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Safe lights—LED roadway markers protect a turtle nesting area from disorienting street lights.

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Overhead lighting, also part of the roadway's rehabilitation, is only turned on during the months when no sea turtle nesting occurs.

A mile-long stretch of Florida coastal highway is now lit by LED discs embedded in the roadway to protect endangered sea turtles during their eight-month nesting season on an adjacent beach. This is the longest and largest use of LEDs on a roadway in the United States and the first application based on the results of a lighting demonstration project that proved successful.

The plight of sea turtles has gained considerable public attention in recent years. All sea turtle species are either endangered or threatened, and Florida's coastline provides nesting to five species that have an annual nesting population of more than 200,000. Palm Beach County is one of the areas where loggerhead sea turtles nest.

The Florida Department of Transportation (FDOT) let a contract in 2003 to rehabilitate nearly 5 miles of highway SR A1A in Boca Raton, where overhead lighting did not meet current lighting standards. Approximately 1 mile of the road passes by a sea turtle nesting zone. As part of the roadway rehabilitation and repaving project, the design team's challenge was to come up with a lighting design that would provide safety for pedestrians and vehicular traffic without affecting nesting areas. The final design that met all of these objectives uses internally illuminated LED markers—a product that had been tested in a demonstration project—applied to a roadway resurfacing project.

Before approving the LED lighting approach, FDOT undertook a demonstration project in 2001 in which existing pole-mounted roadway lights were turned off and embedded roadway lighting was introduced to provide better delineation during sea turtle nesting season. This was in response to the need for FDOT to comply with the federal Endangered Species Act (ESA). Since many roadway improvement projects are paid for with federal highway funds, projects must meet the requirements of the National Environmental Policy Act. Complying with the ESA is one of the requirements.

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The demonstration project monitored three issues—accident data, road users' support, and effectiveness of preventing hatchling disorientation events that were occurring in the area when conventional streetlights were illuminated. The accident data analysis did not highlight any lighting-related safety problems. Respondents to the survey were supportive of efforts to minimize the impact of lighting on the sea turtles and their hatchlings. Disorientation events were reduced 100 percent when the embedded roadway lighting was used instead of conventional street lighting.

Thus, the use of LEDs on the 1-mile stretch of coastal roadway was approved. As a result of FDOT feedback, after considering preliminary safety data analyses, final project lighting specifications called for interspersed conventional reflectors with the innovative LED markers to address concerns about visibility during power outages. A solar alternative was researched but ultimately ruled out because of the lack of time-tested data and the concern that the technology would be more susceptible to vandalism.

The project was complex from a design standpoint because the project's length tested the limits of current LED technology, requiring extensive coordination with the manufacturer. After the paving contractor completed repaving, a subcontractor moved in to begin careful installation of the LED markers, power cable, and power supply. The LED markers are lighted through inductive power transfer between the cable, which is fully sealed in the road surface, and a receiver circuit in the marker.

The first step in the installation sequence includes saw cutting a slot into the roadway 3.0 inches to 3.5 inches deep. Next, a coring bit cores out a circular 5/16- to 3/8-inch hole in which the LED disks will rest. Both the slot and the round core are washed clean of debris. The cable is then placed in the slot. At each marker location (cored areas), the cable is split with special tools and each LED marker is placed over the prepared cable. The entire cable length is then sealed.

Overhead lighting was also part of the roadway's rehabilitation but is only turned on during the months when no sea turtle nesting occurs. Therefore, the reflectors delineate driving lanes during that time.

Project design was completed in June 2006, construction started in April 2007, and the project was completed in December 2007. Weekley Asphalt Paving, Inc., completed the resurfacing of the 4.8-mile stretch of roadway for $4.875 million and the LED lighting system was completed for $235,000.

As a follow-up to this project, FDOT hired Erdman Anthony & Associates, Inc., to develop alternative lighting design standards for all coastal roadways adjacent to sea turtle nesting areas. Preliminary recommendations include the following:

- reduce the required illumination levels from the existing 1.0 horizontal foot-candle (HFC) to as low as 0.7 HFC;
- restrict luminaire wattage to no more than 150 watts (W) in coastal roadways adjacent to sea turtle nesting beaches; and
- reduce existing mounting height restrictions of no less than 25 feet for 150-W luminaire to a maximum of 17.5 feet and even lower, depending on the proximity and difference in elevation of the roadway from the beach.

New technologies such as LED lighting are also recommended for inclusion on FDOT's qualified products list to encourage and facilitate increased use.

In the year that the LED-lit section of roadway in Boca Raton has been in operation, no problems have been identified by the city of Boca Raton, the maintaining agency. The public reaction continues to be supportive of the project.

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