

Passive Airport Lighting that needs no power, little maintenance

An inexpensive system of retroreflective identification markers has been developed for use at smaller airports and heliports in lieu of the traditional lighting systems.

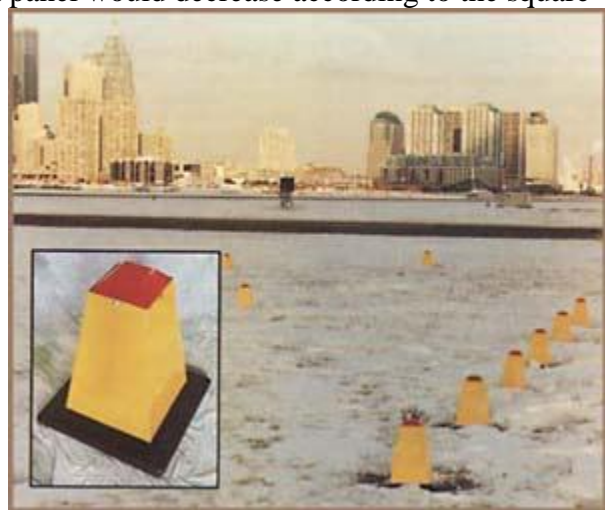


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Large airports are well supplied with effective and highly reliable powered lighting systems, but operators of the world's many smaller aerodromes have long wanted a runway lighting system that is inexpensive to acquire and operate, yet reliable and effective. Retroreflective runway and identification markers, made from a new material that reflects almost all the light falling on it in the direction from which it came, can meet the requirements of these smaller airports. A pilot on a landing approach can clearly see the runway markers because of the reflection of the aircraft's landing lights. Colour filter material installed on the markers provides colours to indicate runways, taxiways, etc. A typical heliport marker manufactured by Reginald Bennett International (RBI), is shown in the accompanying photograph.

The material used to make retroreflective markers employs tiny square-corner reflectors, miniature versions of the devices used to reflect radar signals from targets. These devices make use of the geometric principle that incoming rays entering a reflecting square corner from any angle are reflected in the direction of their source. Thousands of the minuscule reflectors are contained in every square centimetre of the material, enabling marker panels constructed of this substance to reflect almost all light that falls on them. The material has been approved by the U.S. Federal Aviation Administration (FAA) and the U.S. Coast Guard.

The marker panels reflect light with the efficiency of a mirror of the same apparent size, oriented to reflect light back to the emitter. No other reflective material is known to be as efficient at all angles of incidence. To make the panels reflect in any particular desired colour, a coating that absorbs light of all other colours is added. Neglecting such factors as absorption and dispersion in the atmosphere, the amount of light falling on a panel would decrease according to the square of the distance from the emitting lamp. Therefore one could expect to double the distance at which the panels are visible by increasing the lamp's output by a factor of four, or by doubling the size of the panel. In practice, these factors do limit visibility somewhat, but the markers are highly visible from a distance of two to four nautical miles under clear air conditions. Identification markers are manufactured with their sides sloped at the optimum angles to improve their visibility from the air. Runway markers have built-in angles to maximize reflected light within 10 degrees of the runway centreline. Helicopter approach markers are angled for steeper approaches than those flown by fixed-wing aircraft. One problem can arise when using the aircraft's landing lights as the only source of illumination: the beams from landing lights are



focused in such a way that scarcely any light falls on the markers unless they are situated within 20 degrees of the light beam. Pilots who are aware of this problem find that they can easily compensate by adjusting the aircraft's altitude to keep the markers in the beam, but a better solution might be to mount a less directional lamp on or near the nose of an aircraft used to fly to aerodromes equipped with such markers. The markers pose no danger to vehicles that wander off course and inadvertently strike them. Although they are built with sides of rigid aluminum for strength and stability, they are anchored to the ground with frangible couplings, or assembled with connectors which allow them to collapse when struck. Some models are weighed down with sand or gravel for ballast and pinned in place with four anchor pins. Others may be mounted on wooden posts or wooden couplers attached to steel stakes driven into the ground. Either method allows them to withstand winds of up to 150 kilometres per hour and still easily collapse if struck by a vehicle. The markers are unaffected by extremes of temperature. They are able to tolerate blowing sand, ice, snow, rain and salt spray. The only maintenance they require is an occasional wipe with a damp cloth to remove any deposits that may have settled on them from the atmosphere. RBI markers are optimized for night visibility, but they are also visible during daylight hours. To improve their daylight visibility in regions where the markers could become covered by snow, they may be topped with flags of fluorescent orange. These are attached to fibreglass rods which are fastened to the markers by stainless steel springs. To assist pilots to locate airports, RBI has developed an omnidirectional, solar-powered and radio-controlled strobe light system set for either sequential or simultaneous flashing. The strobe light system consists of three 2.8 million peak candle power strobe lights placed at 60 metre intervals on the centreline from the approach end used most often. The system has a visibility and actuation range in excess of eight nautical miles. To activate the system within range, the pilot simply clicks the microphone of the very high frequency (VHF) transmitter three times. The beacon will then continue to flash at about 60 flashes per minute for 15 minutes. The beacons will operate from -55 to 55 degrees Celsius and have a 34-hour operating capability before recharge. They can withstand humidity up to 100 per cent, winds up to 200 kilometres per hour and exposure to rain, snow and blowing sand. The Province of Ontario (Canada) Ministry of Health air ambulance programme has over 50 night landing sites in north-eastern Ontario. Many of these landing sites are located in remote, sparsely populated areas where usage is sporadic and projected lifetime of the site is not long. The majority of these landing sites use RBI retroreflective markers, in lieu of powered lighting systems, to define the heliports. The markers, according to the pilots who use them, provide a view that is the equal of what you would receive with an electrical heliport lighting system. In addition, the benefits of not having an on/off switch cannot be overstated. The helicopter operator for the ministry's north-eastern region reports that at one site, established in 1988 and averaging over 50 landings per year, the RBI markers have held up well in -40 degrees Celsius winter temperatures, with snow and freezing rain, as well as in 30 degrees Celsius summer temperatures. In this five-year period there has been no noticeable degradation of the reflective properties of the material.