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In-Pavement Lights and Winter Operations: Obstacles in the Runway?

Airfield snow removal is a science. To the untrained observer, it is simply a number of big trucks and flashing lights off in the distance. The snow flying out of a blower chute seen from a mile away on the ramp is an impressive sight as the observer compares the plume of snow in the air to what they saw that morning when they fired up their 10 HP Ariens to clear their driveways. Those of us in the business understand the critical nature of clearing the airfield. Each of these mammoth machines playing a unique part in a symphony that requires detailed choreography, skill and timing.

The science involved requires the snow boss to be part meteorologist and part airfield expert. He / she must be adept at handling sensory overload, as the radio request to the tower are made simultaneous to radio traffic from the snow equipment operators, the ringing cell phone and the steady background noise of the windshield wipers scaping across the windshield. It also helps to have a working crystal ball, that can generate accurate time predictions of how long it will take this "conga line" of equipment to clear this 2 mile by 150' surface, so the Tower can space the inbound aircraft correctly.

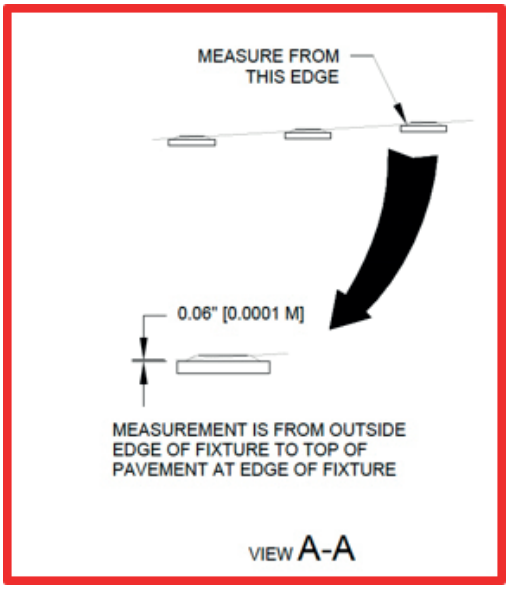
The operators of vehicles must each be extraordinary in their jobs. Some of these vehicles are plowing, running brooms and using high pressure air at the same time. The operators need to control the vehicle and manage all the implements during a high-speed run in a pack of 20 or more vehicles, without leaving formation while following the directions of the Snow Boss under the watchful eye of Air Traffic Control. A major snow event can go on for days and the snow crews need to keep up, getting the priority runways and taxi routes open and then clearing every space, light and sign on the airfield. This can be exhausting and stressful work. Neither the airlines or the passengers are very forgiving of delays that causes flight delays and cancellations. Least of which is the family that has planned their Disney vacation for a year, that might lose out on a day during school vacation.

Airport Facilities, Operations and Aviation planning are always working on perfecting their snow plan and having the right pieces of equipment in the fleet to do the job. One of the issues that occupies space in the plan is snow removal around lights and over in-pavement lights. This involves selecting the correct cutting edge, caster height and down pressure. Each of these issues are fairly easy choices to make. Traditionally, rubber or poly edges are used as they are more forgiving when scraping across in-pavement lights than steel or carbide. The down side to traditional rubber or poly is that they do not scrape as well as a harder cutting edge, they wear quickly and require technicians to remove the rubber or poly edge, flip it over and drive it down lower to make up for the portion that wore off.

In-pavement Lights

No matter what cutting edges you use, if the lights are not properly installed with respect to grade of the surface, the possibility of damage to the light housing exists. The installation specifications and tolerances are very specific and provided in detail by the FAA in Advisory Circular 150/5340-30J. Chapter 11, "Fixture Mounting Bases"

> *The lighting fixture must be level, and the top of the fixture edge must be between +0 inch and -1/16 inch from the pavement top; see Figure A-35 for application of tolerance on crowned pavement sections:*



AC 150/5340-30J, (Figure 35) provides detail for tolerances on crowned pavement.

This guidance illustrates the need for in pavement fixtures to be installed properly with respect to the elevation above grade. If the top of the fixture is mounted at +0 inch and – 1/16 inch from the pavement top, the lights are pretty well protected from damage by appropriate snow removal equipment. To further illustrate the importance, minimizing any obstruction on the pavement surface, AC 150/5345-46E provides more detail on the finish of any portion of the fixture that extends above grade. 3.10.1.2. Finish (b) requires that all edges above the pavement must be rounded to not less than 1/16 inch (1.59 mm) radius.

3.10.1.2. Finish.
All surfaces of the finished top assembly must be smooth, without burrs or sharp edges.

a) Any "O" ring grooves must have a surface finish of 64 micro-inches (μin.) (1.62 micro-meters (μm)) average roughness (R_a) per ANSI B46.1.

b) ***In addition, all edges that project above the pavement must be rounded to not less than 1/16-inch (1.59 mm) radius.***

c) *The surface on the light fixture that mates with the base flange must have a smooth finish to provide good load transfer and sealing.*

The proper installation of in-pavement lights will determine the frequency of damage, introduction of moisture to the fixture and photometric performance.

Load bearing In-pavement lights are defined in AC 150-5340-30J as any application which is subjected to aircraft and /or heavy vehicular loading, either static or dynamic: these are generally located on runway and taxiway roll-over areas. These lights are subject to an aircraft parking on them or being struck during touch down generating high impact loads. Locked wheel turns and eccentric braking loads tend to twist fixtures. The proper installation of in-pavement fixtures approved for load bearing locations is critical to the integrity and operation of the lights. Improper bolts, torque, improper surface preparation leaves these lights vulnerable to shifting or torqueing which could change the orientation of the light in the mount. In simple terms, after a heavy load that bent or broke a bolt, the light may ride up higher above grade.

Inspection of in-pavement lights should be conducted during the installation project, at completion and then periodically. There is a general procedure described in AC 150/5340-30J (12.1.1). The first step is:

Inspect each light fixture to determine that it is installed correctly, at the proper height, in line with the other fixtures, level, and properly oriented.

The light in the figure below is installed too high. Note the space between the level and the runway surface. This light installation will affect how much scraping it will tolerate before getting damaged. It is not uncommon to see a row of centerline lines that are each at a different elevation with respect to grade.

Proper mounting and installation of in pavement light fixtures reduces the opportunity for damage during snow removal. Simple tests can be conducted in the field to see just how high "flush or semi flush" mounted lights are installed

Semi-flush lights must have a $\frac{1}{16}$ minimum radius of curvature on exposed exterior surfaces and ½ maximum projection above runway pavement

Additional protection can be provided by installing Snow Plow Rings (SPR). These rings result in a very clean looking installation further protecting the light fixtures from damage.

If your runway lights are mounted too high, they must either be re-set to the proper height or you are limited to using brooms or cutting edges of rubber or poly. If in fact, your lights are properly installed you can use newer high-tech cutting edges that have ceramic disks embedded in hard rubber. These blades scrape much better than rubber or poly and do not require adjustment. Before using any new cutting edges, you should have already conducted an inspection of all in-pavement lights. Then each plow should be tested at slow speed to adjust the down pressure and set casters or shoes.

LED In-Pavement Light Fixtures

As described in AC 150/5200-30 D, Airport Winter Safety and Operations. 4.2.2.1 (3)

> *Regarding the use of displacement plows, ice and snow will always melt around runway centerline and touchdown zone light assemblies. However, under cold temperature and with LED fixtures, ice rings, termed "igloos," tend to form around them. In order to prevent damage to lights, use appropriate polyurethane cutting edges or shoes and casters on plow moldboards and on the front of rotary plows.*

The ice igloos described are the one negative associated with LED in-pavement lights in cold climates. Built up ice is harder to scrape than snow. Harder blades such as the rubber / ceramics will scrape better. If the in-pavement lights are mounted properly, these blades may be a good option for runways and taxiways with in-pavement lights.

About the Author

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