

EVALUATION OF THE SAFETY AND USER RESPONSE TO EMBEDDED ROADWAY LIGHTING SYSTEMS ON AN FDOT DEMONSTRATION PROJECT

PROBLEM STATEMENT

Roadway lighting is used to accommodate the lighting needs of motorists, bicyclists, and pedestrians where the physical conditions and traffic characteristics indicate the need for additional lighting. However, roadway lighting can adversely affect sea turtle hatchlings. Sea turtles usually nest at night, and sea turtle hatchlings usually emerge from the nest at night. Nesting turtles can be easily distracted from nesting activities by artificial beachfront lighting. Sea turtle hatchlings use the natural light of the moon to guide their journey into the ocean; however, adjacent roadway lighting can disorient the hatchlings and “guide” them on an ill-fated journey to the roadway.

The current Florida Department of Transportation (FDOT) Roadway Lighting Standards provide for motorist and pedestrian safety, but they do not take into account biological conditions on adjacent property. Sound technical alternatives to traditional overhead roadway lighting need to be developed for use in locations where adjacent biological conditions are a concern. Additionally, current design standards need to be improved to include innovative lighting approaches.

OBJECTIVES

The FDOT initiated a demonstration project in which the existing roadway lighting system was replaced with embedded roadway lighting during the sea turtle nesting season (May-October). The purpose of this project was to determine if innovative lighting techniques could illuminate pavement markings without impacting sea turtles on adjacent beaches. An FDOT consultant contractor performed the design and installation of the embedded lighting systems. The project site consists of approximately 0.65 miles of SR A1A in Boca Raton, Florida. The limits of the SR A1A lighting demonstration project are from the north side of the City of Boca Raton’s Spanish River Park south entrance driveway to the south side of the entrance to the Sea Ranch condominiums. The existing roadway, which runs adjacent to the beach, has a typical section consisting of two undivided 12 foot travel lanes, a 5 foot paved shoulder, and an asphalt paved pedestrian path offset from the roadway. This scenic stretch of roadway is popular and receives significant vehicle, bicycle, and pedestrian traffic. Existing area lighting at the site was modified to eliminate a lighting hazard for the marine turtles. The modification involved deactivating the existing overhead street lighting, placing amber lenses on existing pedestrian pathway lights, and installing low bollard mounted luminaires along the pedestrian and bike ways. As a safety countermeasure, an embedded pavement lighting system was installed in the roadway.

The primary objectives of this research project were to assess the existing and new lighting systems in terms of lighting sufficiency and to determine public acceptance of this type of project. The primary tasks performed in support of these objectives included the following:

- measuring illumination levels and lighting distribution on the roadway and adjacent beach areas for the existing and alternative lighting systems
- obtaining and analyzing motorist, bicyclist, and pedestrian responses to a survey about the alternative lighting system
- analyzing past and present crash statistics for the affected roadway segments.

FINDINGS AND CONCLUSIONS

In general, area lighting levels and uniformity were reduced by the elimination of the overhead lighting. The remaining pedestrian area lights provided adequate illumination levels along the pedestrian pathway. However, with regard to security, the existence of non-illuminated areas adjacent to the pathway is problematic. The experience at the site did not indicate a security problem during the demonstration, and users generally felt comfortable with the lighting. A better long-term approach would include augmenting the existing pedestrian lighting with additional pathway lighting. Visibility in the travel lanes and in the bike lanes appears to have been adequate for the traffic conditions of the roadway. The embedded roadway lighting and the low bollard luminaires serve principally as delineation aids. It is possible that they might also contribute to the safety of the roadway; however, the short demonstration duration and limited accident data do not permit a statistical conclusion at this point.

Analysis of crash reports indicates that there is nothing unusual for this section of SR-A1A in terms of crash history (for all roadway users), particularly with respect to nighttime conditions. In general, there were very few nighttime crashes over the three-year period. Of course, the time period (six months) for crash data with the new lighting time was limited. Thus, it was recommended that the crash reports and statistics for this site should continue to be monitored closely for the next year.

The ordered probit models developed for this study indicate which demographic and socioeconomic factors were significant in explaining varying levels of support from certain types of individuals. Generally, researchers found that older persons were less supportive of the new lighting system than younger persons, and women were more supportive of the new system than men. Somewhat surprisingly, no mode specific factors (i.e., bicycle, pedestrian, motor vehicle) were found to be any more significant than the others in explaining opinion responses. Overall, roadway users were very supportive of this alternative lighting system for the benefit of sea turtle nesting safety.



Roadway Under Revised Lighting Configuration

BENEFITS

This project demonstrates the feasibility of utilizing alternative lighting systems, which, when properly designed, can satisfy current lighting design criteria and, at the same time, minimize potential lighting hazards to turtles. Hopefully, the success of this project will facilitate the implementation of innovative lighting approaches to accommodate wildlife needs. Much value can be achieved by developing a Practice Manual for Designing Roadway Lighting Systems in Environmentally Sensitive Areas. Such a manual would not necessarily offer new lighting criteria, but it would show a designer how to use alternative lighting products in a design. Indeed, it would be a valuable resource for Florida and for the nation.

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