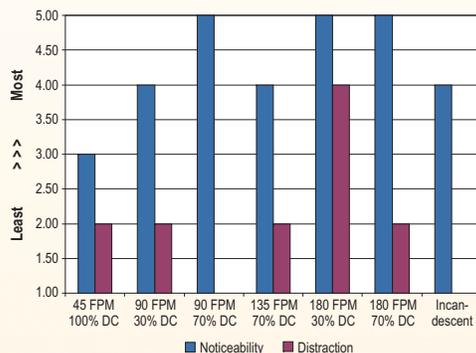


Optimizing Elevated Runway Guard Lights with LEDs

The Federal Aviation Administration (FAA) is seeking to reduce energy use, lower maintenance costs, and improve visibility through the effective use of LED technology on U.S. airfields. The FAA's current requirements for airfield lighting were intended for incandescent lamps, but inherent differences in the way LEDs operate require new research to determine the optimal use and design requirements for LED-based airfield lighting.

The LRC conducted a multiple-stage research project on the use of LEDs in elevated runway guard lights (ERGLs), which help pilots detect the presence of taxiway/runway intersections. The project was conducted to understand the influence and interaction of lighting parameters on the visibility of ERGLs to pilots. The research stages included a psychophysical laboratory study, a field study at a small county airport, and a second field study at a major U.S. airport.



Median noticeability and distraction ratings for selected flash rate (FPM) and duty cycle (DC) combinations tested at the Schenectady County Airport. The ERGL at 90 FPM and 70% DC showed the highest noticeability with minimum distraction at intensity values less than 30% of the incandescent base case.

Laboratory Study

In 2008, an LRC human factors laboratory study investigated many combinations of waveform, flash rate, duty cycle, and intensity using a scale model of a runway/taxiway intersection under different ambient lighting and visibility conditions, such as daytime, nighttime, clear and foggy conditions. The results showed that LED ERGLs could provide visibility equal to or better than incandescent models under certain operating combinations, but with only one-third the intensity of the incandescent ERGL.

Sponsor

Federal Aviation Administration (FAA/05-C-AT-RPI)



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Field Study: Small County Airport

In 2010, a small-scale field evaluation of LED-based ERGLs took place at Schenectady County Airport in Glensville, N.Y. This second stage of the research tested the most promising combinations found in the lab study in a full-scale field experiment at an actual runway-taxiway intersection. Under ideal circumstances, an



A subject is driven through the hold line while rating the LED ERGLs at the Schenectady County Airport.

ERGL should be readily noticed by a pilot but should not distract from the pilot's other duties. In the field experiment, subjects viewed the

LED ERGLs during clear visual conditions from a moving truck that simulated a moving small airplane, and rated each ERGL operating combination for its "noticeability" and "distraction." The field results confirmed the findings from the lab study. Subsequently, a manufacturer of airfield lighting systems built prototype ERGLs according to the LRC's specifications. These prototype ERGLs were used in the final research stage.

Field Study: Major U.S. Airport

In the final research stage, the FAA funded Embry-Riddle Aeronautical University to conduct a large-scale field evaluation to validate the LRC's lab and field findings. Embry-Riddle researchers used the prototype LED ERGLs to study pilots' perceptions during runway operations at a major airport in Florida. Pilots indicated a preference for the LED ERGL over the incandescent model. This field study further validated the results from the LRC laboratory study.

Conclusions

These results signify that a properly designed and built LED-based ERGL is as effective or better than current incandescent-based ERGL in alerting pilots. In addition, LED-based systems have the potential to be less expensive to use and maintain due to lower power demand and longer service life.

Lighting
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