7(a)(2) and the Fish and Wildlife Coordination Act. Furthermore,

ODNR concurs that these actions, processes, and commitments may be followed to assure that projects are evaluated in compliance with ORC Chapters 1518, 1531, and 1533.

This MOA outlines the general process and timeframes that will be followed. The USFWS and ODNR can request additional consultation or coordination efforts and documentation to ensure compliance with the aforementioned laws, or any other relevant and applicable Federal or State laws and regulations. Additionally, nothing in this MOA supersedes or replaces the coordination requirements or responsibilities set forth in state and federal laws, rules, and regulations, or the requirements of any future agreements or programmatic consultations that are established among the parties. Further, it is the parties' intent that nothing in this MOA supersede or replace the following agreements, any future revisions to these agreements, or future agreements:

- the MOA between ODOT and ODNR on the Scenic Rivers Program (Agreement number 11323);
- the Memorandum of Understanding (MOU) between ODOT and ODNR on the Ohio Coastal Management Program (Agreement Number 13225);
- the Programmatic Agreement between ODOT, FHWA, ODNR and the National Park Services for Interagency Coordination for Highway Projects Which Involve Section 6(f) Land and Water Conservation Funds;
- the Framework Programmatic Biological Opinion on the Ohio Department of Transportation's Federal-Aid Highway Program for the Federally Endangered Indiana Bat (*Myotis sodalis*) and Federally Threatened Northern Long-eared Bat (*Myotis septentrionalis*) dated February 29, 2016; and
- the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and Federal Transit Administration (FTA) Range-wide Programmatic Informal Consultation for Indiana Bat and Northern Long-eared Bat; and
- the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the Northern Long-eared Bat.

Nothing in this MOA nullifies or supersedes the authority of the USFWS or ODNR to regulate or enforce applicable laws or rules under their respective jurisdictions.

This ecological coordination MOA is applicable to all federal-aid projects that are implemented with oversight by ODOT and/or FHWA. This includes both ODOT projects and Local Public Agency projects receiving federal funding administered by ODOT. This MOA establishes amongst the signatories: the process for coordination and consultation, the standard commitments pertaining to ecological resource impact avoidance and minimization, and the established coordination and informal consultation timeframes on ODOT transportation infrastructure projects.

A. Ecological Resource Investigations

To determine the appropriate process to follow under this MOA, ODOT will initiate and conduct ecological investigations on all projects that have the potential to result in impacts to federally jurisdictional waters, isolated wetlands regulated under ORC 6111, federal or state listed species or designated critical habitat, or unionid mussels, following the guidance provided in the current version of the ODOT *Ecological Manual*¹ or subsequent revisions. At a minimum, each ecological resource investigation will include the following.

1. A literature review of the project area will be performed to determine the potential presence of federal and state listed species, federally jurisdictional waters, isolated wetlands, USFWS or ODNR managed lands, known streams possessing mussel populations, or any other known sensitive ecological features. The literature survey will determine if the project is within the range of any state

¹ Current (2014) or subsequent applicable versions of the *ODOT Ecological Manual* are available from the ODOT Office of Environmental Services.

or federally listed species (endangered, threatened, proposed for federal listing, federal candidate, and state potentially threatened), and any federally proposed or designated critical habitat, by:

- a. reviewing existing species distribution information provided to ODOT by ODNR through a data sharing agreement and/or range maps for species in Ohio provided by ODNR including, but not limited to a query of the Ohio Natural Heritage database or future manifestations of these data; and
 - b. reviewing the most recent USFWS list of the known ranges of federally listed species within Ohio by County and the locations of designated critical habitat; and
 - c. reviewing the most current version of the *Ohio Mussel Survey Protocol*², or subsequent revisions, to determine the presence and classification of any streams listed within the protocol, and the known potential for a stream to possess populations of mussels, including federally listed mussel species.
2. A field review of each project area will be conducted to document, delineate, and characterize ecological resources located within the project area including (if applicable):
- a. jurisdictional waters of the U.S. and isolated wetlands;
 - b. state or federally listed species, including suitable habitat and federally designated critical habitat (in accordance with applicable ODNR and/or USFWS guidance/protocols);
 - c. unionid mussels (in accordance with the methods outlined in the *Ohio Mussel Survey Protocol*); and
 - d. unique, rare, or high quality natural communities.
3. Appropriate documentation will be prepared commensurate to the project type (as defined in section B.) in accordance with the ODOT *Ecological Manual* (refer to section C.), and will be submitted to the USFWS and/or ODNR as appropriate (as discussed in section B.)

B. Consultation Processes

This MOA outlines ODOT's processes for investigating and documenting:

- projects that require no coordination or consultation based on the absence of ecological resource impacts;
- projects that only have minimal impacts to waters and are programmatically coordinated through interagency concurrence with this MOA (without further project-specific notification);
- and projects that require notification (grouped or individually) due to more substantial impacts to ecological resources.

Projects utilizing this MOA will follow the coordination and consultation processes outlined below.

1. Ecologically Exempt Projects – These project types will not impact any of the ecological resources covered by the laws referenced in the Preamble, will not require coordination or consultation under Section 7 of the ESA or the Fish and Wildlife Coordination Act, and should not result in any activities that violate ORC Chapters 1518 and 1531, or Section 1533.324. Many of the project actions associated with Ecologically Exempt Projects will not have the potential to impact ecological resources. Those that do, will be subject to an ecological resource investigation of the project

² Current (April 2015) or subsequent applicable versions of the *Ohio Mussel Survey Protocol* are available from the ODNR Division of Wildlife

area (following section A) to confirm the absence of impacts. Due to the absence of impacts to ecological resources, these types of project actions will not require consultation with USFWS or ODNR, or the preparation of an Ecological Survey Report (ESR)³ in accordance with the ODOT *Ecological Manual*. However, documentation that the project action will not impact ecological resources will be included in the NEPA documentation prepared for the project and/or the project file. Ecologically Exempt Projects can include any construction activities or actions that will not impact:

- a. waters of the U.S.; or
 - b. isolated wetlands; or
 - c. federally listed species or critical habitat; or
 - d. state listed species; or
 - e. unionid mussels.
2. Non-Notifying Projects – These project types will have minimal impacts to waters of the U.S. or isolated wetlands, and will not impact state or federally listed species or unionid mussels based on an ecological resource investigation of the project area (following section A.). Non-Notifying Projects will not require coordination or consultation under Section 7 of the ESA, and should not result in any actions that violate ORC Chapters 1518 or 1531, and ORC Section 1533.324. It is agreed upon by all signatories of this MOA that the procedures outlined in this agreement will fulfill the coordination requirements of the Fish and Wildlife Coordination Act for all projects that meet the conditions of the Non-Notifying Project type. Providing that the project is implemented in a manner that meets all of the conditions described below, the project will not require specific notification or coordination.
- a. Projects that do not require notification to ODNR must meet all of the following conditions:
 - i. impacts to waters of the U.S. must meet the conditions necessary to be authorized under the U.S. Army Corps of Engineers (USACE) Nationwide Permit (NWP) program or the 404 Regional General Permit for the State of Ohio, Department of Transportation (RGP) without the need for an Individual 401 Water Quality Certification; and/or
 - ii. impacts to isolated wetlands must meet the conditions necessary to be authorized under the Ohio Environmental Protection Agency (OEPA) Level 1 or Level 2 General Isolated Wetland Permit; and
 - iii. the project will not require a specific-species survey protocol approval from ODNR; and
 - iv. the project will not likely result in any impact to state listed species and/or unionid mussels.
 - b. Projects that do not require notification to USFWS must meet all of the following conditions:
 - i. the project will not require a project-specific species survey protocol approval from USFWS; and
 - ii. the project will have “*no effect*” on any federally listed species or designated critical habitat; and
 - iii. the project will not impact streams where the presence of federally listed mussel species is expected (designated as Group 2 or 4 in the most current version of the Ohio Mussel

³ See description of ESR in section C.1.

Survey Protocol).

ODOT agrees to conduct a full ecological investigation, and to prepare an ESR (or equivalent appropriate documentation) in accordance with the ODOT *Ecological Manual*, to document that these conditions have been met. This documentation will be included in the ODOT project file and discussed in the NEPA document prepared for the project.

3. Notifying Projects – Based on an ecological resource investigation of the project area (following section A.), projects that will have more than minimal impacts to waters of the U.S. or isolated wetlands, and/or will result in an impact to state listed species, and/or will result in an impact to unionid mussels (including the relocation of mussels), will require notification and consultation with ODNR. Furthermore, projects that “*may affect*” a federally listed species or federally designated critical habitat will require notification and consultation with the USFWS.

- a. The following conditions apply to projects that will require notification.

- i. Projects that include any of the following conditions will require notification to ODNR:

1. impacts that will require either an Individual 404 permit or an Individual 401 Water Quality Certification; or
 2. impacts that will require an OEPA Level 3 Isolated Wetland Permit; or
 3. conditions that will require a specific-species survey protocol approval from ODNR; or
 4. likely impacts to a state listed species; or
 5. likely impacts to unionid mussels.

- ii. Projects that include any of the following conditions will require notification to USFWS:

1. conditions that will require a species-specific survey protocol approval from USFWS; or
 2. a determination that the project “*may affect*” a federally listed species or designated critical habitat.

- b. The following consultation processes will be implemented on Notifying Projects to ensure consistency in the preparation of project documentation, project coordination, agency review, and agency comments and/or concurrence.

- i. Species-Specific Survey Protocol Approval – During the course of conducting a general ecological survey within a project area, it may be necessary to obtain ODNR and/or USFWS approval to conduct species-specific surveys for state or federally listed species, or to conduct a full mussel survey in accordance with the *Ohio Mussel Survey Protocol*. In these circumstances, any necessary survey approvals or permits will be obtained before conducting the surveys. The degree of coordination and consultation after completion of these surveys will be based on the results of the surveys and the anticipated level of impact or effect to the species or mussel populations present. The following process will be implemented to determine the extent of coordination and consultation that will be conducted on projects requiring these types of surveys.

1. If the results of a species-specific survey indicate that:

- a. a state or federally listed species, federally designated critical habitat, or mussel population is present, or is likely to be present, within the project area, and the

project “*may affect*” a federally listed species or designated critical habitat, or impact state listed species or mussels; or

- b. no state or federally listed species or mussel populations are detected, or are not likely to be present within the project area, and the project will have “*no effect*” on federally listed species and/or will not impact state listed species or mussels, however, conditions B.3.a i.1. or B.3.a.i.2 apply; then

the survey report will be coordinated in conjunction with an ESR following either the grouped consultation process (section B.3.b.ii.) or the individual consultation process (section B.3.b.iii.), whichever is appropriate.

2. If the results of the surveys indicate that:

- a. no state or federally listed species or mussel populations are detected, or are not likely to be present within the project area; and
- b. the project will have “*no effect*” on federally listed species or designated critical habitat or will not impact state listed species or mussels; and
- c. the project does not include any other conditions in section B.3.a. that would require coordination or consultation; then

the species-specific survey report or mussel survey report will be coordinated with ODNR and/or USFWS to present the results, without the need to submit an ESR. With the exception of the requirement to coordinate the species or mussel survey report, this type of project would otherwise be considered Non-Notifying under section B.2. of this agreement. An ESR (or equivalent appropriate documentation) will be included in the ODOT project file for projects of this nature, and discussed in the NEPA document prepared for the project, but would not be coordinated with USFWS or ODNR.

- ii. Grouped Consultation - Projects that include impacts that do not exceed any of the following thresholds will be grouped into a single submittal notification from ODOT to ODNR and USFWS. Grouped consultation will occur on a monthly basis as needed. The grouped consultation process will include a single notification for all projects in the submission, a table summarizing all of the projects included in the submission, and project-specific ESRs and consultation documents⁴ that have been prepared for each project or action. The Level 1 ESR will be the typical document that will be coordinated to provide the project details, ecological resource inventory, and impact assessment during the grouped consultation process. However, under some circumstances a Level 2 ESR may be used for this process. Additional studies or supporting supplemental documentation or reports, including but not limited to documents noted in sections C.2. and C.3., will also be provided when warranted. The following conditions outline the maximum level of project impact that will allow for the use of the grouped consultation process.

1. The following conditions apply to projects that will be grouped for coordination with ODNR:

- a. the project will not result in impacts to waters of the U.S. that require an Individual 404 permit or an Individual 401 Water Quality Certification; however,

⁴ Consultation documents submitted to the USFWS will include the most recent version of the *ODOT and USFWS Transportation Infrastructure Project Consultation Summary Form* (referred to as the Project Consultation Summary Form).

- b. the project may result in impacts to isolated wetlands that will require the need to obtain an OEPA Level 3 Isolated Wetland Permit from OEPA, and/or
 - c. the project may result in an adverse impact on state listed species; and/or
 - d. the project may result in impacts to unionid mussels.
- 2. For the purpose of conducting informal ESA Section 7 consultation with USFWS, any project that “*may affect, but is not likely to adversely affect*” any federally listed species or designated critical habitat, but will not require an Individual 404 permit or an Individual 401 Water Quality Certification, may be included in a grouped consultation notification to the USFWS.
- iii. Individual Consultation – The individual consultation process will include the submission of a project-specific notification for the project, a project-specific ESR, and any other consultation documents that have been prepared for the action. Additional studies or supporting supplemental documentation, including but not limited to documents noted in sections C.2., C.3., and C.4., will be provided when warranted.
 - 1. The following conditions outline the level of project impact that will initiate the use of the project-specific consultation process:
 - a. Individual project consultation with ODNR will be conducted on any project that requires an Individual 404 permit or an Individual 401 Water Quality Certification.
 - b. Individual project consultation with USFWS will be conducted on any project that:
 - i. a determination of “*may affect, likely to adversely affect*” has been made for any federally listed species or designated critical habitat, thereby requiring formal consultation with USFWS; or
 - ii. a determination of “*may affect, not likely to adversely affect*” has been made for any federally listed species or critical habitat; however, the project will require an Individual 404 permit or an Individual 401 Water Quality Certification.
 - 2. Consultation packages used during the individual consultation process will include the appropriate ESR as described in section C. ESRs will be sent to the USFWS and ODNR and comments received will be considered during the selection of alternatives (when applicable), addressed in the NEPA document for the project, and may result in project-specific environmental commitments.

Additional documentation for projects requiring formal consultation will be provided in accordance with the requirements of a Programmatic Biological Opinion (PBO) for a federally listed species (if applicable), or through the submission of a Biological Assessment (BA).

C. Consultation Package Contents for Notifying Projects

ODOT will prepare Ecological Survey Reports (ESR), unionid mussel survey and/or relocation reports, species-specific survey reports, and BAs, as necessary, to summarize the results of the ecological resource investigations and to coordinate and consult with ODNR and USFWS. Following are descriptions of the documents that may be used during consultation.

- 1. Ecological Survey Report - ODOT has developed three levels of ESRs, (Level 1, Level 2, and Level 3) for the documentation and coordination of various ODOT transportation projects that impact

ecological resources. The level of ecological survey and reporting is determined by the ecological resources present in the project area, the relative quality of the resources identified, and the expected severity of the impacts to those resources based on the proposed work type. Each level of report includes documentation, delineation, and assessment forms needed to identify and characterize ecological resources within a project study area. The data collected are intended to provide a basic inventory of the fauna, flora, and water resources present within the vicinity of the project, and to allow for impact prediction based on the known design parameters for the project. These ESRs will be the primary documents for coordinating a project with ODNR, and along with the Project Consultation Summary Form, for requesting technical assistance and initiating informal consultation with the USFWS. ESRs will be prepared following the format and content discussed in the most recent edition of the ODOT *Ecological Manual*, and will only be prepared by experienced individuals that meet the ODOT *Consultant Prequalification Requirements and Procedures*⁵ for conducting Ecological Surveys.

a. At a minimum, ESRs submitted to ODNR and USFWS will include the following:

- i. General Project Information including the project name (County, Route, and Section), the ODOT Project Identification number (PID), the study area size, the report author, the date(s) of field work, adequate project location mapping including the location on a 7.5 minute topographic quadrangle (with quadrangle name), the coordinates of the project (Latitude and Longitude in decimal degrees), the Hydrologic Unit Code (HUC), and a description of the project. The project description will include a discussion about the project study area and important aspects of the proposed work (type of transportation infrastructure improvement/repair, etc.) providing as much relevant detail as is available at the time of the survey.
- ii. Completed standardized data tables and discussions documenting the results of the literature and field reviews will be included for each ecological resource. Information will be provided on land cover as well as the presence of streams, wetlands, other waters of the U.S., unionid mussels, federally listed species, state listed species, and suitable habitats and/or federally designated critical habitat for listed species.
 1. If any portion of the known range of a federally listed species occurs within the county of a proposed project, that species will be listed in the ESR, and a discussion of suitable habitat or potential impacts to the species will be included for each project.
 2. A list of any state threatened or endangered animal species that are of specific concern to ODNR, and whose known ranges include the area of the proposed project (as determined by information provided to ODOT by ODNR via a data sharing agreement) will be listed and addressed in the ESR.
- iii. A preliminary estimation of impacts to each resource. The description of the impacts to aquatic resources will include linear feet and/or acreage of impact, and an explanation of the type of impact (e.g. temporary fill, rock channel protection, addition of piers or abutments, fill from grading, etc.) to the extent that it is known at the time of consultation. In the absence of detailed plans, the project scope will be reviewed to determine the greatest area of potential disturbance, and the maximum potential impact to ecological resources necessary to complete the project. If a population of unionid mussels has been identified within the project area, the report will indicate if impacts are anticipated. The description of impacts to federal and state listed species will include a description of impacts to suitable habitat, and a description of impacts to any individuals or populations of these species if they are found within the project area. An effect determination will be

⁵ Current (2014) or subsequent revisions to the ODOT *Consultant Prequalification Requirements and Procedures* are available from ODOT Office of Consultant Services.

made for each federally listed species. An estimate of the likelihood of impact will be determined for state listed species. Impacts expected to each species will be discussed for each project with records or encounters. Any project that will impact a state listed species may require additional species-specific surveys per section C.2.

- b. The following discussion summarizes the three levels of ESRs prepared by ODOT, and when they may be applicable.
 - i. Level 1 ESR – The Level 1 ESR is typically used to document projects that have minimal potential for substantial impacts to the environment. Project impacts may involve stream crossings, bank stabilization, and/or minor wetland fills, that can be authorized under the USACE NWP program or the RGP, and/or the OEPA Level 1 or 2 Isolated Wetland Permit. Given their size and scope, these types of projects would not likely include any feasible alternatives or alternatives analysis.
 - ii. Level 2 ESR – The Level 2 ESR is typically used for projects that include stream channelization, widening, deepening, relocations, new structures on new locations, or other extensive long-term modifications of ecological habitats in the vicinity of the proposed project. The Level 2 ESR is used for projects that will require an individual 404 and/or 401 permit and/or an OEPA Level 3 Isolated Wetland Permit. These types of projects may be on new alignment segments, may substantially impact sensitive ecological resources (e.g. high quality waters or scenic rivers), and may involve multiple alternatives within a project area and a detailed alternatives analysis.
 - iii. Level 3 ESR – The level 3 ESR will be used for projects which involve impacts to multiple wetlands and streams, could have considerable impacts to terrestrial habitats, and will require the investigation of one or more project corridors. These types of transportation projects often produce adverse ecological impacts and require an alternatives analysis. The Level 3 ESR will result in the preparation of three separate reports:
 1. Level 3 Preliminary Draft ESR - The Level 3 Preliminary Draft ESR incorporates secondary source literature review studies and appropriate field reconnaissance studies at the corridor level to identify the ecological resources within each corridor (there are no impact estimates associated with this report). The Level 3 Preliminary Draft ESR will be used (along with other information gathered on environmental resources, public opinion, geotechnical data, and design criteria) to help identify multiple feasible project alternatives for further study.
 2. Level 3 Draft ESR - The Level 3 Draft ESR incorporates detailed ecological studies that have been done on the alternatives. The report compares alternatives and addresses avoidance and minimization of potentially significant ecological impacts. Field studies conducted for the Level 3 Draft ESR must identify, delineate, and assess all water resources within the alternative alignments. The studies must also characterize and assess all terrestrial and aquatic wildlife, vegetative communities, listed species, and listed species habitat within each alternative
 3. Level 3 Final ESR - The Level 3 Final ESR is prepared to update, refine, and summarize all ecological resources and impacts associated with the preferred alternative selected for a project.
2. Species-Specific Report – Specific surveys and reports may be required for state or federally listed species on a case by case basis. These surveys often require a qualified and permitted individual to prepare and receive approval of a study plan from the appropriate resource agency (USFWS and/or ODNR) before conducting the survey. Following the survey, a report will be generated discussing the presence or probable absence of a species from the proposed project

area. Additional reporting will also be required for species relocations and/or monitoring that are done as part of a project to minimize impacts to a species.

3. Unionid Mussel Survey Report – A mussel survey or reconnaissance report will be prepared, in accordance with the most recent version of the *Ohio Mussel Survey Protocol*, for:
 - a. any projects that will impact streams with the potential to provide habitat for populations of unionid mussels;
 - b. any project for which evidence of mussels is detected within a stream or watercourse that will be impacted by a project; or
 - c. any project that will impact a stream or watercourse that is known to provide habitat for populations of federally listed mussel species.

Reports will also be completed in accordance with the *Ohio Mussel Survey Protocol* for any mussel relocations that are done as part of a project to minimize impacts to mussels. The survey work associated with the reports will be completed by individuals that meet the qualifications in the *Ohio Mussel Survey Protocol*.

4. Biological Assessment (BA) – The BA is a document prepared by ODOT/FHWA that contains information concerning federally listed and proposed species, and federally designated and proposed critical habitat, which may be present in the action area. The document includes the evaluation of potential effects of the action on such species and habitat. It is understood that:
 - a. programmatic BAs and associated PBOs will be followed, and associated reporting coordinated, when applicable;
 - b. project-specific BAs will be prepared for any project that is “*likely to adversely affect*” a federally listed species or federally designated critical habitat, and for which a PBO is not applicable.

D. Comments and Environmental Commitments

ODOT commits to the following procedures and conditions:

1. ODOT will follow the *Ohio Mussel Survey Protocol* when conducting reconnaissance and/or full mussel surveys on all streams 10 square miles or greater in drainage area that will be impacted by a project, with the following exceptions.
 - a. If the results of a reconnaissance survey determines that mussels are not present in the study area, the survey will not be coordinated with ODNR for review unless the project also meets one of the conditions listed under section B.3.a. for Notifying Projects. In cases where the project is considered Non-Notifying, and a reconnaissance survey does not detect the presence of mussels, ODOT will include the *Ohio Mussel Habitat Assessment Form* in the project file, and the results in the NEPA document prepared for the project per section B.2. of the agreement. ODOT will also make a copy of the *Ohio Mussel Habitat Assessment Form* available to ODNR.
 - b. On projects that involve the replacement or repair of an existing bridge or culvert structure on existing alignment, minor bank stabilization, or scour repair (with no feasible alternatives), a mussel relocation may be conducted at the time of the reconnaissance survey on non-listed streams and Group 1 streams where only populations of common mussels that are habitat generalists (as included in Appendix H of the *Ohio Mussel Survey Protocol*) are found during the reconnaissance. This relocation can be conducted without the need for site specific prior notification if all of the following conditions apply:

- i. a thorough reconnaissance survey on a Group 1 or a non-listed stream in Appendix A of the *Ohio Mussel Survey Protocol* detects only species noted in Appendix H of the protocol; and
- ii. the surveyor is either state or federally permitted to conduct mussel surveys in accordance with the protocol.

The mussel relocation and reporting will be completed following all of the conditions of the current *Ohio Mussel Survey Protocol*, with the exception of the need for prior notification. Due to the presence of only common mussels that are habitat generalists, and the lack of listed species, relocations conducted in these situations will be valid for a period of two years from the date of relocation.

2. In-water work, defined as the placement or removal of temporary or permanent fill materials below the Ordinary High Water Mark, cannot take place in the following stream types during the following restricted periods. Requests for waivers from these in-water work restriction periods will be made outside of this agreement following ODNR Policy 56 or an equivalent agreed upon waiver request process. The in-water work restriction periods for ODOT projects are as follows:

- a. Non-native/Introduced Salmonid streams 9/15 – 6/30

If the project involves in-water work that will hinder the passage of salmonids through the use of construction causeways or other fills that fully span the river, the in-water work restriction period will apply to the following streams: **Arcola Creek** (entire reach), **Ashtabula River** (Hadlock Rd. to mouth), **Ashtabula Harbor**, **Big Creek** ((Grand River drainage basin) Girdled Road to mouth), **Cold Creek** (entire reach), **Conneaut Creek** (entire reach), **Conneaut Harbor**, **Cowles Creek** (entire reach), **Ellison Creek** ((Grand River drainage basin) entire reach), **Euclid Creek** (entire reach), **Grand River** (dam at Harpersfield Covered Bridge Park just upstream of the S.R. 534 bridge to mouth)/**Fairport Harbor**, **Indian Creek** (entire reach), **Kellogg Creek** ((Grand River drainage basin) entire reach), **Mill Creek** ((Grand River drainage basin) entire reach), **Paine Creek** ((Grand River drainage basin) from Paine Falls to mouth), **Rocky River** (Cedar Point Rd. (East Branch/West Branch confluence) to mouth), **Smokey Run** ((Conneaut Creek RM 3.5) entire reach), **Turkey Creek** (entire reach), **Vermilion River** (dam at Wakeman upstream of the S.R. 20/60 bridge to mouth), **Wheeler Creek** (entire reach), **Whitman Creek** (entire reach).

- b. Native Brook Trout streams 9/15 – 6/30

In-water work restrictions periods will apply to the following streams with populations of wild native brook trout: **Aurora Branch of the Chagrin River** (RM 0.38 to mouth), **Chagrin River** (Chagrin Falls to mouth), **Corporation Creek** ((Chagrin River RM 0.27) entire reach), **Gulley Brook** ((Chagrin River RM 5.54) entire reach), **Rocky River** (above Cedar Point Rd), **Ward Creek** ((Chagrin River RM 1.0) entire reach).

- c. Percid streams 3/15 – 6/30

In-water work restrictions periods will apply to the following Percid streams: **Great Miami River** (dam south of New Baltimore to mouth), **Hocking River** (lower section), **Huron River** (from the East Branch/West Branch confluence to Lake Erie), **Little Miami River** (lower section), **Maumee River** (split dam at Mary Jane Thurston State Park and Providence Park in Grand Rapids to mouth), **Maumee Bay**, **Muskingum River** (Devola Dam No. 2 off S.R. 60 north of Marietta to mouth), **Ohio River** (entire reach), **Portage River** (entire reach), **Sandusky River** (Ballville Dam off River Road in Fremont to mouth, and extending upstream from the Ballville Dam if it is subsequently removed), **Sandusky Bay**, **Scioto River** (lower section), **Toussaint River** (entire reach).

d. Other streams

4/15 - 6/30

In-water work restriction periods will apply to the following other streams: Cold/cool water equivalent (Class 3) primary headwater streams (watershed ≤ 1 mi²) that support fish populations; Exceptional Warmwater Habitat streams; Coldwater Habitat Streams; Warmwater Habitat streams with watershed ≥ 20 mi²; streams with aquatic Threatened and Endangered species; Lake Erie and Bays. Special conditions (such as the occurrence of aquatic threatened or endangered species) may mandate local variation of restrictions.

e. Streams with no in-water work restriction periods

No in-water work restrictions will be necessary on Non-native/Introduced Salmonid streams if the in-water work allows for the continued passage and migration of Salmonids through the use of construction causeways that only partially span the waterway (the restrictions for "Other streams" must be checked for applicability). Additionally, the following stream types do not require any in-water work restriction periods: Cold/cool water equivalent (Class 3) primary headwater streams (watershed ≤ 1 mi²) that do not support fish populations; Warmwater equivalent, Modified Warmwater equivalent, and Limited Resource Water equivalent (Class II and Class I) primary headwater habitat streams; Warmwater Habitat streams <20 mi² without T&E species; Modified Warmwater Habitat; Limited Resources Waters; and Limited Warmwater Habitat.

3. Written permission will be obtained outside of this MOA for any necessary in-stream blasting from the Chief of ODNR's Division of Wildlife in accordance with ORC Section 1533.58.
4. Projects located within flood plains will comply with necessary flood plain criteria. Those projects in FEMA designated flood plains will be coordinated with the appropriate resource managers outside of this MOA in accordance with ORC 1521.13(B) and the *Ohio Department of Transportation Floodplain Management Guidelines*⁶.
5. Project impacts that require the implementation of stream or wetland mitigation will do so outside of this MOA in accordance with current Clean Water Act requirements as regulated by the US Army Corps of Engineers and Ohio EPA regulations (33 CFR parts 325 and 332 and 40 CFR part 230, and OAC 3745-01-54), and Ohio isolated wetland law (ORC 6111.027).
6. A review for Coastal Zone consistency in accordance with the Coastal Zone Management Act (16 USC 1456, et seq. and implementing regulations, 15 CFR 930, et seq.), the Ohio Revised Code 1506.03, the *Memorandum of Understanding Between the Ohio Department of Natural Resources and the Ohio Department of Transportation (No.13225)*, or any subsequent revisions to the agreement, will be performed outside of this MOA for any projects that occur within the Coastal Management Zone along Lake Erie in Wood, Ottawa, Lake, Sandusky, Erie, Lorain, Cuyahoga, Lake, or Ashtabula Counties.
7. Projects that occur within 1,000 feet of any state designated wild, scenic or recreational river will be coordinated outside of this MOA in accordance with *Memorandum of Agreement Between the Ohio Department of Transportation and the Ohio Department of Natural Resources (Division of Watercraft) For Project Coordination On Ohio's State Wild, Scenic and Recreational Rivers (Agreement Number: 11323)*, or subsequent revisions to the agreement, to comply with ORC, Section 1547.82.
8. Impacts to lands owned by ODNR will be evaluated and coordinated outside of this MOA in accordance with Section 4(f) of the Department of Transportation (DOT) Act of 1966 and Section 6(f) of the Land and Water Conservation Act. The *Programmatic Agreement Between the State of*

⁶ The current (February, 2016) *ODOT Floodplain Management Guidelines* is referred to within this MOA. Subsequent applicable revisions to the *ODOT Floodplain Management Guidelines* will also apply to this agreement.

Ohio, Department of Transportation, Federal Highway Administration, State of Ohio, Department of Natural Resources, and National Park Service For Interagency Coordination For Highway Projects Which Involve Section 6(f) Land and Water Conservation Fund Properties, or subsequent revisions to the agreement, will be followed when applicable.

9. The specifications set forth in the most current version of ODOT's *Construction and Material Specifications (CMS)*⁷, *Supplemental Specifications (SS)*⁸, *Location and Design (L&D) Manual Volume 2*⁹, and *Hydraulic Standard Construction Drawings*¹⁰ will be used to ensure adequate erosion and sediment control during and following construction that is compliant with applicable regulations.
10. When applicable per the ODOT *L&D Manual Volume 2*, new culverts on new alignments will be installed with depressed culvert inverts to convey the bankfull discharge design. Depressed culvert inverts should produce a natural channel bottom within the culvert that should be continuous with the adjacent channel sections, providing a substrate that will allow for the free passage of aquatic fauna. Where appropriate and feasible as a mitigative technique, the use of this design will also be applied to the replacement of existing culverts.
11. On projects with impacts to aquatic resources, all aquatic resources indicated on the plans shall be demarcated in the field as per ODOT SS 832 and the applicable waterway permits special provisions prior to site disturbance. This will be done to ensure that only permitted stream and wetland impacts will occur, and that the remainder of the aquatic resources on the site will be avoided. Within riparian areas, only the vegetated buffer minimally necessary for construction will be removed for the project. Materials utilized in, or adjacent to, aquatic resources for temporary or permanent fill or bank protection shall consist of suitable material free from toxic contaminants in other than trace quantities. Broken asphalt is specifically excluded. Chromated Copper Arsenate (CCA), and other pressure treated lumber shall not be used in structures that are placed in aquatic resources. Furthermore, an oil spill kit will be located within 150 feet of any equipment working in a stream or wetland. The oil spill kit shall be maintained for the life of the construction contract.
12. Where appropriate and feasible as a mitigative technique, ODOT will use vegetated riprap and other bioengineering techniques for stream bank stabilization and/or slope repair. When applicable, native vegetation will be used in the construction of these features.
13. Per ODOT *CMS (107.10)*, the creation of staging areas, the storage of materials and equipment, and the borrowing or wasting of materials will not occur in areas labeled as environmental resource areas. Additionally, all properties to be utilized by the Contractor outside the project right-of-way will be cleared for all environmental resource impacts prior to the beginning of work by the Contractor. Should the areas proposed for use by the Contractor outside the project right-of-way limits contain environmental resources, all environmental clearances and permits will be obtained by the Contractor prior to the beginning of work.

⁷ The current (January 1, 2016) ODOT *Construction and Materials Specifications (CMS)* and associated item numbers are referred to within this agreement. Subsequent applicable revisions to the CMS will also apply to this agreement.

⁸ The current (January 1, 2014) *Supplemental Specification (SS) 832* is referred to in this agreement, and available from the ODOT Office of Construction Management. Subsequent applicable revisions to the SS 832 will also apply to this agreement.

⁹ The current (July 17, 2015) *Location and Design (L&D) Manual, Volume 2* is referred to in this agreement, and available from the ODOT Office of Hydraulic Engineering. Subsequent applicable revisions to the L&D Manual Volume 2 will also apply to this agreement.

¹⁰ The current (July 17, 2015) *Hydraulic Standard Construction Drawings* are referred to in this agreement, and are available from the ODOT Office of Hydraulic Engineering. Subsequent applicable revisions to the *Hydraulic Standard Construction Drawings* will also apply to this agreement.

14. Per ODOT *CMS (104.04)*, all areas of disturbed ground occupied by the Contractor in connection with the work (with the exception of cultivated fields) will have suitable vegetative cover established by seeding and mulching according to *CMS (Item 659)*. When appropriate conditions apply, ODOT will consider the use of native grasses and wildflowers for revegetating disturbed areas according to *CMS (Item 659.09)* or similar seed mixes composed of native herbs and grasses.
15. When practicable and applicable to a project, ODOT will work collaboratively with federal and state agencies on the protection, restoration, enhancement and best habitat management practices for migratory birds.
16. Prior to the removal of bridge structures over waterways, the underside will be carefully examined for the presence of birds and bats. ODOT will coordinate or consult with ODNR and/or USFWS as appropriate should any birds or bats be found nesting or roosting, respectively, on the underside of the bridge.
17. ODOT will address comments received from USFWS and ODNR in the following ways:
 - a. The comments will be referenced and addressed in the NEPA process for the specific project.
 - b. When necessary and/or appropriate, ODOT will respond directly to USFWS and/or ODNR with additional justification, information, commitments for avoidance, minimization, and mitigation.
 - c. Comments, recommendations, and requirements received from USFWS and ODNR that become project-specific environmental commitments will be incorporated into the project plans, and/or the project special provisions, and/or the environmental commitment tracking system, to ensure implementation of the commitments.

E. Monitoring Process for Non-Notifying Projects

USFWS or ODNR can request a quality assurance review (QAR) of projects that met the Non-notifying Project type (B.2.) at any time during the implementation of this agreement. The purpose of the review would be to verify that projects that have been determined by ODOT to meet the conditions of the Non-notifying Project type do not include specific issues of concern to USFWS or ODNR that have been overlooked. Concerns identified through the QAR process could result in the development or removal of conditions noted in B.2.

F. Consultation Timeframes

ODNR and USFWS will adhere to the following timeframes to review and provide comments on a project once they have received a project consultation package from ODOT.

1. ODNR will review, request additional information, or provide comments within 30 calendar days of receipt of a project consultation package for a Notifying Project type.
2. USFWS will review, request additional information, or provide comments or concurrence within 30 calendar days of receipt of a project consultation package for a Notifying Project type that is being coordinated informally under the ESA, or that is being coordinated utilizing an applicable Programmatic Consultation¹¹, with the following noted exception.

On projects that meet the programmatic concurrence outlined in the Framework Programmatic

¹¹ Unless other timeframes are specified in the Programmatic Consultation's Biological Opinion and/or agreements.

Biological Opinion on the Ohio Department of Transportation's Federal-Aid Highway Program for the Federally Endangered Indiana Bat (*Myotis sodalis*) and Federally Threatened Northern Long-eared Bat (*Myotis septentrionalis*), and that will not affect any other federally listed species or critical habitat, the USFWS will notify ODOT with any requests for additional information within 30 calendar days. If the USFWS does not notify ODOT of any concerns within 30 calendar days of receipt of the project consultation form, the programmatic concurrence on the effect determinations for the Indiana and northern long-eared bats applies, and ODOT will proceed with project development.

3. USFWS will follow applicable timeframes as required by Section 7(b) of the ESA on any projects requiring formal consultation that are not included in an applicable Programmatic Consultation (see F.2.).

It is understood by all parties, that any project-specific comments received by ODOT within 30 days of the coordinated consultation package submission will be addressed individually and incorporated into the project documentation. No NEPA document will be processed until the 30 day time period has elapsed, or ODOT receives a response or concurrence to a consultation submission for a Notifying Project type.

G. Expiration, Modification, and Termination

This agreement will remain valid unless and until a signing party has a concern with the use of this agreement and notifies the other parties in writing.

This ecological coordination MOA shall commence on the last date of the signatures set forth below and shall remain in effect until terminated by either USFWS, ODNR, or ODOT, with 30 days advanced written notice to the other parties. This MOA shall be reviewed by all parties within 5 years of the anniversary date of the commencement of this MOA or as needed. If any party determines the need to amend, modify, or otherwise change the terms and conditions set forth herein, the parties shall schedule a meeting for the purpose of revising this MOA. Such meetings shall be set within 30 days of any notice identifying a need for revision. Should the parties agree to modification of the MOA, then an amendment shall be drawn, approved, and executed in the same manner as the original agreement.

Any party to this MOA may request that it be amended or administratively modified to reflect changes, whereupon the parties shall consult to consider such an amendment. If the parties agree to amend this MOA, then the parties may amend the agreement with new signatures and dates after all necessary reviews are completed. The term of the agreement shall remain unchanged unless expressly stated in the amended MOA.

Minor changes may be made through appropriate clarification guidance to better refine the processes contained herein by agreement among the specified parties. These types of minor procedural changes will not require re-execution of the MOA.

Any person executing this MOA in a representative capacity hereby agrees that he/she has been duly authorized by his/her principal to execute this MOA on such principal's behalf.

Participating Agency signatures are located on pages 16 through 18.

OHIO DEPARTMENT OF TRANSPORTATION

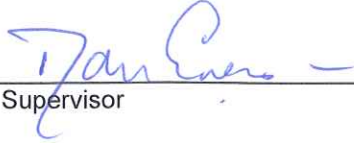


Timothy M. Hill, Administrator, Office of Environmental Services
3/11/16
(date)

Approved:


Jerry Wray, Director
3/10/16
(date)

U.S. FISH & WILDLIFE SERVICE

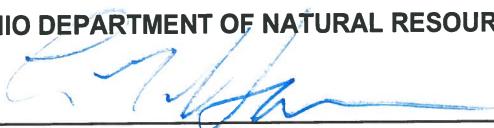


Dan Everson, Area Supervisor

3-18-2016

(date)

OHIO DEPARTMENT OF NATURAL RESOURCES



James Zehringer, Director

3/29/16

(date)

About the Joint Transportation Research Program (JTRP)

On March 11, 1937, the Indiana Legislature passed an act which authorized the Indiana State Highway Commission to cooperate with and assist Purdue University in developing the best methods of improving and maintaining the highways of the state and the respective counties thereof. That collaborative effort was called the Joint Highway Research Project (JHRP). In 1997 the collaborative venture was renamed as the Joint Transportation Research Program (JTRP) to reflect the state and national efforts to integrate the management and operation of various transportation modes.

The first studies of JHRP were concerned with Test Road No. 1 — evaluation of the weathering characteristics of stabilized materials. After World War II, the JHRP program grew substantially and was regularly producing technical reports. Over 1,600 technical reports are now available, published as part of the JHRP and subsequently JTRP collaborative venture between Purdue University and what is now the Indiana Department of Transportation.

Free online access to all reports is provided through a unique collaboration between JTRP and Purdue Libraries. These are available at docs.lib.purdue.edu/jtrp/.

Further information about JTRP and its current research program is available at engineering.purdue.edu/JTRP.

About This Report

An open access version of this publication is available online. See the URL in the citation below.

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