

Standard Operating Procedures (SOP)
NCDOT Preliminary Bat Habitat Assessments (Structures, Caves & Mines)



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This document serves to standardize survey techniques for bat habitat assessments along NCDOT projects. Aside from the paper copies of the forms in the back of this document, there is an option to complete bat habitat assessment forms electronically through the Survey 123 application on your phone or tablet (contact Cheryl Knepp clknepp@ncdot.gov to be added as an ArcGIS Online group member to gain access to this app). There are four survey types: Bridge, Culvert, Abandoned Structures and Caves/Mines. All features have “header” attributes (Observers, Project Number, Date, Road Name, County, Structure Number and Crossing). Road name refers to the name of the road that carries the structure. In other words, what road are you on when standing on the bridge/culvert. The other “crossing” field refers to the feature that is intersected (waterbody, road, railroad). If the bridge crosses both a road and a waterbody, put the names of both. The Structure number refers to the 6-digit NCDOT assigned number given for each structure with the first three numbers indicating county code. If there is no structure number (in the case of some culverts), provide the latitude and longitude coordinates in decimal degrees. The other headers need no further explanation so no details will be provided in this procedure’s manual for those attributes. This manual is arranged by feature, the attribute is written exactly as it appears on the form and its definition follows the colon.

The term “project footprint” is used throughout this document referring to the currently known potential extent of project impacts (i.e. ROW, slope stakes, study area, etc.). Please refer to the individual scope of the project which will define the particular limits of this area. Appendix A, B and C in this document provide images and tables that will further assist in identifying attributes.

Office Assessment

The office assessment starts with a query of the USFWS IPaC site to determine which species require consultation within your project area. Log on to USFWS IPaC site here: <https://ipac.ecosphere.fws.gov/>, define your project area and request an official report of species listed for your project.

Search available resources to identify cave features, abandoned mines and underground quarries within 0.5 mile of the project that could provide potential hibernacula or summer roosting habitat. Resources include U.S. Geological Survey topographic and geologic quadrangle maps and available mine data layer available on the Mineral Resources On-Line Spatial Data USGS webpage <http://mrddata.usgs.gov/mrds/find-mrds.php>. Features identified as potential habitat located within one-half mile of the project (*see tutorial in Appendix D*), will need to be assessed prior to field surveys using the Mineral Resources Data System shapefile. The mines layer does not provide information on caves, surveyors should use NCNHP data for potential bat records that indicate cave locations. A review of topographic maps, aerial photography and project plan sheets is also performed to identify habitats that may provide summer roosting, foraging, and commuting habitat for listed bats.

Field Assessment

Equipment needed to complete the assessments includes binoculars, spotlight (~1,000 lumen), mirror on a pole and camera and/or borescope (snake camera). Please follow NCWRC’s decontamination guidance for culverts in Division 9-14 (Appendix F). Decontamination is not necessary at non-confined spaces like bridges.

¹April 2025 latest version updated structure material standard and time of year changes, updated V5: 2024 updated Summer Survey Guideline and decon protocol dates, V4: 2023 added clarifying language and WRC decon. V3: May 2022 update: 3’ culvert threshold for tricolored bat listing V2: 2019 Survey 123 app. Version 1: 2014.

Following recent discussions with USFWS (Asheville), bridges in Division 9-14 may be surveyed for evidence of bat use from May 1 to October 1. Surveys will be conducted on concrete deck bridges only (surveys of bridges with timber decks or metal decks are no longer required). Culvert surveys in Division 9-14 will be conducted between December 15 and February 15 and will only occur in the tricolored bat hibernation zones. This link shows year round zone, <https://experience.arcgis.com/experience/9e4a7e7ce83448679714a313810f9fce> the hibernation zone is west of the year round zone and unshaded in the map. All other Divisions may be surveyed year-round. Bridge/structure assessments are valid for two years (according to the Range-wide Indiana/NLEB Survey Guidelines).

The surveyor will walk the deck to inspect all guardrail crevices, and gaps between metal or wood posts and the bridge structure. A mirror on a pole is helpful to inspect deck crevices and expansion joints open at the sides of the bridge. Underneath the bridge, use a spotlight to examine all visible parallel and perpendicular crevices for bats. Back several feet away from the bridge to view crevices over pier caps (deck crevice/expansion joint) with binoculars and a spotlight. This may allow you to see up to 3 feet or more into the crevice. Examine every exposed wall under the bridge and look behind or alongside bird and wasp nests for roosting bats. Look up into any clogged deck drains. From the bridge deck, look over the guardrail or edge of the bridge to check surfaces on top of bridge pillars/caps for accumulated guano. Check horizontal surfaces underneath the bridge for guano pellets, but also use the spotlight to look for guano hanging on the walls or inside vertical crevices. Examine rocks, plant leaves, or the ground beneath crevices or near pillars for guano pellets that have fallen from a roost site or as bats emerged. Large accumulations of guano can emit a slight smell of ammonia. Look for staining on vertical walls, around crevices, and on pier caps. Bat staining is generally light to dark brown in color but can dry to a whitish crust. Often, staining from bats can be distinguished from water or salt staining by the presence of guano, stuck to the surface where the staining is or onto surfaces nearby. Look closely at suspected staining with binoculars or with the naked eye to search for intermixed guano. Please take photos with a good telephoto zoom to get the appropriate level of detail necessary for bat and guano identification. NCDOT Biological Surveys Group currently use a Nikon CoolPix P900. It has an 83x wide optical zoom (4.3-357mm 1:2.8-6.5). If you are not confident in bat identification, email high quality photos to [BSG terrestrial team biologists](#) for species confirmation. Many times, bats are just opportunistically roosting and move on so, unfortunately, if we can't get good pictures the day of the observance and need to do a site visit, we will miss identification potential if we return to a bridge and the bat has already left the roost.

The same methods of inspection apply to culverts. With a spotlight, inspect all cracks, crevices, shafts and weep holes. Minimum dimensions for conducting a culvert survey are 5 feet in height and 60 feet in length. In Division 9-14 (USFWS Asheville work area), in anticipation of listing of tricolored bats, the height threshold has been adjusted down to 3 feet but leave the **type** of survey up to the project manager. It will be up to the discretion of the surveyor based on the level of risk they are willing to assume and the equipment they have access to. NCDOT does have equipment that can survey small pipes but access to this equipment is limited due to the technical experts that are required to operate it and the cost of the equipment. If the surveyor decides not to conduct an internal culvert survey, they will perform a flashlight survey, looking in both ends of culverts that fall within the 3'x60' threshold. However, we will continue with set minimum thresholds of 5'x60' for internal culvert surveys based on a minimal size required for safe access and inspection in a mostly upright posture. Flashlight surveys require a thorough search from both ends of the culvert using a high lumen flashlight and binoculars.

Sometimes, a culvert of 5' tall can have a buildup of sediment such that its height is actually less than 5'. Only conduct internal surveys if the surveyor feels comfortable in these situations. For example, you have been contracted to survey all culverts on a project that fall within the threshold of $\geq 3' \times 60'$ (dimensions are based on the original designed size of the culvert). However, once on site, you find the culvert on the plan sheet is listed as 3' but sedimentation has filled the opening such that the field condition culvert height is more like 28". If the originally designed size is 3', then that is considered part of the contract to survey. Now, it is up to the surveyor to determine if they will conduct an internal survey or flashlight based on safe access.

If evidence of bats is found, but no bats are observed, additional surveys may be necessary, discuss with NCDOT BSG/Division Project lead. This SOP is for initial surveys and USFWS may recommend additional surveys for Endangered Species Act Section 7 consultations based on initial findings.

This SOP covers procedures for assessing potential bat roosting habitat (structures, caves and mines). There are some preliminary questions on the form that help determine if any suitable roosting trees for northern long eared bat (NLEB) or Indiana bat are present in the project footprint as well. This SOP does not address any additional surveys necessary for presence/absence of bats that may be foraging or commuting in the project area. Those additional Phase II surveys (mist netting/acoustic) have an increased level of effort associated with them and help determine if listed bats are present or absent within the project vicinity. Phase II surveys are only suggested to provide an option for project managers to survey instead of assuming presence of foraging or commuting bats. The guidance for those surveys can be found here: [Range-Wide Indiana Bat & NLEB Survey Guidelines \(2024\)](#).

Completion of data forms using the Survey 123 application automatically reports the data to BSG. If the forms are completed using paper copies, the forms should be submitted along with other project deliverables to the NCDOT project manager or using NCDOT SharePoint site. Once habitat assessment forms have been submitted, notify BSG via email (BSG@ncdot.gov).

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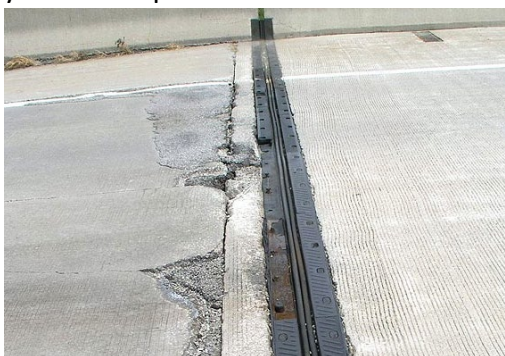
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- Data Forms**
- Bat Habitat Assessment Form – Bridge
 - Bat Habitat Assessment Form – Culvert
 - Bat Habitat Assessment Form – Abandoned Structures
 - Bat Habitat Assessment Form – Caves/Mines

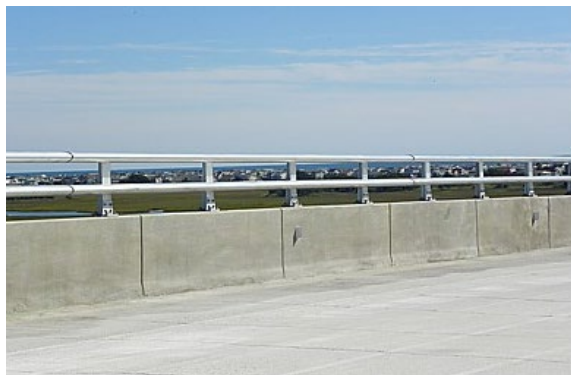
Bridge Attributes:

- **% Surrounding Habitat:** surrounding habitat will need to be assessed prior to field surveys using aerial imagery and best professional judgment. These habitat types are based on National Land Cover Database (NLCD) classifications which were developed by the Multi-Resolution Land Characteristics (MRLC) consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale. Fill in a number that represents the approximate percent of the following habitats found within 1 mile of the project footprint.
 - o Urban/Commercial
 - o Suburban/Residential
 - o Agricultural
 - o Herbaceous/Shrub/Grassland/Barren Land
 - o Deciduous Forest/ Evergreen Forest/ Mixed Forest
 - o Woody Wetlands /Herbaceous Wetlands/Open Water
- **Any live trees and/or snags >3" dbh in the project footprint:** this question is designed to capture the presence of potential roosting and foraging habitat within the project footprint for the northern long-eared bat. Isolated trees >1000' from the nearest woodlot are not included. This does include live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or hollows.
- **Any trees and/or snags ≥5: IN bat:** this question is designed to capture the presence of roosting habitat within the project footprint for the Indiana bat, *Myotis sodalis* within the project footprint. Provide photos of potential roost trees and put descriptions and locations in the notes section.
 - o IN Bat: how much sun do these trees rec: this question is a follow up to the question above about snags and hollows.
 - o IN Bat: list species of habitat trees: this question is also a follow up to the shaggy/snags/hollows question, list the tree species (i.e. *Abies fraseri*) that have exfoliating bark, cracks, crevices, and/or hollows.
- The four questions dealing with Caves and Mines in the project footprint and vicinity (within 0.50 mile {see explanation in Appendix D}) will need to be assessed prior to field surveys using the Mineral Resources Data System shapefile. For a tutorial on how to do this see Appendix D, Locating Mines. Provide photo, descriptions and locations. While on site, the biologist should investigate (on foot) any potential winter roost sites that are **visible** within line of sight of the bridge. Look for rock outcroppings, or other topographical features that may indicate the presence of a cave or unmapped mine.
- **Major Water Source:** select the one that best describes the water source at the bridge being inspected (not within the entire project area). The app only allows one selection so if there are multiple water sources, select the dominant type.
- **Suitable Drinking Habitat:** This question is intended to assess accessibility of a water source in the project footprint. Is the water source suitable for bats to access or is there a lot of vegetation blocking the flight path to the water?
- **Artificial Light:** select if there is artificial lighting present that potentially cast light on the bridge. This could be in the form of nearby light poles, fixtures on the bridge, etc.
- **Guard Rails:** select the guard rail material, if there are multiple, select the dominant type; see pictures and "Barrier Rail" in the Structure diagram in Appendix A.

- Deck Type: select the decking material, decking material is visible from underneath the bridge, do not confuse this with the wearing surface (i.e. asphalt on top of the bridge); metal forms on the underside of the deck are not the deck, the deck in those cases is concrete and bats are likely utilizing the expansion joints if anything, so step out to the side and look to see if the deck is accessible and concrete. See pictures and “Deck” in the diagram in Appendix A.
- Beam Type: select the beam material, see pictures and “Beams or Girders” in the diagram in Appendix A.
- End/Back Wall Type: select the end wall material, see pictures and “Backwall” in the diagram in Appendix A.
- Creosote Evidence: for bridges with wooden components, are any of the timbers soaked in creosote? This will be obvious by the strong smell and/or presence of dark, oily stains on timbers.
- Suitable Roosting Crevices: does the bridge have any vertical crevices that have potential for suitable bat roosts. Typically, crevices that support bats are ½” to 1 ¼” wide and anywhere from 4” to >12” deep. You will need to look under the bridge, along the guard rails and on the side of the bridge at the end bents to assess this question. An example of this is an expansion joint that bats are accessing from the underside of the bridge that is covered with a rubber compression seal or a type of poured sealant on the top of the bridge which protects them from rain. The picture on the right below is the view looking up at the bridge’s expansion joint from below. Sometimes the concrete guardrail has a very narrow crevice (½” to 1 ¼”) that will be sealed on top and open on the side, if you observe this, select yes to this question.



An example of a suitable roosting crevice is an unsealed expansion joint along a guard rail/jersey barrier that bats could access which is deep enough to protect them from wind and rain, hence >12” deep.



- Deck Drains: bats have been found roosting in bridge deck drains that have been inadvertently top sealed. The drains have either been mistakenly paved over or the deck drains have been clogged with debris. This will need to be assessed from the underside of the bridge by directing light into each clogged deck drain.
- Height of Bridge Deck Above the Ground or Water: To collect a consistent measurement, record the height from the surface below to the bridge deck (not the top of the bridge). Use the area with the max height observed. Report the height of the bridge (below deck) to the water or road surface beneath. This information will help us determine what bridge height a bat will use. If a bat is observed, roost height is important as well and should be recorded in the notes section, but the overall bridge height helps us have a consistent overall metric to determine use.
- Bridge Alignment: in which direction is the bridge oriented?
- Human Disturbance Under the Bridge: Record human disturbance under the bridge as high, medium, low or none. An example of high disturbance would be if there are people living under the bridge, or a popular fishing area. Also, if there are fire pits or chairs or lots of graffiti. Vehicular or train traffic does not constitute human disturbance. An example of no disturbance would be a bridge that spans a small, stream in a forested area devoid of any human sign. If you select “high”, please describe why in the notes section.

-
- Evidence of Bats Using Bridge: did you observe any bats, urine staining or guano piles? See Appendix B for pictures of evidence.

The next few questions will only need to be answered if bats were observed or if there was evidence found of bats using the bridge:

- Emergence Count Performed: did you perform an emergence count at dusk? If so, see Emergence Count procedure in Appendix E *Range-Wide Indiana Bat & NLEB Survey Guidelines*.
- Evidence of Bats Using Nests: did you observe any bats using bird/wasp nests under bridge?
- Type of Evidence: select the type of evidence you are observing, select all that apply.
- Bat Roost Location Type: In the question above, if you observed bats roosting on the bridge, were the bats in crevices or roosting out in the open/on the walls under the bridge?
- Bat Roost Material: If you observed bats roosting on the bridge, what material were they attached to?
- Bat Species Present: pick the species you observed from the list in Appendix C, if you are unable to see them well enough for a correct identification, then record that in the notes section. Try to take photos without disturbing the bats.
- Bat Species Present 2 & 3: record a second or third bat species here if observed.
- Notes: this field has 100 characters to record information such as shaggy trees/hollows and their locations, if you were unable to inspect the entire structure for some reason (safety), if you see guano or urine staining, where exactly you have seen the bats, roost height, etc. For example: urine staining observed and guano piles in and around the western most expansion joint, under the eastbound traffic lane. **TAKE PICTURES.**

Culvert Attributes: Minimum dimensions for conducting an internal culvert survey are 5 feet in height and 60 feet in length. This is based on recent findings of surveys conducted by NCDOT across North Carolina Coastal Plain, Piedmont and Mountains in partnership with NCWRC, USFWS, NC Bat Working Group and Indiana State University. **In the west, flashlight surveys will be conducted on anything 3 feet in height and above with a min. length of 60', see pg. 2 for further explanation. Take a picture of the inlet and outlet end of the surveyed pipe.**

- **% Surrounding Habitat:** surrounding habitat will need to be assessed prior to field surveys using aerial imagery and best professional judgment. These habitat types are based on National Land Cover Database (NLCD) classifications which were developed by the Multi-Resolution Land Characteristics (MRLC) consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale. Fill in a number that represents the approximate percent of the following habitats found within 1 mile of the project footprint.
 - o Urban/Commercial
 - o Suburban/Residential
 - o Agricultural
 - o Herbaceous/Shrub/Grassland/Barren Land
 - o Deciduous Forest/ Evergreen Forest/ Mixed Forest
 - o Woody Wetlands /Herbaceous Wetlands/Open Water
- **Any live trees and/or snags >3" dbh in the project footprint:** this question is designed to capture the presence of potential roosting and foraging habitat within the project footprint for the northern long-eared bat. Isolated trees >1000' from the nearest woodlot are not included. This does include live trees and/or snags ≥ 3 inches dbh that have exfoliating bark, cracks, crevices, and/or hollows.
- **Any trees and/or snags ≥ 5 : IN bat:** this question is designed to capture the presence of roosting habitat within the project footprint for the Indiana bat, *Myotis sodalis* within the project footprint. Provide photos of potential roost trees and put descriptions and locations in the notes section.
 - o IN Bat: how much sun do these trees rec: this question is a follow up to the question above about snags and hollows.
 - o IN Bat: list species of habitat trees: this question is also a follow up to the shaggy/snags/hollows question, list the tree species (i.e. *Abies fraseri*) that have exfoliating bark, cracks, crevices, and/or hollows.
- The four questions dealing with Caves and Mines in the project footprint and vicinity (within 0.50 mile {see explanation in Appendix D}) will need to be assessed prior to field surveys using the Mineral Resources Data System shapefile. For a tutorial on how to do this see Appendix D, Locating Mines. Provide photo, descriptions and locations. While on site, the biologist should investigate (on foot) any potential winter roost sites that are **visible** within line of sight of the bridge. Look for rock outcroppings, or other topographical features that may indicate the presence of a cave or unmapped mine.
- **Major Water Source:** select the one that best describes the water source in the culvert being inspected (not nearby or within the entire project area, just what is observed right there at the culvert).
- **Suitable Drinking Habitat:** This question is intended to assess accessibility of a water source in the project footprint. Is the water source suitable for bats to access or is there a lot of vegetation blocking the flight path to the water?
- **Guard Rails:** select the guard rail material

- Culvert Material: select the type of material that the culvert is constructed with, if there are multiple, make a note in the Notes section.
- Number of barrels: record the number of barrels associated with the structure.
- Structure Specific Questions: A series of questions specific to the characters of the culvert that are self-explanatory. For the dimensions (H, W, L) of the culvert, please enter the designed/original size of the culvert structure in **feet (if less than 1, enter a decimal fraction)**. If there is sedimentation that decreases the size of the opening (height), please put the height of the barrel opening observed on the date of the visit. For example, the original five-foot culvert has a maximum of one foot of sediment accumulated on the bottom, decreasing the opening that the bats fly through now to four feet. So, for the question asking about observed height on day of visit, record four feet. If the sedimentation changes throughout the length of the culvert from one foot to two feet, please enter a measurement that represents the narrowest opening for bats to fly through (5' minus 2' max observed sedimentation = 3'). Please use the notes section to describe this in detail.
- Culvert Type: select the best descriptor (arch, pipe, box)
- Openings protected from high winds: This question is intended to describe if the temperature can stay consistent in the culvert, making it desirable roosting habitat, high winds can change this. Are the entrances protected from high winds? Is there a lot of vegetation in the vicinity of the culvert opening or is it an open area?
- Crevices present: are there breaks in the culvert sections that allow space for a bat to tuck into or hang from?
- Rough surfaces, imperfections, bird nests: are there rusted out areas (if metal) or other imperfections for a bat to tuck into or hang from?
- Human Disturbance in the Culvert: an example of high disturbance would be if there are people living inside a culvert which spans a busy highway, graffiti, fire pits, etc. An example of no disturbance would be a remote culvert in a non-navigable stream.
- Depth of water in culvert: record in feet (ex. instead of 6", please record 0.5')
- Emergence Count Performed: did you perform an emergence count at dusk? If so, see Emergence Count procedure in Appendix E *Range-Wide Indiana Bat & NLEB Survey Guidelines*.
- Evidence of Bats Using Nests: did you observe any bats using bird/wasp nests under bridge?
- Evidence of Bats Using Culvert: did you observe any bats, urine staining or guano piles? See Appendix B for pictures of evidence. If so, record exactly what you saw and where you saw it in the notes section. **TAKE PICTURES**
- Bat Species Present: pick the species you observed from the list in Appendix C, if you are unable to see them well enough for a correct identification, then record that in the notes section. Try to take photos without disturbing the bats.
- Bat Species Present 2 & 3: record a second bat species here if observed.
- Notes: this field has 100 characters to record information relevant to bats like if you see guano or urine staining, where exactly you have seen the bats, etc.
- Notes (culvert section): record if there is vegetation blocking the entrances, excessive sedimentation or cobwebs inside. Also, if you were unable to inspect the entire structure for some reason (safety), report that. **TAKE PICTURES.**

Abandoned Structures Attributes:

- **Structure Number:** this is a number that you create to represent the abandoned structure you are assessing. Typically start with one and label it appropriately on a provided field map.
- **Canopy Cover:** determine which category defines the percent of closed canopy cover at structure.
- **% Surrounding Habitat:** surrounding habitat will need to be assessed prior to field surveys using aerial imagery and best professional judgment. These habitat types are based on National Land Cover Database (NLCD) classifications which were developed by the Multi-Resolution Land Characteristics (MRLC) consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale. Fill in a number that represents the approximate percent of the following habitats found within 1 mile of the project footprint.
 - o **Urban/Commercial**
 - o **Suburban/Residential**
 - o **Agricultural**
 - o **Herbaceous/Shrub/Grassland/Barren Land**
 - o **Deciduous Forest/ Evergreen Forest/ Mixed Forest**
 - o **Woody Wetlands /Herbaceous Wetlands/Open Water**
- **Distance to Nearest Woodlot:** is the closest woodlot further than 1,000' or less than 1,000' away?
- **Water Source within 1 Mile:** select one from the drop down menu that best describes the major water source within one mile. If there are multiple water sources, select the dominant type.
- **Structure Type:** select from list
- **Structure Condition:** select from list
- **Roof Type:** select from list
- **Structure Description:** 100 characters allowed in this field. Include information such as the location of the bats and signs of use, include a paper sketch.
- **Is there regular human use or disturbance:** select Y/N
- **Structure Length, Width, Height:** in feet
- **Exterior Evidence of Bat Use on Structure:** do you observe any guano or urine staining?
- **Describe Bat Use on Exterior:** If yes to above, describe what and where.
- **Interior Airflow Noticeable:** Is there noticeable airflow inside? Select Y/N
- **Interior Air Temp vs Outside:** select from list.
- **Inaccessible Areas that could House Bats:** Are there inaccessible areas of the structure that could house bats (e.g. attics, ceiling spaces). If yes, describe here.
- **Evidence of Bats Roosting in Structure Interior:** if evidence exists of bats roosting in the structure (guano, urine staining, piles of insect parts) then describe what and where, take pictures. If there is evidence of bats but no bats are observed, additional surveys might be needed, consult project lead.
- **Bat Species Present:** pick the species you observed from the list in Appendix B, if you are unable to see them well enough for a correct identification, then record that in the notes section.
- **Bat Species Present 2:** record a second bat species here if observed.

Caves/Mines Attributes:

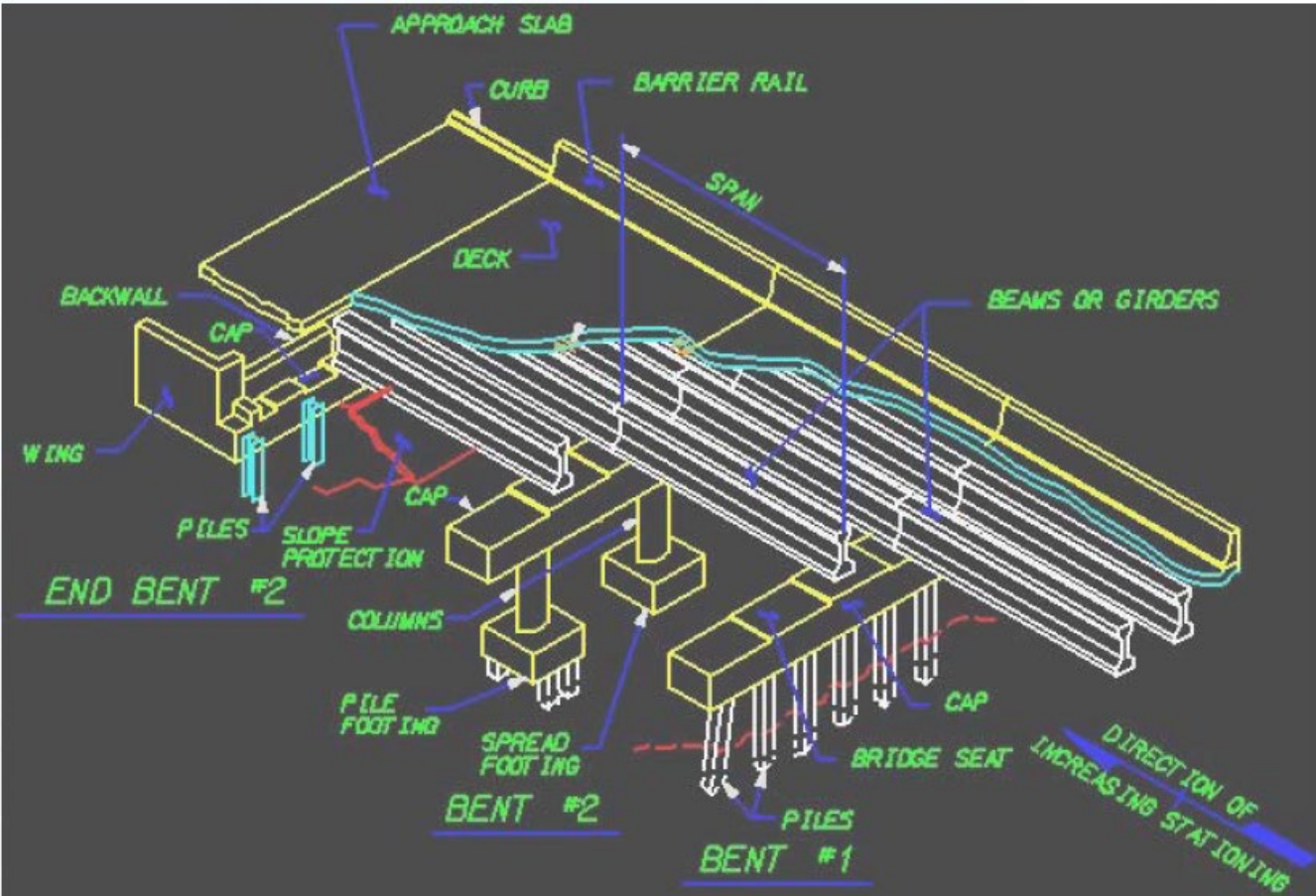
Survey all cave, mines, rock outcrops and other similar features that may support roosting bats. Entrance of abandoned mine portals, quarries or cave openings can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety and health problems may occur as a result of entering abandoned mines. It is not authorized or required by anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These procedures do not require any employee, consultant, lessee or other such designee to enter into any cave opening, quarry or mine portal.

- Entrance/Portal Number: this is a number that you create to represent the entrance to the cave or mine portal you are assessing. Typically start with 1 and label it appropriately on a field map.
- % Canopy Closure at Entrance: determine which category defines the percent of closed canopy cover over the portal to the mine or cave opening.
- Opening Type: select from list
- Opening Height x Width: in feet
- Length of Portal/Opening: in feet
- Internal Height: in feet
- Internal Width: in feet
- Slope up or down from Entrance: select from list, does the ground slope up toward the entrance or down into the entrance?
- Entrance Stable: select Y/N
- Direction of Airflow: select from list
- Amount of Airflow: select from list
- Internal Air Warmer or Cooler than Outside Temp: select from list
- Evidence of Collapse: select Y/N
- Ceiling Condition: capture the overall “texture” inside the cave/mine. For instance, are the walls and ceiling generally smooth, or are there lots of cracks, and crevices. Also, are the walls/ceiling crumbling? Loose rock inside?
- Depth of Water Internal Opening: in inches, record the depth of the water observed in the opening
- Any Evidence of Past Flooding: select Y/N
- Miles to Nearest Water Source: may need to be assessed prior to field surveys using GIS or maps.
- Foraging Signs: insect wings, legs, etc.
- Any Portals Known to be Connected: include this information, which portals are connected?
- Any Observed Side Passages: are there other passages you noticed in the cave or mine of note?
- Bat Species Present: pick the species you observed from the list in Appendix B, if you are unable to see them well enough for a correct identification, then record that in the notes section.
- Bat Species Present 2: record a second bat species here if observed.
- Notes: anything of note

Appendix A

Structure Diagram and Pictures

Structure Diagram



Guard Rail Type:

- Concrete



This is considered a concrete guardrail, it has an aluminum top guard but if you see this, please call it concrete



- Timber



- Metal: Aluminum



Steel



Deck Type:

- Concrete Deck



This is the common look of a concrete deck from below, also pictured are the concrete beams running parallel along the bridge. See discussion below about “stay in place” metal forms on a concrete deck.

The following pictures are showing a concrete deck that was poured using timber forms so it looks like timber, but don’t be fooled!



- Metal



A steel plank floor is usually corrugated metal forms on top of steel beams/girders with **asphalt** overlay (no concrete). The first picture above is of a repair job which helps visualize the layers of this type of bridge deck to see what the top of the corrugated metal looks like with asphalt removed. Therefore, if you see asphalt on top and corrugated metal underneath, it is likely a steel plank floor bridge. Look at the bottom of bridge pictured below. **Typically, it will have drain holes where metal stay in place forms (discussed below) for concrete decks will not.**



There is also something called a “stay in place” form which technically has a concrete deck. For our purposes it’s more important to list the surface that the bats would attach to. Pictured is a “stay in place” metal form on top of steel beams which is pictured here prior to pouring the concrete deck. If you see corrugated metal like the kind the men are holding in the picture underneath of your assessment bridge and concrete on top, it is likely just metal “stay in place” forms for a concrete deck. If you find roosting bats, record the surface the bats would attach to...for example, are they roosting in the concrete expansion joints of the deck. So, if bats are roosting within the concrete indicate that ‘concrete’ in the ‘Bat Roost Material’ field. If they are holding onto the metal, select metal.

- Timber Deck



- Open Grid Deck



Beam Type:

- None, this is an example of a deck type that does not have beams; it is a precast concrete cored slab.



- Concrete Beam



- Steel Beam



- Timber Beam

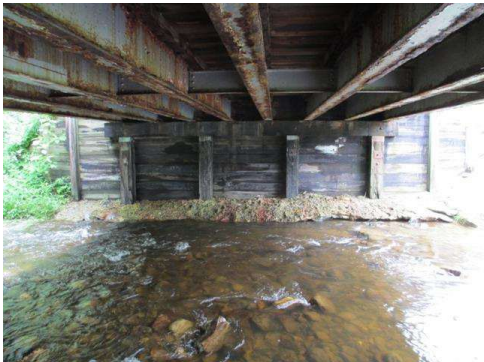


End/Back Wall Type:

- Concrete



- Timber



- Masonry



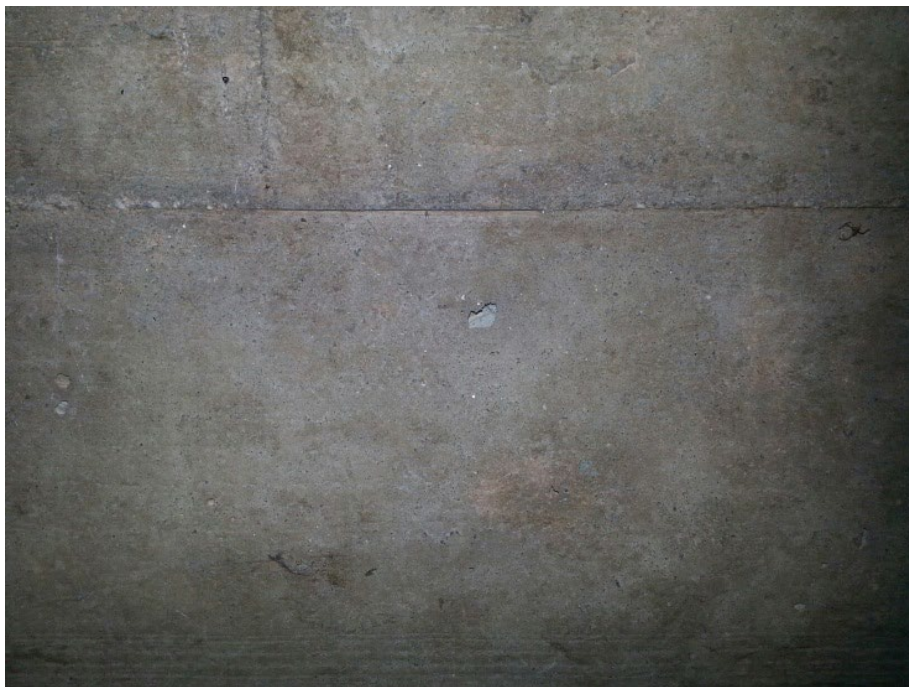
Appendix B

Evidence of Bats & ID of Bat Species in Bridges

The photo to the left is of bat guano on a vertical wall. Look closely at the picture on the right, from a distance it may seem as though those dark marks are guano.



But upon close inspection, they are chips in the concrete.





bat guano

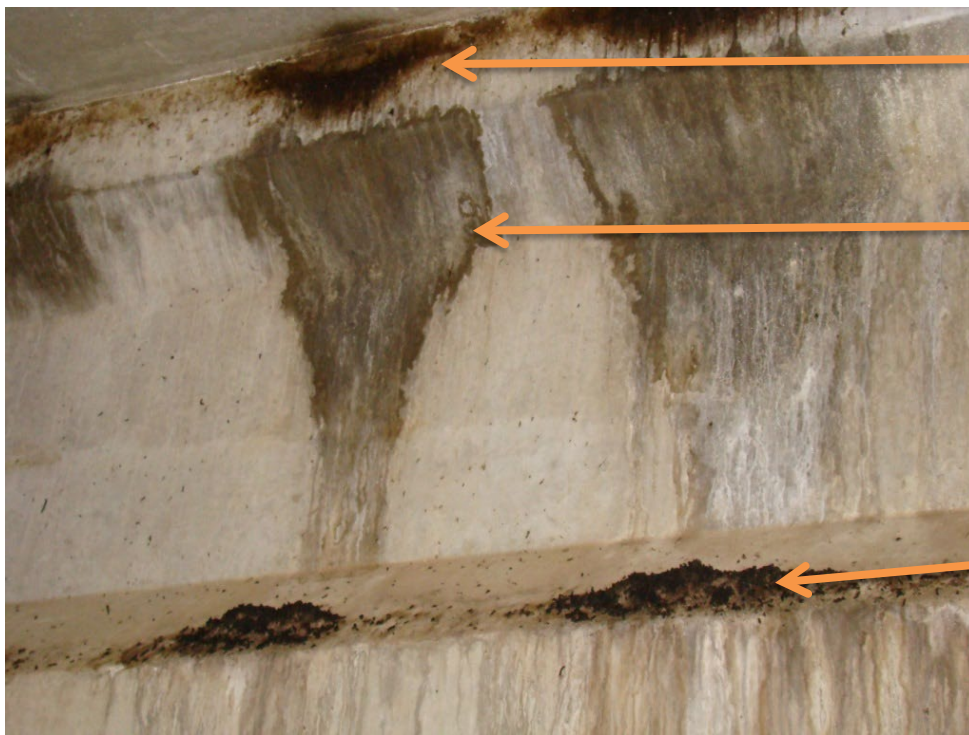


mirror/light to detect bats in a crevice



Urine staining and guano on ground





oil stains & dirt

urine staining

guano

oil stains & dirt



Salt staining (below), not urine from bats. Smell is a good indicator.



Identification of bat species roosting in bridges



Myotis grisescens in clogged drainpipe – Note monochromatic gray colored fur (sometimes paler below), fully furred and pointed face, pointed ears, sharp tragus, long (40+ mm) forearm.



Myotis grisescens in drainpipe.



Myotis grisescens in crevice – Note monochromatic gray colored fur, fully furred face, and long forearms.

Indiana State University



Myotis grisescens in crevice –
Note monochromatic gray-
colored fur.



Myotis grisescens in crevice –
Note fully furred pointed face,
pointed ears, and long
forearms. The bat appears
relatively large compared to
other *Myotis* species but is
distinguishable from the
characteristics of *Eptesicus*
fuscus.



Myotis grisescens (L) and
Eptesicus fuscus (R) in crevice –
Note the gray bat lacks a
prominent muzzle with
bulbous glands. The big brown
bat has more rounded ears.
Fur color differs across the two
species.

Indiana State University



Eptesicus fuscus in crevice –
Note dark face and ears, along
with prominent muzzle.



Eptesicus fuscus in crevice with
guano – Note reddish-brown
fur, dark and prominent
muzzle with bulbous glands,
and long forearm.



Tadarida brasiliensis in crevice
– Note wrinkles on muzzle and
dull-colored fur. Also, the base
of the ears almost come
together on the forehead.

Indiana State University



Myotis sodalis roosting underneath a bridge - Note dull color of fur, pinkish cast to nose, and snub nose. Also note the presence of guano pellets on the vertical wall of the concrete beam.



Myotis leibii roosting in guardrail crevice - Note reddish brown fur, dark mask on face, dark ears and wings, and small size.



Perimyotis subflavus roosting in a culvert – Note reddish brown color of fur, red forearms contrasting with black wings, small size.

Indiana State University

Identification of bat guano to genus



Small guano, likely from
Myotis or *Tadarida*.



Eptesicus fuscus guano.

Indiana State University

Appendix C

Abbreviations for NC Bat Species

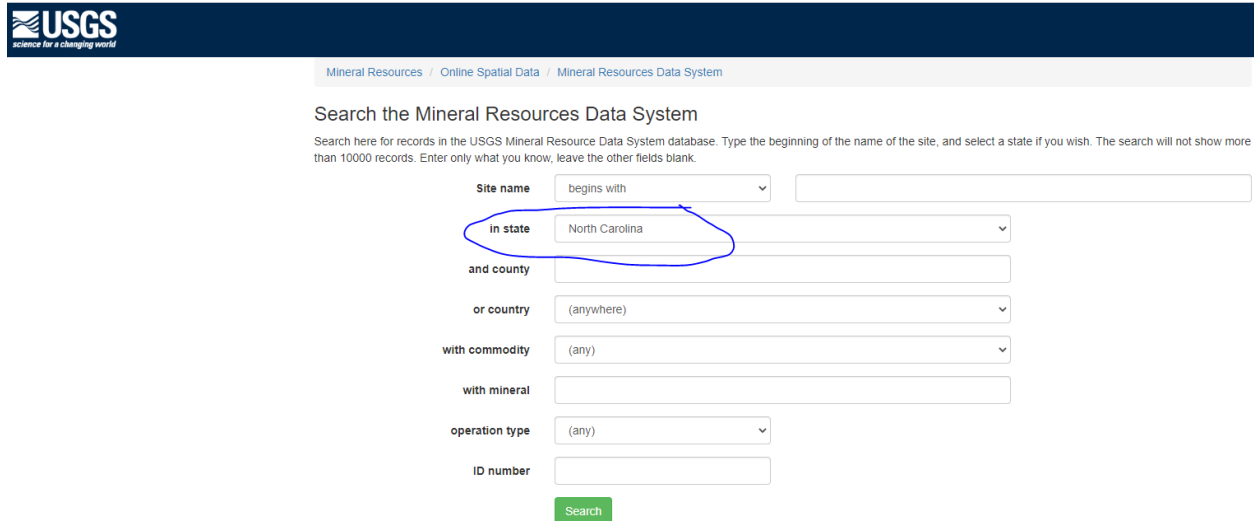
Abbreviations to Use for Known Bat Species in North Carolina 2014			
CORA	<i>Corynorhinus rafinesquii</i> Rafinesque's Big-eared Bat	MYAU	<i>Myotis austroriparius</i> Southeastern Bat
COTO	<i>Corynorhinus townsendii virginianus</i> Virginia Big-eared Bat	MYGR	<i>Myotis grisescens</i> Gray Bat
EPFU	<i>Eptesicus fuscus</i> Big Brown Bat	MYLE	<i>Myotis leibii</i> Eastern Small-footed Bat
LANO	<i>Lasionycteris noctivagans</i> Silver-haired Bat	MYLU	<i>Myotis lucifugus</i> Little Brown Bat
LABO	<i>Lasiurus borealis</i> Eastern Red Bat	MYSE	<i>Myotis septentrionalis</i> Northern Long-eared Bat
LACI	<i>Lasiurus cinereus</i> Hoary Bat	MYSO	<i>Myotis sodalis</i> Indiana Bat
LAIN	<i>Lasiurus intermedius</i> Northern Yellow Bat	NYHU	<i>Nycticeius humeralis</i> Evening Bat
LASE	<i>Lasiurus seminolus</i> Seminole Bat	PESU	<i>Perimyotis subflavus</i> Eastern Pipistrelle Bat/Tri-colored Bat
		TABR	<i>Tadarida brasiliensis</i> Brazilian/Mexican Free-tailed Bat

Appendix D

Locating Mines

Locating Mines Procedure

1) Go to the Mineral Resources On-Line Spatial Data USGS webpage <http://mrdata.usgs.gov/mrds/find-mrds.php> and fill in NC in the “state” field



USGS
science for a changing world

Mineral Resources / Online Spatial Data / Mineral Resources Data System

Search the Mineral Resources Data System

Search here for records in the USGS Mineral Resource Data System database. Type the beginning of the name of the site, and select a state if you wish. The search will not show more than 10000 records. Enter only what you know, leave the other fields blank.

Site name begins with

in state North Carolina

and county

or country (anywhere)

with commodity (any)

with mineral

operation type (any)

ID number

Search


2) Choose format Shapefile and click Get Data



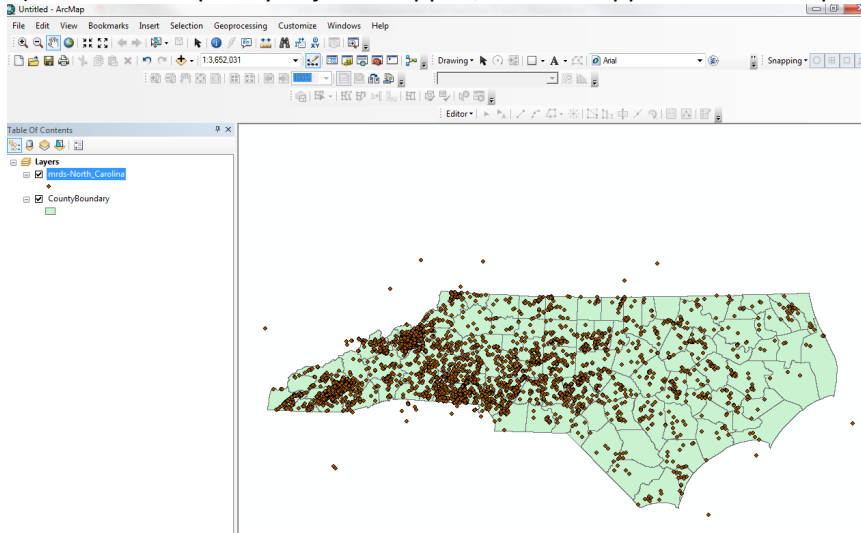
Choose format: Shapefile Get Data

3) A zip file is returned click on the link to the zip and download.


4) Extract the .zip by right clicking on the folder and selecting Extract All

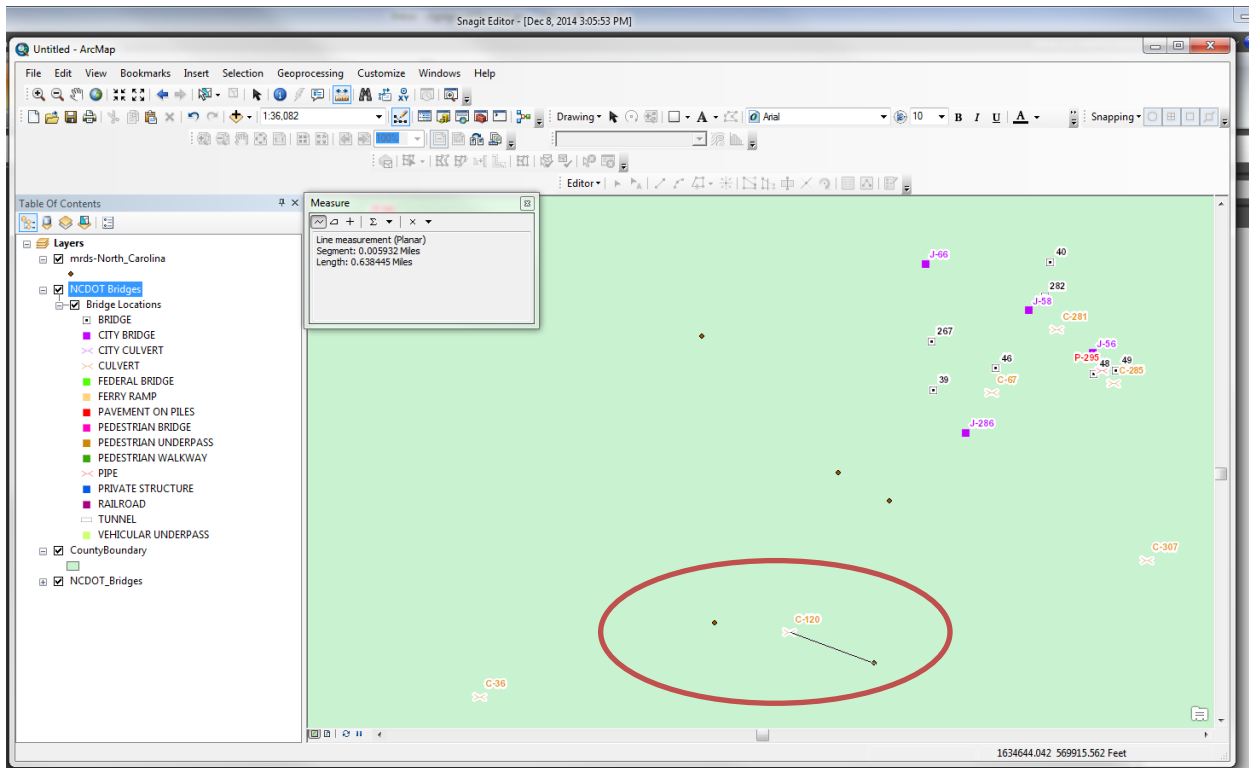
5) Open ArcGIS and click the add data button 



6) Select the .shp file you just unzipped, it should appear like the map below:



7) Now you can locate your project. Other common data layers can be found at the NCDOT GIS webpage <https://connect.ncdot.gov/resources/gis/Pages/GIS-Data-Layers.aspx> you can also do searches on NC One Map for layers <http://data.nconemap.com/geoportal/catalog/main/home.page>. If you have a mine in your project footprint, investigate further.

- 8) Use the measure tool in ArcGIS to measure 0.50 mile out from your project  to determine if any mines are within your project vicinity (0.50 mile). The example below says 0.6 but just pretend it says 0.5 miles for the purposes of this tutorial.



- 9) If you do locate a point within 0.50 mile of your project, make note what the distance is and click on the information button  to obtain more details about the cave or mine. In the example above, the mine is pretty close...0.5 mile east of the culvert C-120 (my project). I click on the information icon  and I'll record the following details: Site Name and Operator Type: Stanley County surface mine (**this step is now only necessary if you find a mine found within the project footprint**).

Identify

Identify from: <Top-most layer>

mrds-North_Ca

Stanley Co

Location: 1,634,644.042 569,946.884 Feet

Field	Value
FID	4347
Shape	Point
dep_id	10127244
mrds_id	
mas_id	0371670014
site_name	Stanley County Mine
latitude	36.2008
longitude	-80.22479
region	NA
country	United States
state	North Carolina
county	Stanly
com_type	N
commod1	Clay
commod2	
commod3	
ope_type	Surface
dep_type	
prod_size	
dev_stat	Past Producer
ore	
gangue	
other_matl	
orebody_fm	
work_type	
model	
alteration	
conc_proc	
names	
ore_ctrl	
reporter	Eastern Field Operations Center (EFOC)
hrock_unit	
hrock_type	
arock_unit	
arock_type	
structure	
tectonic	
ref	{Deposit:: POR IS ALBEMARLE, NC} {Deposit:: MSHA LIST 11/23/79.}
yfp_ba	
yrfst_prd	0
yfp_ba	
yrfst_prd	0
dy_ba	
disc_yr	0
prod_yrs	
discr	

Arial

10

B I U A

1634644.042 569946.

Click here to add networks.

10) If you do find subsurface or surface-subsurface mines within your project footprint you will need to investigate further. Sometimes using aerials will eliminate the need for a site visit. If aerials indicate that the mine is clearly now located in a commercial area or agricultural field, there is no need to conduct a site visit. Any subsurface mines in forested areas should be investigated.

N.C. Dept. of Transportation | March 2024 Standard Operating Procedures Bat Habitat Assessments

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Appendix E

Survey 123 & GO!NC

ESRI Survey123 User Guidance


The following instructions are for the electronic collection of bat habitat data on four infrastructure types; bridges, culverts, abandoned structures and mines. Steps below outline how to setup access and collect the data in the Survey 123 platform.

1. Access Invitations in ESRI Groups

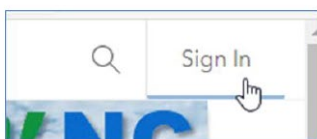
Choose the device on which you will be using to collect the data (tablet, phone) and ensure that Wi-Fi is enabled. On your device, sign into your ArcGIS Online (AGOL) account.

<https://ncdot.maps.arcgis.com/>. Log in with your credentials (username and password) or use your ArcGIS organization's URL to ensure you have an account and access. If you do not, follow these steps:

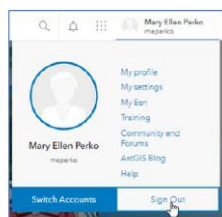
- NCDOT employees: Email gishelp@ncdot.gov request a GO!NC account to be created for you. You will be prompted to sign a user agreement and then your account is created. Even if you had previously set up an ArcGIS Online account, it was likely purged last year when NCDOT went to the new portal. Please follow this step unless you are a frequent ArcGIS Online user (in the past year).
- For users without an NCDOT email address. Please obtain an account through your own agency's/company's ArcGIS Online organizational subscription. Many agencies and consultants/contractors have their own. Once the AGOL username has been passed to NCDOT, NCDOT staff can 'invite users' to join the group; your account will receive an invitation to join the Bat Survey Group.
- ★ *If your account is new, you NOW need to go to GO!NC at <https://ncdot.maps.arcgis.com> and sign in to activate your account. Once your account has been activated, please email me your user name exactly how it appears in the upper right hand corner of the portal, and then I can add you to the "Bat Survey Group" in ArcGIS Online. For example, this is how mine is displayed:*

 Cheryl L Knepp
clknepp_NCDOT

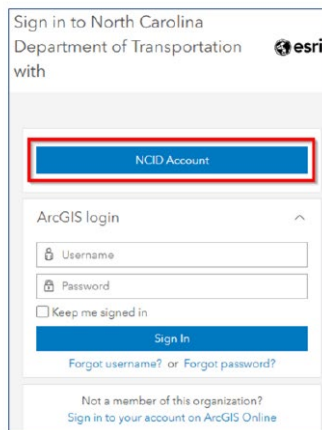
1. Click "Sign In" in the upper right corner.



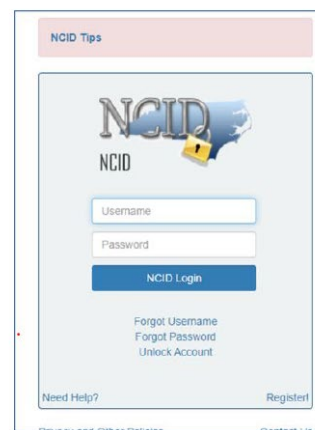
If signed in using a non-NCID account, sign out first.



2. Click on the "NCID Account" option.



3. Sign in using your NCID credentials.



2. Instructions for Downloading Survey123 Application on Phone or Tablet

a. Software Download

Survey123 Field App: Phone/Tablet installation

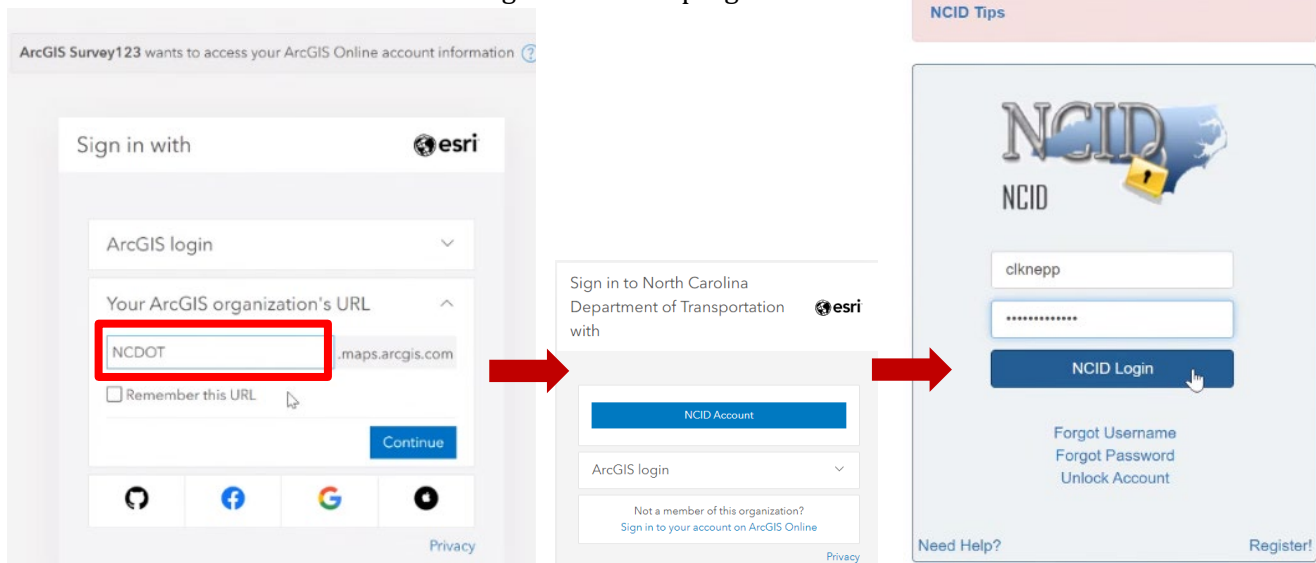
- [Apple iOS](#)
- [Microsoft](#)
- [Android/Google Play](#)



Note: Field Maps is not supported by Microsoft 10 and above

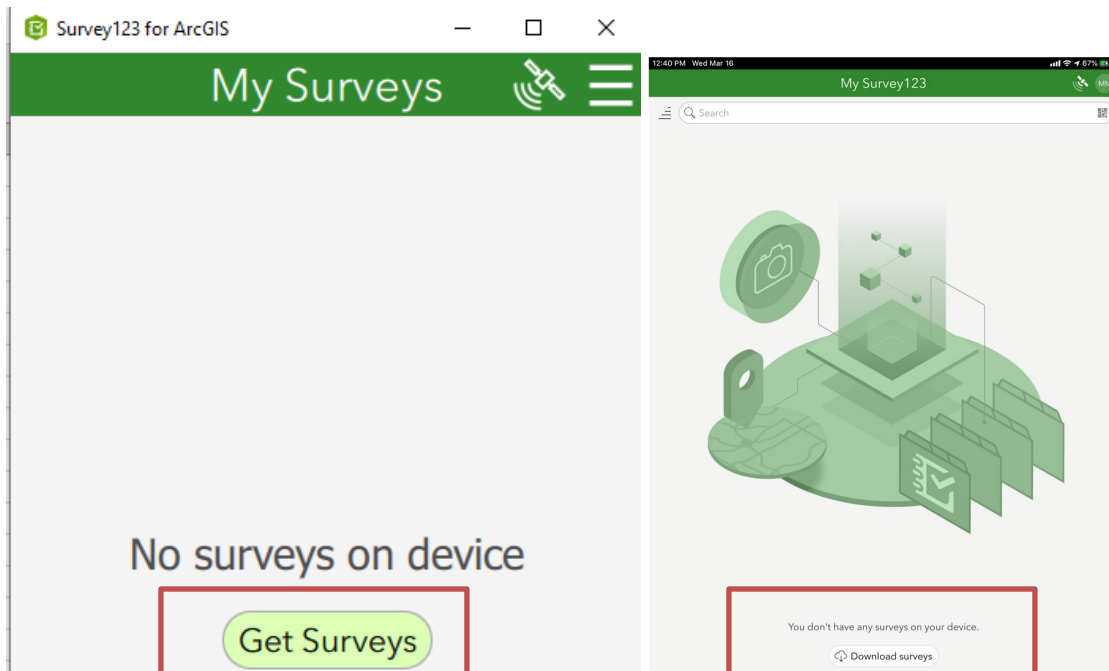
b. Data form Application Access: NCID Account

- You will need your NCID username and password to access the Applications on your mobile device and computer desktop.
- Desktop link: <https://ncdot.maps.arcgis.com>
 -
 - Select 'Sign In' in the top right

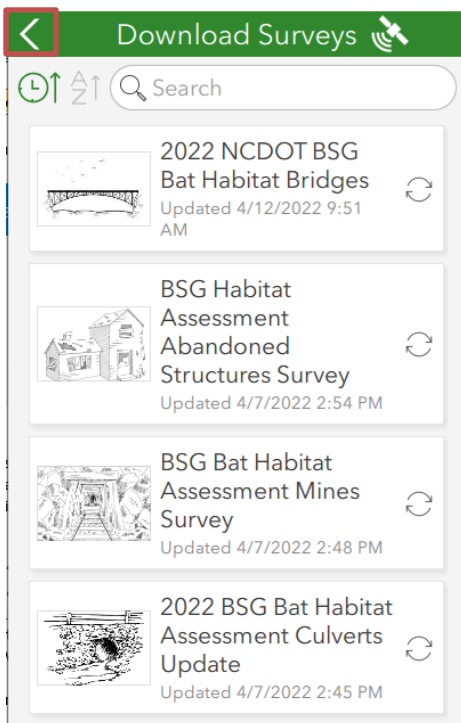


3. Survey123 Data Collection

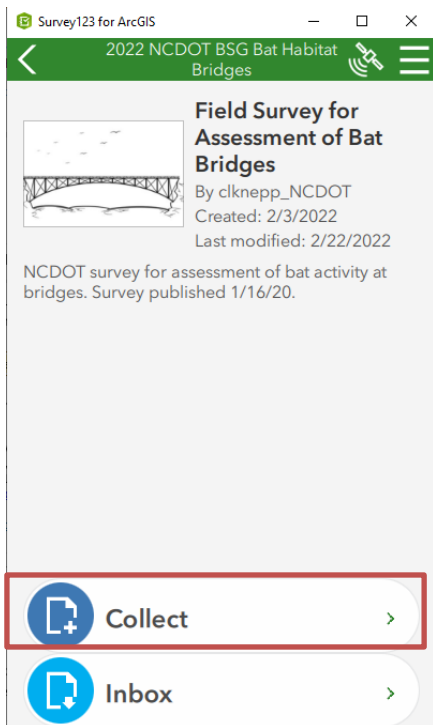
- Open in Survey123 on your tablet or phone, it will look like either of these formats. Or in the upper right-hand corner click your initials. Select 'Get Surveys' or 'Download Surveys' button



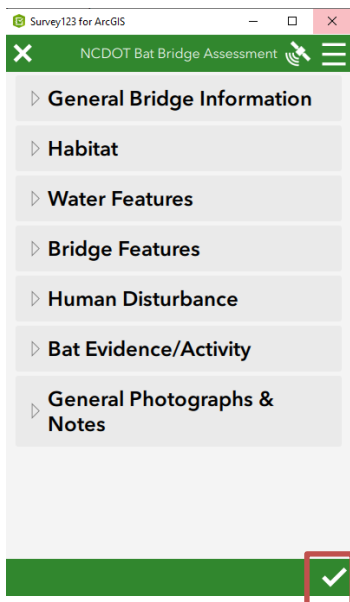
- Scroll to find or type in the following names in the search bar. Select the cloud on the right to download the four survey forms below. Once you have downloaded all four, click the back arrow in the top left of the green title bar.



- Start your data collection. Select the appropriate survey you wish to collect. An example of the bridge app is pictured below. Select 'Collect' and complete each section per *NCDOT Preliminary Bat Habitat Assessments Standard Operating Procedures Manual*.



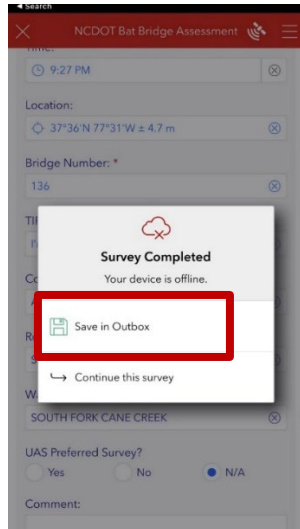
Once you are done, click the arrow in the bottom right to submit your data form.



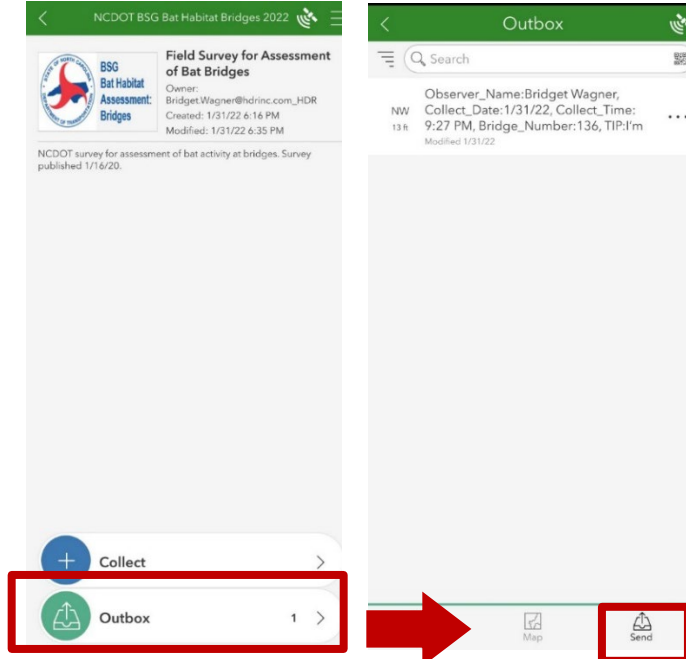
This is all you need to do to complete a survey, the following pages are for working offline (no signal) or if you want to edit your data or generate a .pdf form for your report.

3.1 Offline Survey123 Use

If the field team is lacking cell and/or Wi-Fi coverage, Survey123 will still open and operate as it normally would, except for sending submitted surveys to an 'Outbox' that the team will be able to 'Send' once the device is within range of cell or Wi-Fi service. Upon submitting a Survey when offline, the following dialog will appear:



The user can save as many survey records as necessary to the outbox and send them once they have proper service:



If the user will be in urban areas and close to cell towers no pre-download of information is necessary. Everything will sync to the cloud server in real time.

Appendix F

NCWRC Decontamination Guidance for Culvert Surveys (for use in counties with positive Pd records)

NCWRC Decontamination Guidance for Culvert Surveys

NCWRC follows the U.S. Fish and Wildlife Service White-nose Syndrome Guidelines to minimize the spread of *Pseudogymnoascus destructans* (*Pd*), the fungal pathogen that causes White-nose Syndrome (WNS): [October 8, 2020 USFWS WNS Decon Protocol](#). Update 2024: <https://whitenosesyndrome.org/mmedia-education/national-wns-decontamination-protocol-u-s>. Please see the USFWS Decon Protocol for a list of products with demonstrated efficacy against *Pd*. These are referred to as “approved products” hereafter.

Decontamination Packing List:

1. Outer layers (long-sleeved top layer and scrub pants) – 1 set per county if surveying multiple counties in a day
2. Gloves (latex/nitrile disposable or reusable dishwashing gloves).
3. Approved decontamination products (i.e., 70% isopropyl alcohol wipes and spray, bleach wipes and spray, or others listed in USFWS guidance)
4. Storage bin
5. Trash bags

Clean and Dirty Zone Designation

Before the survey begins, designate the **clean** and **dirty** zones (Figure 1). The **clean** zone includes the area where the truck is parked and the nearest area surrounding it/leading to it. The **dirty** zone includes the entrance area to the culvert and the area leading to it. Once the survey begins, the clean zone must not be entered until surveyors and gear are clean at the end of the survey.

Before the survey, place bleach wipes and spray (or other approved products) on the clean side of the **clean-dirty line** (the interface of the clean and dirty zones) along with a trash bag for trash and a storage bin for containing dirty clothes/gear after the survey. Placing a stick on the ground to represent the clean-dirty line is helpful.

At the end of the survey, bring all gear to the dirty side of the **clean-dirty line**. First thoroughly wipe your gloves with bleach wipes to eliminate/reduce *Pd* load before you touch anything else. Then clean any gear to be decontaminated onsite (i.e., nonporous items like rubber boots/waders, camera, flashlight) and immediately place it into the clean zone while remaining standing in the dirty zone. Gear to be decontaminated later (i.e., porous items like clothing or backpacks) should be placed in the storage bin that is located just over the clean-dirty line in the clean zone.

Once all items are clean/contained for offsite decon, the surveyor is clear to step into the clean zone. Once in the clean zone, no person or gear should cross back into the dirty zone. If this happens, gear or footwear must be cleaned again before going back into the clean zone.

Onsite Decontamination Guidelines

- Wear an outer layer of clothing into the culvert that can be shed after the survey and stored in a storage bin for decon offsite. If surveying culverts in multiple counties in one day, change outer layers between counties.

- If wearing chest waders, wear a long-sleeved outer layer over the top half of the body and take it off between surveys and store in storage bin.
- If wearing rubber knee boots, wear both a long-sleeved layer and an outer pants layer (scrubs work well) and take off between surveys and store in storage bin.
- Wear latex/nitrile gloves that can be discarded or wiped down with an approved product between surveys.
- Spray and wipe down waders/rubber boots between each survey with an approved product.
- Wipe down spotlights, headlamps, clipboard, datasheet, pencils, camera, and any other nonporous equipment that was brought into culvert with an approved product between surveys.

Offsite Decontamination Guidelines

- Fully submerge clothing/gear in hot water (131°F/55°C) for 5 minutes.
OR
- Fully submerge clothing/gear in 10% bleach-water solution for at least 10 minutes.

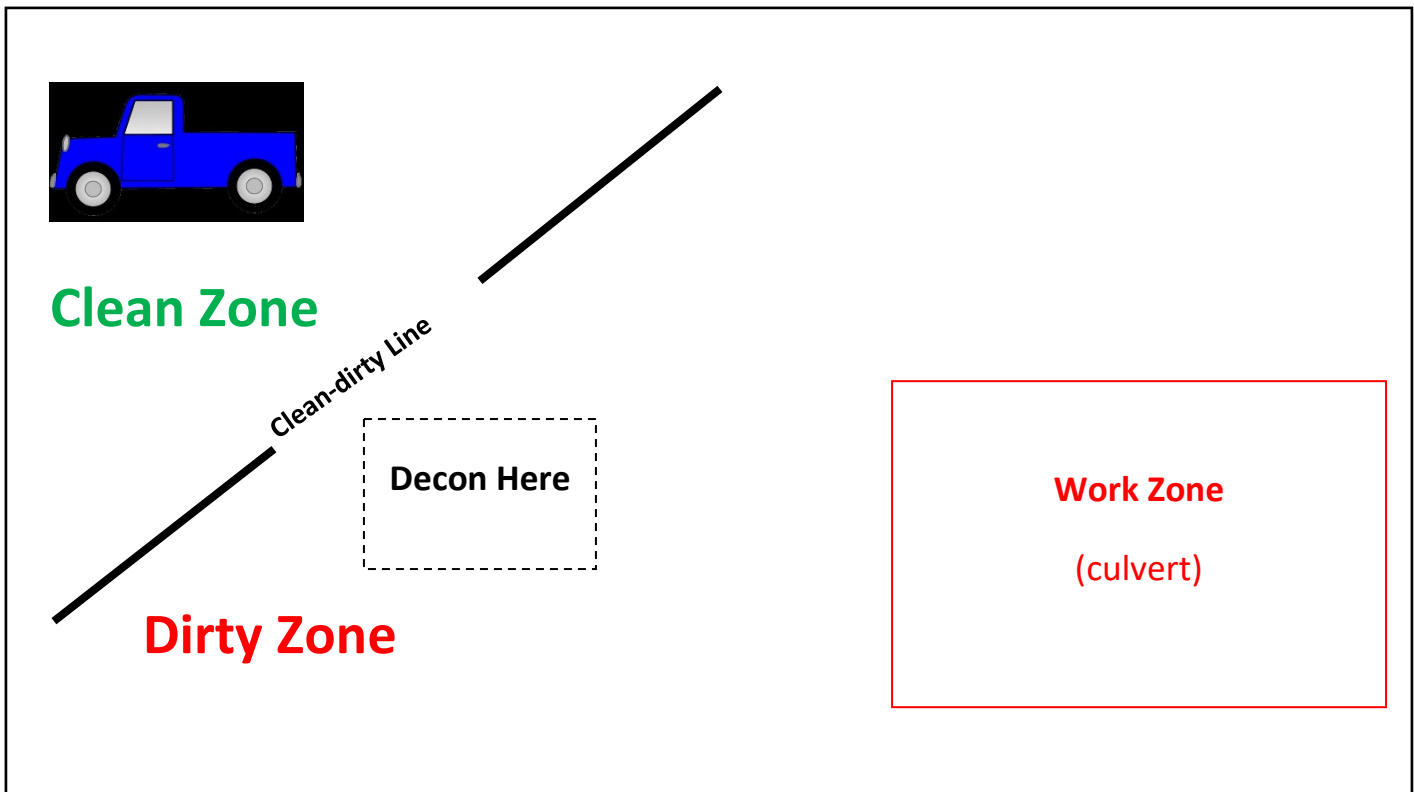


Figure 1: Example of onsite decontamination set-up.



Bat Habitat Assessment Form

NCDOT Bridges

Observers: _____

TIP or DOT project number: _____

Date: _____

Bridge Road (Name of facility carried) _____

County: _____

Bridge Number (six digit): _____

Crossing (name of the feature intersected): _____

% Surrounding habitat w/in 1 mi.
of project footprint (approx)

Urban/Commercial _____

Suburban/Residential _____

Herb/Shrub/Grassland _____

Agricultural _____

Deciduous/Evergreen/Mixed Forest _____

Woody Wetland/Herb Wetland/Open Water _____

Any trees ≥ 3 " DBH within project footprint?

N/A

yes

no

Complete this section for Indiana bat counties (Cherokee, Clay, Graham, Haywood, Jackson, Macon, Swain, Rutherford: Bat Cave/Lake Lure area only)

Any trees or snags ≥ 5 " DBH with exfoliating (shag) bark or crevices?

N/A

yes

no

If yes to shag/snag, how much sunlight do they receive during the day?

N/A

1-3 hours

4-6 hours

7+ hours

If yes to shag/snag, list species of habitat trees ≥ 5 " dbh _____

If snags ≥ 5 " DBH are present in sunlit areas, provide photos and location.

If large hollow trees are present, provide photos and location.

Presence of:

In project footprint

In vicinity (0.5 mi)

Caves

yes

no

yes

no

Abandoned mines

yes

no

yes

no

If 'yes' to any of the above, provide photos, description, and location.

Major water source in project footprint

N/A

river

stream/creek

pond

lake

swamp

Suitable drinking source for bats to access (veg blocking the flight path to the water? yes

no

N/A

Structure specific questions:

Artificial lighting

unknown

yes

no

Guard rail material

none

concrete

metal

timber

Deck material

concrete

metal

timber

open grid

Beam material

none

concrete

metal

timber

End/back wall material

concrete

masonry

timber

Creosote evidence

yes

no

Suitable roosting crevices present ($\frac{1}{2}$ - $1\frac{1}{4}$ " wide)

yes

no

Deck drains

yes

no

Max height of bridge deck (bottom of deck) above ground or water (ft): _____

Bridge alignment

N/S

E/W

NW/SE

NE/SW

Human disturbance under bridge

high

med

low

none

Evidence of bats using bridge? (photos needed)

yes

no

Below section completed only if bats/evidence of bats observed:

Emergence count performed? (If yes, complete form next page)

yes

no

Evidence of bats using bird nests, if present?

yes

no

Type of Evidence (circle all that apply)

guano

staining

bats observed

Roost Type (circle all that apply)

crevice

open area

Roost Material

metal

concrete timber

Bat species present (list all species): _____

Notes (list each species locations, roost height and estimated number of each species): _____



Bat Habitat Assessment Form

NCDOT Culverts

Observers: _____

TIP or DOT project number: _____

Date: _____

Road Name above culvert: _____

County: _____

Structure # or Lat/Long: _____

Name of the feature culvert is carrying (stream): _____

% Surrounding habitat w/in 1 mi.
of project footprint (approx)

Urban/commercial _____

Suburban/residential _____

Herb/Shrub/Grassland _____

Agricultural _____

Deciduous/Evergreen/Mixed Forest _____

Woody Wetland/Herb Wetland/Open Water _____

Any trees $\geq 3"$ DBH within project footprint?

N/A

yes

no

Complete this section for Indiana bat counties (Cherokee, Clay, Graham, Haywood, Jackson, Macon, Swain,

Rutherford: Bat Cave/Lake Lure area only)

Any trees or snags $\geq 5"$ DBH with exfoliating (shag) bark or crevices?

N/A

yes

no

If yes to shag/snag, how much sunlight do they receive during the day? N/A

1-3 hours

4-6 hours

7+ hours

If yes to shag/snag, list spp of habitat trees $\geq 5"$ dbh _____

If large hollow trees or snags $\geq 5"$ DBH are present in sunlit areas, provide photos and location.

Presence of:

caves

In project footprint

yes no

In vicinity (0.5 mi)

yes no

abandoned mines

yes no

yes no

If 'yes' to any of the above, provide description and location.

Major water source in project footprint:

N/A

river

stream/creek

pond

lake

swamp

Suitable drinking habitat accessible?

yes

no

N/A

Structure specific questions:

Guard rails

none

concrete

timber

metal

Culvert material

concrete

timber

metal

plastic

Number of barrels: _____ (double, triple, etc.)

Culvert height (ft): _____ Culvert width (ft): _____ Culvert length (ft): _____

If culvert is buried/crushed/sedimentation, observed narrowest opening height (ft): _____

Culvert type

pipe

box

arch

other _____

Openings protected from high winds

yes

no

Crevices present:

yes

no

Rough surfaces, imperfections, bird nests

yes

no

Human disturbance in culvert

high

med

low

none

Depth of water in culvert (if applicable) _____ (ft)

Below section completed only if bats/evidence of bats observed:

Evidence of bats using?

yes

no

Emergence count performed? (If yes, complete form)

yes

no

Evidence of bats using bird nests, if present?

yes

no

Type of evidence

guano

staining

bats

Roost material

concrete

metal

other: _____

Bat species present:

Notes (include description of bat location within culvert, sedimentation buildup, drainage inlets inside culvert, etc.)



Habitat Assessment Form

NCDOT Abandoned Structures

Surveyors: _____ TIP or DOT project number: _____

Date: _____ Road Name/SR Number: _____

County: _____ Lat/Long: _____

Property Owner & contact info, if known: _____

Structure number: _____

Canopy closure @ structure 0-25% 26-50% 51-75% 76-100%

%Surrounding habitat w/in 1 mi. Urban/Commercial: _____ Suburban/Residential: _____

Agricultural: _____ Herb/Shrub/Grassland: _____

Deciduous/Evergreen/Mixed Forest _____

Woody Wetland/Herb Wetland/Open Water _____

Distance to nearest woodlot (approx): >1000 feet <1000 feet

Is there a water source w/in 1 mi.? yes no

type: river stream/creek lake swamp pond

Structure type: house trailer barn shed other: _____

Structure condition: intact/well sealed a few small access ways

many/large access ways (open doors/windows) empty shell of a building

Roof type: metal asphalt shingle other: _____

Structure description: _____

Regular human use/disturbance: yes no

Structure size(ft) length: width: height:

Is there evidence of bat use on structure exterior (guano, staining) ? yes no

If yes, describe what and where: _____

If structure interior can be accessed safely:

Noticable airflow inside: yes no

Interior air temp vs outside: varies by sec/floor same warmer than outside cooler than outside

Are there inaccessible areas of the structure that could house bats (e.g., attics, ceiling spaces):

If yes, describe: _____

Is there evidence of bat roosting in structure interior (guano, staining, moth wings)?

If yes, describe what and where: _____

Can bat genus/species be determined?

Bat species present: _____

Take photographs of bats or evidence of bats (guano, staining).

(over)

If there is evidence of bats but no bats are observed, please check the building for night roosting after 11 PM. If there are parts of the structure that cannot be accessed for inspection, conduct an emergence count at sunset

Structure Assessment - Emergence Count



If an emergence survey is needed, it should begin 1/2 hour before sunset and continue for an hour or until it is too dark to see bats. Surveyors should position themselves outside so that emerging bats will be silhouetted against the sky. Do not conduct emergence count if temp is < 50F or if there is rain.

Temperature at start of count: _____
Emergence count starting time: _____
Time of sunset: _____
Emergence count ending time: _____
Number of bats leaving structure: _____
Can bat genus/species be determined? _____
Describe where bats exited structure: _____

Comments, notes:

Provide a diagram of the structure, where observers were placed for the emergence count, and location of any points of ingress/egress for bats. Please include a north arrow.



Bat Habitat Assessment Form

NCDOT Caves & Mines

Observers: _____

Date: _____

County: _____

TIP or DOT project number: _____

Road Name/SR Number: _____

Portal entrance number: _____

% Canopy closure at portal (approx):	0-25	26-50	51-75	76-100
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Opening type:	cave	quarry	shaft
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Opening height(ft): _____

Opening width(ft): _____

Length of portal opening(ft): _____

Internal height(ft): _____ Do not enter the portal to collect measurements if unsafe

Internal width(ft): _____

Slope up or down from entrance:	up	down
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Entrance stable:	yes	no
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Direction of airflow:	into cave	out from cave
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Amount of airflow:	heavy	slight	none
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Internal temp:	warmer than outside	cooler than outside	same
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Evidence of collapse:	yes	no
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Ceiling condition: _____

Depth of water internal opening(in.): _____

Any evidence of past flooding:	yes	no
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Miles to nearest water source: _____

Foraging signs (evidence of bats: moth wings- take pictures): _____

Any portals known to be connected? Which? _____

Any observed side passages?: _____

Bat species present: _____

Additional notes: