

Successes In Stewardship

Celebrating 10 Years

May 2012

Installing Turtle-Friendly Lighting on Florida's Coastal Roadways

Transportation agencies across the country strive to mitigate the impacts that transportation facilities have on the natural environment. In Florida, for example, roadway lighting can interfere with sea turtle nesting beaches, affecting the breeding success of sea turtles, which are listed as endangered under the Endangered Species Act (ESA). The Florida Department of Transportation (FDOT) considers wildlife impacts in the planning and design stage of roadway development and strongly supports projects, studies, and research to mitigate the impacts of artificial lighting on sea turtles. In 2001, FDOT implemented the Coastal Roadway Environmentally Sensitive Lighting Initiative, an effort that incorporates years of research to develop coastal roadway lighting designs that reduce or eliminate impacts to adjacent sea turtle nesting beaches. This ongoing initiative involves several projects that are described below. In 2011, the Federal Highway Administration (FHWA) identified the Coastal Roadway Environmentally Sensitive Lighting Initiative as an [Exemplary Ecosystem Initiative](#). FHWA granted the award to highlight the project's innovative approach to wildlife preservation and its use of cutting-edge science to achieve significant, high-quality results.



FDOT installed turtle-friendly, embedded lighting on State Road A1A (SR A1A) in a 2001 demonstration project. (Courtesy of FDOT)

Identifying Threats to the Sea Turtle Population

All sea turtle species are listed as either endangered or threatened under the ESA. Sea turtles are of great concern to Florida, as the State's coastline is a nesting ground for five sea turtle species that have a total annual nesting population of more than 200,000 turtles. Preserving the quality and integrity of the nesting beaches helps these marine animals recover their declining population.

Threats to the sea turtle population are widespread, including natural predators, marine pollution, poaching, disease, and climate change. Artificial lighting also poses a threat to sea turtles in the form of photopollution, which is the negative influence of stray, artificial lighting on the survival and reproductive activities of nocturnal organisms. Stray light from homes, businesses, and street lighting reaches the beach, sometimes deterring female turtles from nesting there. When female turtles do nest, artificial lighting also poses a threat to their hatchlings. Hatchlings emerge from nests at night and must

immediately crawl to the ocean, using light cues to find their way. Artificial lights sometimes disorient hatchlings, preventing them from reaching the ocean. FDOT states that, of the estimated 6.2 million hatchlings in Florida each year, about 1 million die from predation, dehydration, collisions with vehicles on roadways, or sun and heat exposure.

Addressing Light Impacts on Sea Turtles

Previous [FDOT roadway lighting standards](#) addressed motorist and pedestrian safety in the design of roadway lighting systems, but they did not fully consider adjacent environmental conditions. FDOT began the Coastal Roadway Environmentally Sensitive Lighting Initiative to integrate the ESA into the planning process rather than wait to address it later during the National Environmental Policy Act (NEPA) process. NEPA requires project sponsors using Federal funds to identify and mitigate impacts to listed species in compliance with the ESA.

FDOT set out to understand the impacts of street lighting on sea turtles. The Agency evaluated the severity of the lighting problems on all of Florida's coastal roadways where sea turtles nest by measuring the extent to which streetlight illumination reached the beach. FDOT mapped the results of this evaluation to determine where the impacts were greatest.

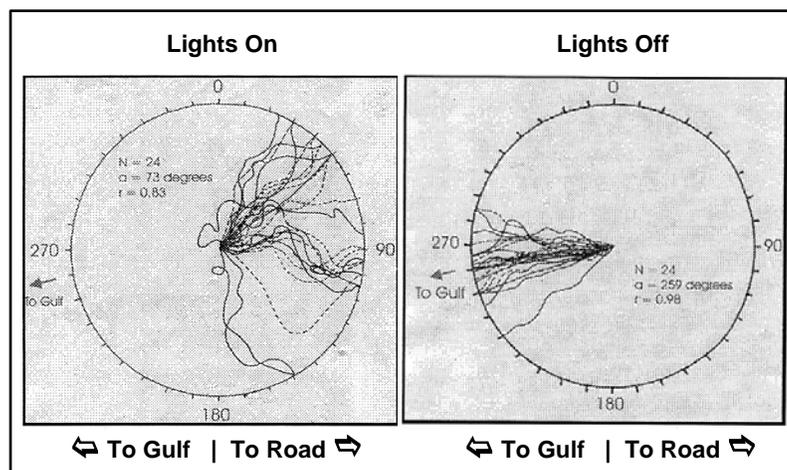
Near beaches with moderate to severe light impacts, FDOT experimented with various alternative lighting applications to determine how each would affect hatchling orientation. These lighting applications included filtering street lighting to exclude shorter wavelengths (turtles perceive and react to short wavelengths of light), decreasing wattage to reduce light output, reflecting light away from the beach by using shields, embedding lighting in the roadway, and turning off all street lighting. The experiments showed that exposure to filtered lighting did not deter female nesting turtles, but did disorient hatchlings. However, turtles exhibited normal behavior with the streetlights turned off and with the embedded lighting alternative.

Based on these results, FDOT sought to identify a lighting design that would provide safety for pedestrians and vehicular traffic without affecting sea turtle nesting areas. In 2001, FDOT undertook a demonstration project that turned off existing roadway lighting and installed embedded LED lights along State Road A1A (SR A1A) in Boca Raton. In addition to the embedded LED lighting, FDOT installed low lighting along the bike path adjacent to the road to improve safety for cyclists. The project spanned the entire nesting season of 2001.



Embedded roadway lighting provides adequate illumination for vehicles and pedestrians and does not affect nesting areas. (Courtesy of FDOT)

Florida Atlantic University (FAU) conducted a research study to determine the effects of the demonstration project's embedded LED lighting system in Boca Raton on sea turtle hatchlings. FAU's results indicated a 98 percent decrease in disoriented hatchlings on the adjacent beach. FDOT later funded a University of Florida study to compare the illumination levels of the new and old lighting systems, assess SR A1A roadway user opinions of the new lighting system, and analyze crash data before and after installation of the new lighting system. The study noted that travel lane and bicycle lane visibility increased with the new lighting. While sidewalk and crosswalk visibility decreased, it was within acceptable levels for the low pedestrian volumes experienced. Overall, the evaluation surveys indicated that roadway users were very supportive of the alternative lighting system for the benefit of sea turtle nesting safety. The crash data analysis did not identify any lighting-related safety problems for the demonstration project.



Diagrams of hatchling tracks in response to overhead lights on (left) and overhead lights off and embedded lights on (right) at Coquina Beach illustrate the effects of artificial lights on sea turtles. When the overhead lights are on, hatchling tracks lead toward the roadway, and when overhead lights are off, hatchling tracks lead toward the Gulf. (Courtesy of FDOT)

from reaching the neighboring beaches. FDOT's decision to replace the shield while retaining the existing foundation, electrical connection, and pole drastically reduced project costs. Preliminary nesting data indicate that sea turtle hatchling disorientations along Broward County beaches have been declining since 2006, likely due to FDOT's effort.

Sharing Best Practices

In 2010, FDOT developed two resources related to the Coastal Roadway Environmentally Sensitive Lighting Initiative. One of these resources is a lighting design guide that acquaints those unfamiliar with lighting design and engineering with the options available when planning in ecologically sensitive areas. The other resource is a technical standards manual that provides engineers with alternative lighting designs to consider for use on coastal roadways adjacent to sea turtle nesting

Based on the success of the 2001 demonstration project, FDOT installed embedded LED lighting along 1.5 miles of SR A1A in 2008. The Agency kept the existing streetlights along the corridor in place, but it turns them off during sea turtle nesting season. FDOT also posted signs along entrances to SR A1A, alerting the public about the light reduction program. This corridor contains the longest and largest use of LEDs on a roadway in the United States.

FDOT lighting strategies are not limited to embedded LEDs. In fact, FDOT led an effort in 2006 to prevent stray streetlight from reaching sea turtle nesting beaches in Broward County. The original cost estimate to upgrade the 24-mile system with turtle-friendly lighting was approximately \$20 million, well beyond the \$700,000 budget. The FDOT District 4 Lighting Team developed a cost-effective solution that reduced artificial light on adjacent beaches without requiring reconstruction. FDOT replaced the traditional cobra-head shield on streetlights with a flat shield, which more effectively blocks artificial light

beaches. These internal resources serve as references for FDOT District staff to address artificial light concerns. The work of the Coastal Roadway Environmentally Sensitive Lighting Initiative may be applicable not only for coastal roadways, but also for roadways near other ecologically sensitive areas. Addressing wildlife concerns in the planning process allows FDOT to more easily incorporate ESA issues in NEPA while better protecting ecosystems.

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Look What's New!

- FHWA recently launched the [Transportation Liaison Community of Practice](#) website, which is intended to help foster better understanding of the roles and benefits of Transportation Liaisons, as well as facilitate greater access to and sharing of expertise, resources, and opportunities for innovation and professional development. All visitors can view the calendar of events and learn more about the role of liaisons. Transportation liaisons and their managers can register on the website to gain access to a resource library with best practices, case studies, and sample documents and agreements, a list of subject matter experts, and other features coming soon.
- The U.S. Institute for Environmental Conflict Resolution is hosting the 2012 National Conference on Environmental Collaboration and Conflict Resolution (ECR2012): "Working Across Boundaries," to be held on May 22-24, 2012 in Tucson, Arizona. ECR2012 will include training workshops, plenary discussions, technology exhibits, panel sessions, and presentations across four diverse conference tracks. Visit the [ECR2012 website](#) for more information and to register.

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