STATUS AND MANAGEMENT OF BATS ROOSTING IN BRIDGES IN FLORIDA

PROBLEM STATEMENT

At least 5 species of bats use highway bridges in Florida as roosting sites. Because many natural roosts such as caves and large hollow trees are rare, bridges serve as primary or common roosts for bats in some areas. Bats are an important component of Florida's environment, and knowledge of bat roosts in bridges would help the Florida Department of Transportation (FDOT) protect the bats while maintaining bridge functions and employee safety. Specific information on where bat roosts are located, the type of bridges preferred by bats, and guidelines for minimizing conflicts between bats and bridge inspection and maintenance crews would be useful to staff in FDOT districts.

OBJECTIVES

The primary objectives of this study included the following:

1. Determine the presence of bats in a sample of FDOT-maintained highway bridges, map known bridges used by roosting bats, and estimate the number of bridges with bat roosts in Florida in 2003.
2. Summarize the characteristics and design features of bat roost bridges, and correlate bridge features with presence of roosting bats.
3. Prepare guidelines for minimizing contact between FDOT employees and bats at bridge roosts, and suggest methods for FDOT employees to record presence of bats in bridges.
4. Identify bridges that are planned for replacement or repair in the FDOT 2025 plan, and describe ways that bat roosts in those bridges could be conserved.

FINDINGS AND CONCLUSIONS

To evaluate the use of highway bridges by roosting bats in Florida, researchers looked for evidence of bats at randomly and non-randomly selected bridges. The non-random sample included all bridges known to have supported a bat roost in the past, based upon existing information and reports from other bat biologists and FDOT staff. The random sample included bridges of five structural types that, based on previous observations, were most often used by roosting bats: (1) prestressed concrete multibeam, (2) prestressed concrete continuous multibeam, (3) prestressed concrete slab, (4) concrete T beam, and (5) steel multibeam. Researchers randomly selected 5% of the bridges of these types from each FDOT district and visited them concurrently with the non-randomly selected bridges, between February and October 2003. At each bridge, researchers noted any evidence of bats and, when possible, recorded the species and number of individuals.

Bats were observed in 5.4% of the 299 randomly selected bridges throughout the state. However, within each FDOT district, the number of bridges occupied by bats was not correlated with the number of bridges surveyed (Pearson correlation –0.04, P=0.920). Researchers found an additional 135 bridges occupied by bats during the non-random sampling when they visited historic or reported roosts and bridges incidental to the random searches. A total of 151 bridges, including both random and non-random samples, were occupied by roosting bats. Bat bridges occurred throughout the state, except in far south Florida and the Keys, and 83 (55.0%) of occupied bridges occurred in north Florida, i.e., Districts 2 and 3. Extrapolating from the random sample, it may be surmised that there are about 300 concrete bridges in Florida that support roosting bats. If that estimate is accurate, about half of the bat bridges have not been identified.

Researchers found 4 species of bats roosting in bridges but could not identify the species of bats present at 38 (25.2%) of the bridges. Free-tailed bats (*Tadarida brasiliensis*) were by far the most common species, both in number of bridges occupied (N=104) and estimated number of individuals. They occurred in bridges in all Districts except District 6 (i.e., Miami-Dade and Monroe Counties). The southeastern myotis (*Myotis austroriparius*) was observed roosting in 8 bridges in northwest Florida (District 3), big brown bats (*Eptesicus fuscus*) in 35 bridges in north Florida (Districts 2 and 3), and evening bats (*Nyteceius humeralis*) in 10 bridges in north and southwest Florida (Districts 1-3). In previous years, researchers have also found Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) roosting in Florida bridges, but that species was not recorded in this study. Most occupied bridges supported only 1 species of bat, but 35 bridges contained multiple species. Evening bats and southeastern myotis only occurred in bridges with other species.

Using FDOT bridge data, researchers compared all bridges occupied by bats with the randomly sampled unoccupied bridges and found a significant association between bridge structure type and the presence of bats ($\chi^2 = 31.86$, df = 3, $P < 0.001$). More bats than expected by chance roosted in prestressed concrete bridges with multiple beams. Researchers observed bats roosting only in concrete bridges or on the concrete components of steel bridges, but never on metal surfaces or in timber bridges. Bridges with bats were constructed before 1993 and were significantly older than bridges without bats (t test, $P< 0.001$). The mean year of construction for occupied bridges was 1969, while the mean for unoccupied bridges was 1977. Average daily vehicle traffic was significantly greater (t test, $P< 0.001$) across unoccupied bridges than across bridges with bats. Unoccupied bridges averaged 32,953 vehicles daily, while bridges with bats averaged 16,152 vehicles. Neither total length ($P = 0.079$) nor bridge height ($P = 0.870$) differed significantly between bridges with bats and those without.

The final report includes suggestions for providing roosts in new, repaired, or reconstructed bridges, and guidelines for ensuring employee safety and minimizing conflicts between bats and bridge inspection and maintenance crews. Forty-two bat bridges planned for improvement in the FDOT 2025 Cost Feasible Plan are identified so conservation of the roosts in these bridges may be considered in further FDOT planning.

BENEFITS

The database of bridges with bat roosts gives FDOT a current list of bridges, by district, where employees should be aware of bats when conducting inspection and maintenance activities. The developed safety guidelines should greatly reduce or eliminate the risk of disease or injury to persons working near bat bridges, and the management guidelines should help FDOT staff deal with any bat roosts that adversely impact staff duties. The information provided should help employees detect bats in other bridges and could be recorded in the FDOT bridge inspection database so that the list of bat bridges is kept current.

Transportation across bridges should not be affected by the presence of bats, but proper design and maintenance of bridges can significantly improve roosting opportunities for bats at relatively little cost. Incorporating conservation of bats and bat roosts is an added task for FDOT managers and planners, but protecting existing roosts during routine maintenance and inspection duties is not difficult, and designing roost sites into new or existing bridges is not expensive. The bat bridge data are now being used to identify bat bridges that are planned for improvement or replacement, and the guidelines provided should help FDOT staff manage and work around existing bat roosts. As protection and creation of bat roosts in bridges provide important benefits to bat populations at relatively little cost, these concepts should be strongly considered and widely applied by FDOT construction and design staff. Incorporating new roosts into bridge designs might serve as mitigation when existing bat bridges need to be replaced or improved. Creating bat roosts in bridges can also have substantial public relations benefits for FDOT, when properly advertised.

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