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LEDline® linear guidance lighting systems

LEDline®: For Improving Road Safety and Efficiencies;

To whom it May Concern,

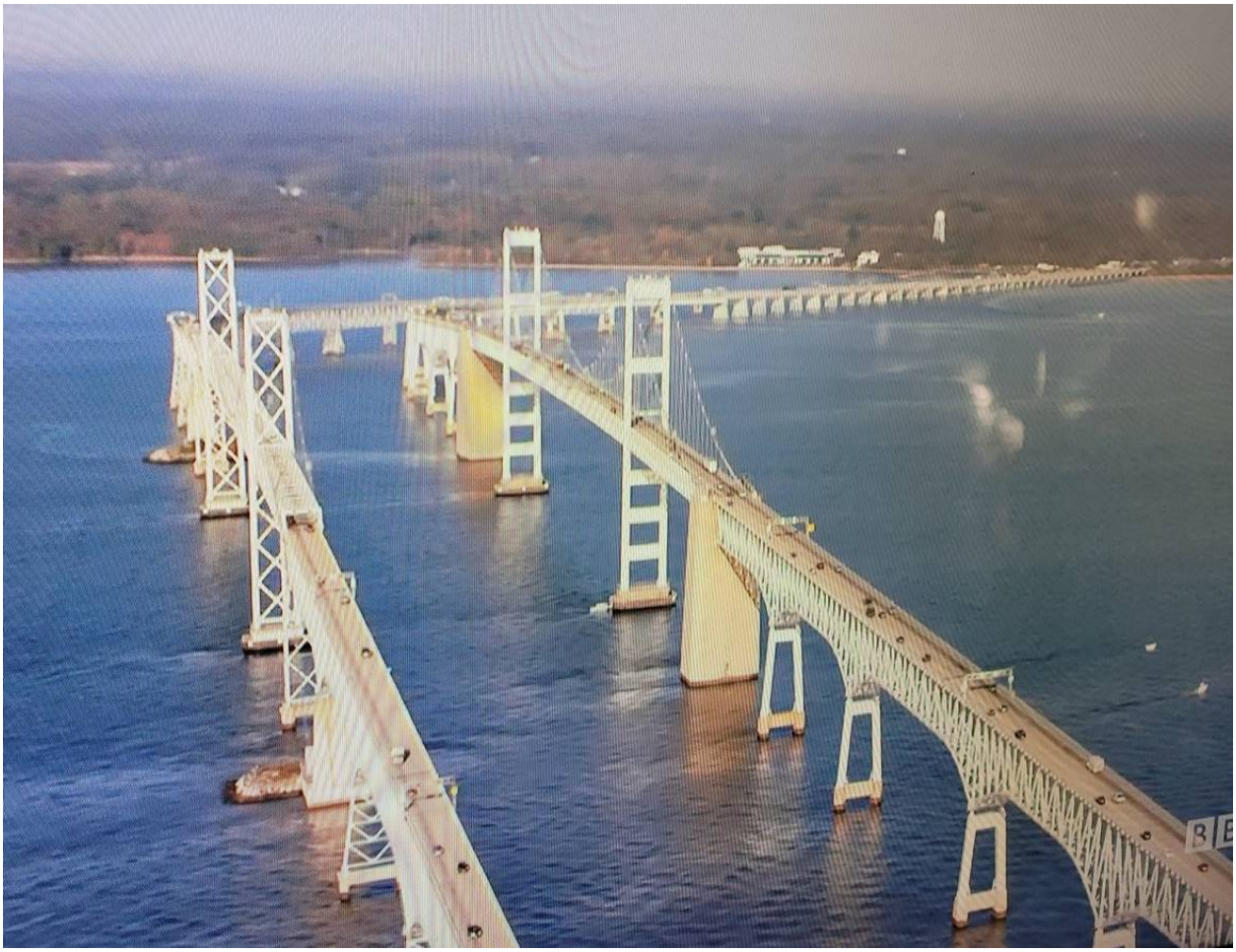
Please see the enclosed updated of the LEDline® road information for you and your road / traffic safety people, to help with innovations to reduce traffic congestion and improve road safety.

Do you have any projects to improve traffic safety and efficiency in areas where having smart roads will help reduce traffic congestion and improve road safety at;

- crosswalks, where one makes drivers aware of the crosswalk, but at night, one wants to also illuminate / highlight anyone on the crosswalk to show that it is in USE;
- wrong way onto freeways;
- extra wide or confusing intersections, where left turn traffic sometimes goes the wrong way on the left turn, especially in fog or other bad weather;
- have SPUIs where guidance is necessary;
- intersections where traffic runs the red lights and so one would want to make it even clearer that the red light was on by perhaps having the road change color with lights;
- highlighting pedestrian safety islands by lighting the raised pavement area and the crosswalk;
- separating different vehicle modes, trams, buses and others lanes, with different with different colored lane lines and nighttime lit lane lines;
- freeways hard shoulders during rush hour, when the hard shoulder use is allowed;
- or for other areas / circumstances, where one needs to increase road safety with lit road markings that are visible in any weather?

If so, please contact HIL-Tech, as we can help?

An Example of Smart Road use With Lit In-pavement LEDline®; the Maryland State Chesapeake Bay Bridge has two side by side bridges and freeways also on bridges leading to them and even with two separate bridges / freeway approaches etc., the traffic severely backs up.



Classic Contraflow Situation: To more immediately deal with the situation and without having to build another bridge or widen the present freeways, because of the huge differences in traffic volumes during the morning and evening rush hours, (east in the morning and west in the evening), Maryland intends to use the spare capacity of the lower volume bridge, to reduce the traffic congestion wait times.

The Maryland State Transportation Authority; Automated Lane Closure System: BB-3008-000 and BB-3014-000 Awarded Contracts: Shortly, Maryland

will be installing LEDline® on the freeway approaches on either side of the Chesapeake Bay Bridges, which is providing a key part for their "Automated Lane Closure System". This project is designed to reduce rush hour traffic congestion and traffic wait times by using the alternate bridges spare capacity. If anyone would like to see drawings, please contact me at nhutchins@cogeco.ca
Utilizing a lane of the other side's freeway / infrastructure when it has spare capacity with reduced usage, is a win/ win for all, as traffic will then be allowed to use a lane on the other sides bridge immediately increasing the whole road / bridges capacity.

In addition, **without having to build more infrastructure; more bridges and wider freeways to accommodate the ever-increasing traffic flows there, the expanded road capacity is achieved at minimal cost in an immediate fashion, compared to waiting for new bridges or roads to be built.**

By making the freeway lane that has approaching traffic and automating the LEDline® lane closure, Maryland should drastically reduce the costs of the morning and evening rush hour traffic congestion there with; less driver waits and lost time and less driver frustrations; there will be far less wasted gas, so better solutions for the environment; all without the costs of having to widening the freeways or building another bridge. Therefore, the LEDline® here is an efficient solution at reducing traffic congestion at low cost. There are many like traffic congestion situations approaching bridges and tunnels, which would benefit from such use to reduce traffic congestion everywhere!

Below are pictures of the two freeway approach roads to the two Chesapeake Bay Bridges. Copyright Aldridge Electric.

LEDline® can be used for a wide variety of safety and traffic improvements for roads by;

- helping to reduce accidents at sites, that, for one reason or another, seem to have a lot of repeat issues, so road markings need to be made crystal clear in all weather conditions;
- its use on pedestrian crosswalks is also helpful as it not only notifies approaching vehicles that someone wants to use the crosswalk, but at night, it highlights and floodlights / lights up any one within the crosswalk between the lights, helping to improve safety.
- use at complicated intersections when tied into traffic lights, to guide left lane traffic to the correct positions;
- being used in contraflow situations when, because the morning and evening rush hours traffic volumes being much greater in one direction compared to the other, by allowing opposing traffic to use parts of the other sides infrastructure to reduce the traffic congestion. Here, in-pavement guidance helps keep traffic apart, allowing the use of the other side infrastructure, minimizing the need for building additional, roads, bridges or tunnels;
- use in the road, at repeat high accident intersections, with lit in-pavement lights red changing with the traffic signals, red when there is a red light,

perhaps green when the green signal is on. This would be to make it clear when to go and help prevent drivers from driving through intersections when the red traffic signal is on;

- use at SPUI's (Single-point urban interchange) to guide traffic;
- being used to outline the hard shoulders on freeways when hard shoulder running is allowed during rush hours;
- being used on barriers for visibility, since the LEDs are bright enough to show in full sunlight and unlike reflective markers will show up even if covered with dirt or 153mm (6") of snow. (LEDline® melts snow).

Linear LEDline® LED in-pavement guidance lamps, are visible in any weather including full sunlight and are used for highlighting pavement markings such as toll lanes and /or barriers and are used at high accident sites to reduce accidents, by making the pavement and other markings visible in any weather. They can also be use to highlight pavement markings in automated rush hour tidal lane traffic controls when one wants to use the other side of the road's infrastructure, to reduce rush hour traffic congestion.

Please feel free to circulate this to any interested parties as LEDline® helps to improve road safety at repeat accident sites and can help reduce traffic congestion by indicating when alternate sides of the road's infrastructure or the hard shoulders of freeways can be used by traffic.

Note: The following has nothing to do with LEDline®, however, the enclosed is part of my efforts to bring to everyone's attention Global Warming and its many issues. Please feel free to use the following in your e-mails.

Warning of Global Warming: I hope the enclosed is of interest, particularly since Global Warming is forcing everyone to rethink energy efficiencies to reduce one's carbon footprint. **All projects need to be evaluated as to their effect on Global Warming. Those that add to Global warming need to be rethought and other solutions proposed.**

FYI: The enclosed is from the BBC (May 2019) "**Rise in global sea levels could have 'profound consequences'**" - https://www.bbc.co.uk/news/science-environment-48337629

"For 2100, the ice sheet contribution is very likely in the range of 7cm - 178cm, but once you add in glaciers and ice caps outside the ice sheets and thermal expansion of the seas, you tip well over two metres," This possibility is potentially just 81 years away!!!

(**NOTE:** Theoretically, provided one lives a long time, one is likely to experience at least one 100-year storm in one's lifetime. Recently, in Chicago, they have had four in the last few years, so statistically, Global Warming shouldn't be taken lightly!)

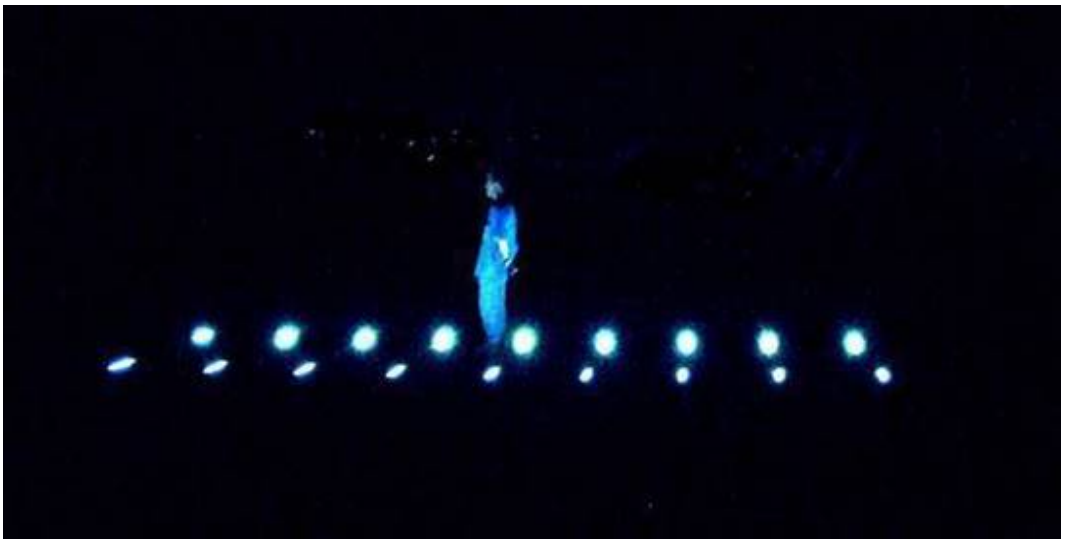
(**Note: Canada and the Artic is warming up twice as fast as the rest of the world and recently, the United Nations and others now estimate that we have only some 20 years to come up with solutions to prevent the average world temperature rising by more than 1.5ºC (2.7°F), and thus causing major climate issues**).

It is the world's engineers who can act, do the most and respond quickest, therefore, please reconsider everything that does not help to bring down Global Warming.

The FHWA has approved LEDline® for use on FHWA roads as Raised Pavement Markings as per their MUTCD.

Some Third-Party Tests:

- **Sea Water Depth Tests:** Early LEDline® has and is being used for the escape chamber lighting for submarines. The Canadian Navy has now tested examples of earlier LEDline® units through thousands of high-pressure cycles at seawater depths of 1000ft (300m), therefore, LEDline® is submersible.
- **Early Product FHWA Crosswalk Tests:** Virginia Tech. studied early 6 x embedded LED lamps for highlighting people at night on crosswalks. Pictures and video Copyright Dr. R. Gibbons of Virginia Tech.. Todays lamps are much brighter as each of the LEDs are now far brighter and there are now 12 x embedded LEDs not six as before.



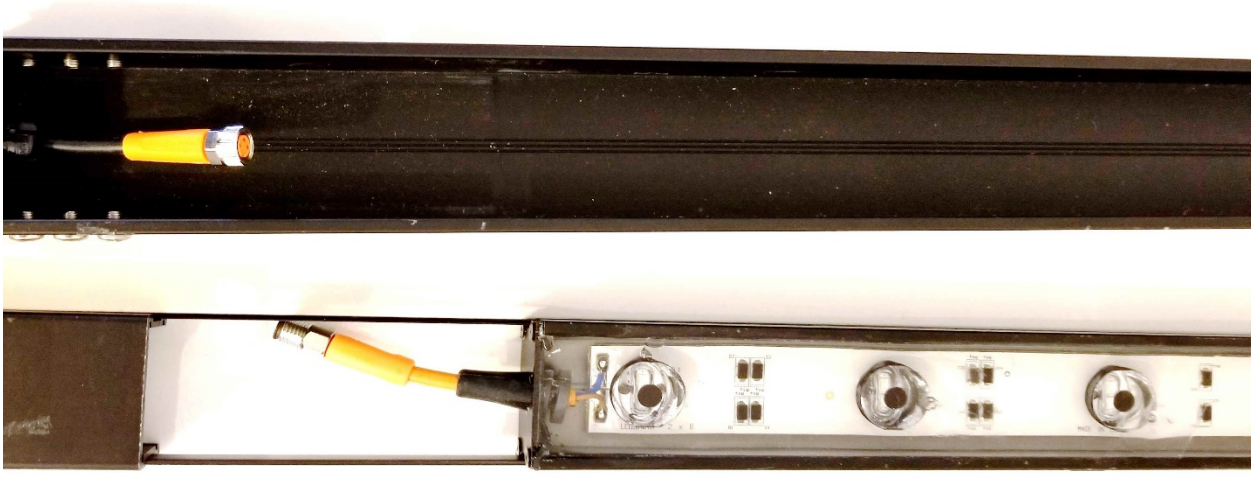
- FHWA Early Toughness Test on Older Style Product: After direct loading of some 88,000 lbs. onto the lamp, with no effect, (as below) the LEDline® lamp was then suspended across two steel mounts. A directed force of some 1059 lbs. was then put onto the middle of a lamp, (not the lamp with its road Mounting Plate), and the test lab then bent the lamp some 75mm (3”) out of true. Despite this, the solid clear material was not cracked and the lamp continued to function normally.

HIL-Tech:
HIL-Tech is a Canadian company that designs and produces the in-pavement lights in Ontario, therefore, the lamps have been designed for Canadian / North American winter conditions. They are highly visible in all weathers (sunlight to snow whiteouts) and are completely snow ploughable since they are flush with the road surface, so don't oppose snow ploughs.

In addition, unlike other LED lamps (LED, FAA Taxiway and other LED lamps), LEDline®, provided they are lit, will melt snow without requiring any additional heating elements. Early trials with 6 c embedded LEDs demonstrate that LEDline® will melt holes in snow of some +7" (178mm) or deeper. As such, LEDline® will show up in any weather conditions, helping to improve road safety.

LEDline® is Tough: The LEDS and electronic circuits within the lamp are buried in a tough, clear, UV and weather resistant matric. The LEDline® itself has non-contact power pick up connections via its solid, submersible induction connectors from its induction powered distribution line, so is induction (non-contact) powered and not hard wired into the pavement.

In addition, the surface lamp quick disconnects, which allow maintenance, is a screw together IP69 fitting, the highest rated electrical IP connector available, other than deep sea high pressure electrical connectors, so everything is tough and submersible.

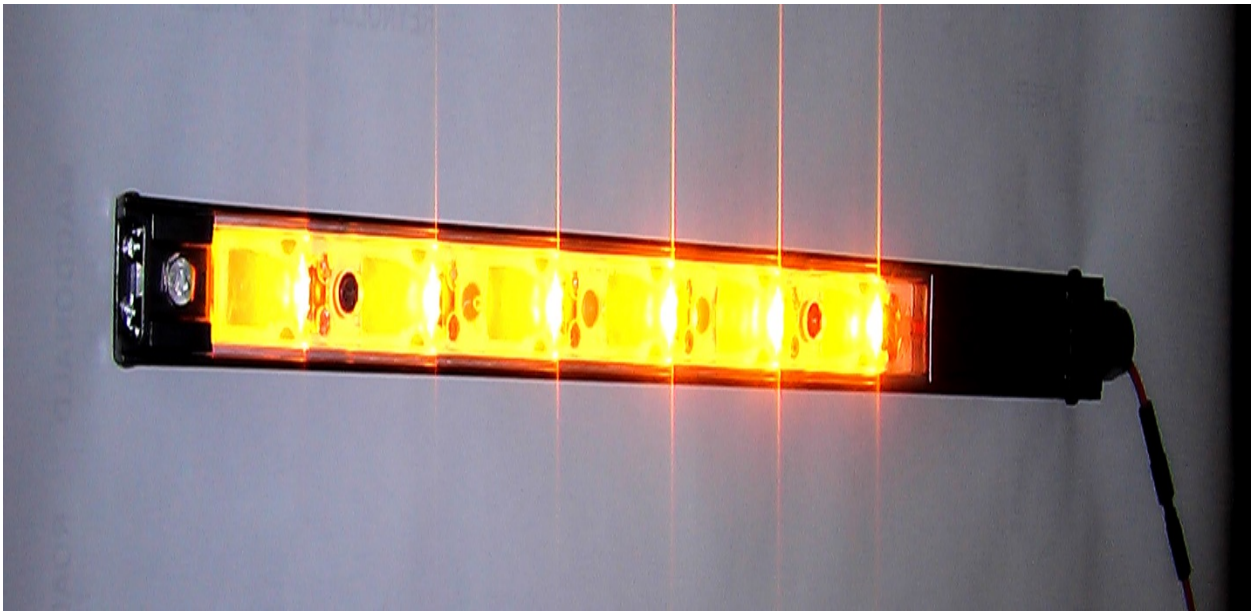


An Unusual Test for any Lighting System: In HIL-Tech's recent test, a 10 Ton (20,000lbs.) Roller Traveling Over a surface Laid LEDline® Unit: It Survived and Continued to Work! **Not many other lamps could do this.**

LEDline® Solid; Linear; LED Guidance System, Video of Roller Test:

YouTube Video: obD5BSAdK38

Typical LEDline® Unit Inside its In-pavement Mounting Plate.



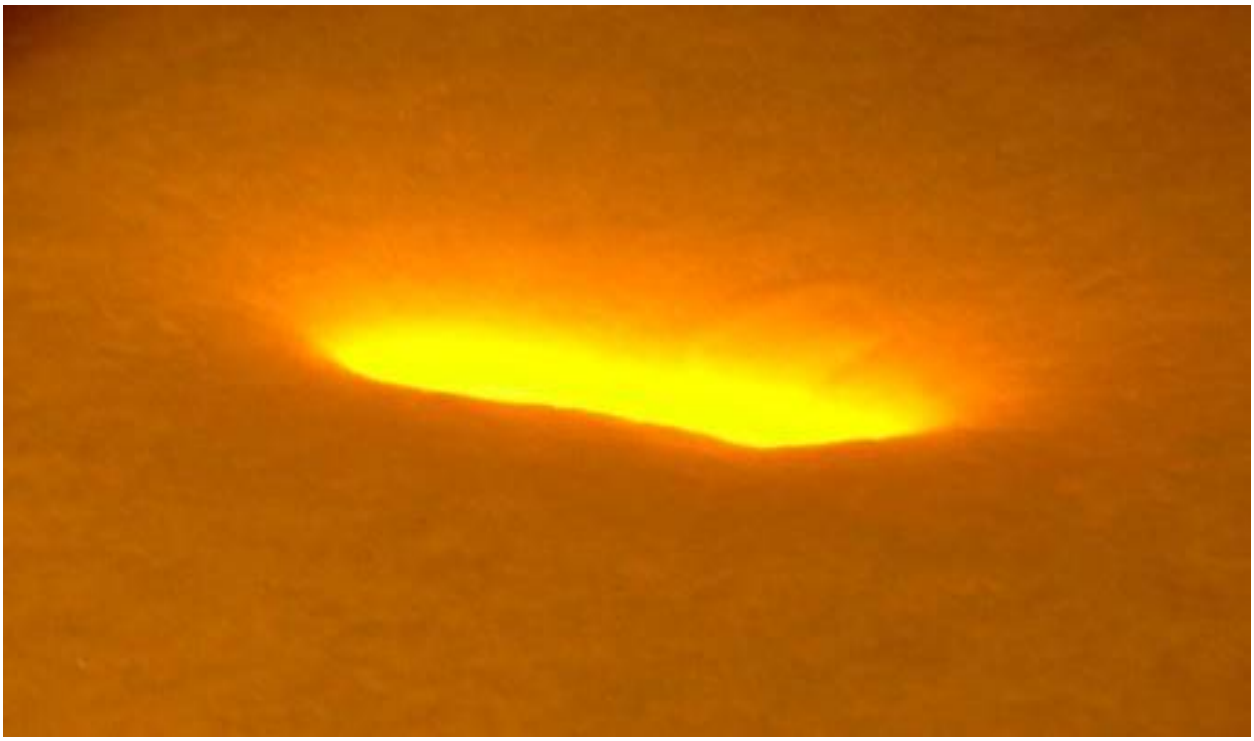
Usage on Roads: Highly visible in all weathers, (melts snow) LEDline® might be helpful in reducing accidents and is used for;

- for highlighting pedestrian crossings, especially at night, highlighting and lighting up anyone using the crosswalk;
- highlighting in-road pedestrian safety islands and barrier markings in any weather,
- potentially reducing accidents at road sites that, for one reason or another, seem to have a lot of repeat issues;
- highlighting traffic contraflow situations in rush hours, without having to build more infrastructure, where because of the imbalance of the morning and evening rush hour traffic flows, there is the need for temporary use of the other side of the road, bridge or tunnel's more empty lanes, lane to help alleviate the rush hour traffic gridlock;
- providing additional safety notices for wrong way issues, wrong way access to freeways or wrong way driving on roads, where lit in-pavement directional arrows, can inform drivers as to the direction of travel;
- roundabouts, to indicate the direction of traffic;
- for in-pavement signage, merge arrows, or road / lane numbers etc.,

- difficult / complicated traffic intersections, where the in-pavement lights are controlled by the traffic signals, providing a lit green guidance line for traffic to follow in left turn situations,
- slowing vehicles at high-speed corners, intersections or freeway exits, by having lit guidance lanes draw attention to the speed of the vehicle, perhaps by creating movement, pulsing or sequencing towards the driver etc.;
- helping autonomous vehicle guidance, particularly since it survives in in-pavement applications and the LEDs **melt snow without needing any additional heating elements**, something other LED lamps cannot claim.

Do you have any high accident areas, where potentially we could help reduce the number of accidents, if so, this would be a good place to use / demonstrate this technology?

LEDline® being Gang Snow Ploughed (Picture taken from video at www.ledline.net)



Per the MUTCD, LEDline® being used to separate traffic.

In-pavement LEDline® Sign and right turn arrow.

When a tunnel is blocked in the Bjørvika Tunnel Oslo, LEDline® is used as ceiling sequencing tunnel guidance for traffic. Video at www.ledline.net

Demonstrating LEDline®'s Visibility: Right side, are 2007 style yellow LEDline®, (only 6 x embedded LEDs) being used as an airfield lit gate lead in Left, are standard green, FAA / ICAO (incandescent bulbed, which has more heat than light) FAA Taxiway Lights. Both visible in the same snow / weather conditions. (**Note:** Like these green incandescent taxiway lights, **LEDline® melts Snow without Any Additional Heating Elements)**.

Lit since being installed, Sept. 2009, picture below Jan. 2010, (it has never been turned off), LEDline® at Vancouver International's De-icing Pads.

Comparing LEDline®, to Standard Airfield In-pavement Lights:
LEDline® is much less expensive to buy and is far, far less expensive to install. Indeed, as a generalized truism**; LEDline® is able to be installed in days what normally takes weeks with standard FAA – ICAO airfield in-set lights**.

HIL-Tech has seen a contractor, unfamiliar with LEDline®, with a single saw cut machine and 5 people, install in asphalt some 230 x LEDline® units, their power distribution wire, and power control system, all in about 5 days. (**Note:** since any epoxy glue's curing times can be affected by bad weather / rain / low temperatures etc., this factor might also impact a quote depending on the time of year one is contemplating installing the LEDline®). Had these 230 lamps have been the standard airfield series circuit lights, then what would have been required would be;

- Developing new protocols for the various installation / construction crews and training the air traffic controllers on new procedures to avoid the construction area;
- Cordoning off the area to aircraft to prevent any accidents;
- Selecting an area where the major equipment can be safely left when not in use;
- Bringing in the major trenching equipment to dig up the area;
- Digging the series circuit trench and installing all the series circuit wiring (1.5m (59”) deep);
- Installing 230 steel cans (each being some 330mm (13”) diameter and needing to be installed some 475mm (18” deep));
- Installing the 230 x lights;
- Installing the CCR power supply and its controls etc.;
- And then connecting everything; weather and schedule permitting.

Such an installation would have taken major digging and other equipment many months, not the 5 days the 230 x LEDline® units took. In addition, all the machinery to do the job, being major construction equipment, would have had to be left on site when the workers left, causing major operational, and safety headaches for the airport’s administration.

Benefits of Using LEDline®: Compared to standard airfield inset lights, which need heavy trenching and boring equipment to dig the approx. 0.5m - 1m (19” - 3.28 ft.) depth needed for the series circuit and the 330 mm (13”) diameter, x 460mm (18") hole depth needed for the steel in-pavement lighting cans, a 45mm (1.8”) deep x 60 mm (2.4”) wide groove is nothing! As such, the LEDline® is far less cost and far, far quicker to install as it is essentially a surface installation.

- The equipment used for LEDline®’s® installation is minimal, (a saw cut machine), since the LEDline® only needs to be installed within a small groove in the surface of the pavement. (Note: The concrete slab or asphalt is saw-cut or routed out along the line where the LEDline® is to be installed. No LEDline® unit should ever span across any expansion joint. At every expansion joint where the power line wire crosses, there needs to be a

standard expansion loop of wire to cope with any differential slab / ground movement).

- Because LEDline® is installed in such a shallow groove that does not penetrate through to or beneath the pavement, LEDline® installations do not cause water and freeze thaw issues underneath the pavement, weakening the pavement structure.

- Given the minimal time and minimal needed equipment for its installation, LEDline® installations will be much safer during the construction period, since the equipment can easily be removed at the end of a work shift, so will be far less lightly to cause any runway incursions or aircraft accidents. With series circuit construction, because of the required substantial major digging equipment, such equipment is often left on site on the airfield until it is no longer required. This means that pilots / aircraft have to be notified of such equipment hazard, as it poses significant risks for aircraft accidents. This aspect is hugely important for airfield operations, since LEDline® installation is so much quicker, safer and far, far less intrusive to airfield operations!

Developing an Installed LEDline® Quote: Based on the following guidelines, any contactor should be able to easily work out a price to install LEDline® on any road or airfield. All they need to know is;

- the project location and size (the amount of saw cuts needed for the LEDline® and its power line wire);

- the cost of use / rental of a suitable operator, saw cut machine and the two sizes of standard blades, one 12mm (0.5”) wide and the other with a spacer, 60mm (2.4”) wide (if they do not already have them;

- dependent on the size of the project, the cost of 5 or more workers to cut the grooves and install the product;

- the time it will take to install the product, including wiring up the power supply to mains or some other power and having the two-part epoxy style glue holding the Mounting Plates into the cut grooves, set. (Note: On slopes. we recommend a two-part epoxy style glue that is NOT self leveling, but stays where it is put, this way a cartridge is used so the hardener and filler are properly portioned out and the glue does not run out. It also makes less mess and installation is easier;

- everyone should understand that LEDline® uses non-contact induction power pick up connectors (they are not hard wired) to power each LEDline® unit from the low powered induction series circuit, so that they do not need to be hard wired. All that is required is for the required number of induction power pick up connectors to be slid onto the direct burial cable, which makes installation very easy and fast, so its installation time will be very fast and cost much lower than traditional series circuit inset lights);
- where the Master Controller and its 1 - 6 Power Modules (the LEDline® power supply) will be located;
- the amount and cost of the direct burial wire they will be using;
- the amount and cost of the needed epoxy (remains where it is put) style glue that they are to use;
- and the cost of the LEDline® components.

Since LEDline® costs so much less to purchase and is far, far easier, and much quicker and far less cost to install than new infrastructure bridges; widening roads to create extra lanes; or building new ones, is there was a project where we could, (on a no obligation basis), provide you costs for our lit guidance? Such a quote would illustrate to everyone the major cost savings available, if LEDline® was used?

If you have any questions, or if there are some issues that are not clear, please do not hesitate to contact me.

Stay safe, stay well!!

Nick
N. D. Hutchins
Director