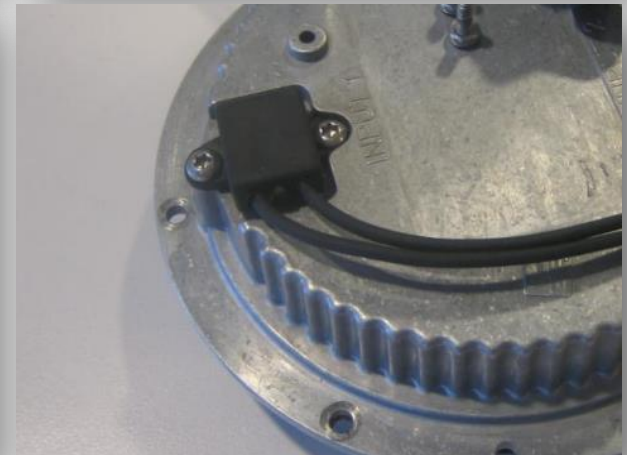


How to increase the lifetime of AGL Assets

Roland Maes - Account Management

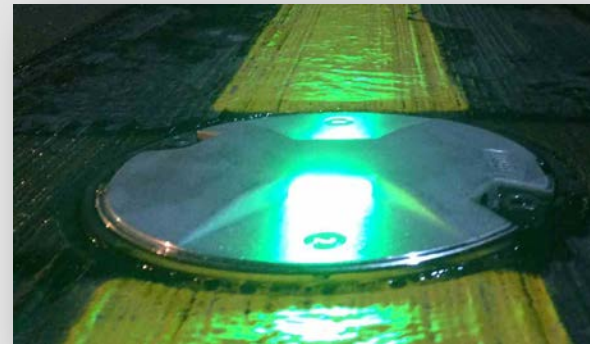
Three main elements that impact the quality and longevity of all AGL Assets.

1 Design



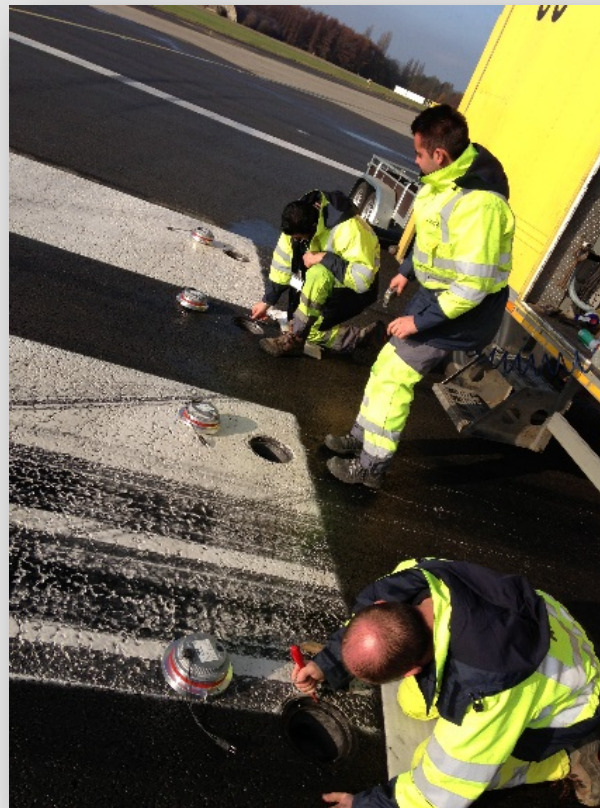
Three main elements that impact the quality and longevity of all AGL Assets.

2 Installation



Three main elements that impact the quality and longevity of all AGL Assets.

3 Maintenance



Main causes for unservicability

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Lights with halogen lamps: Most of the maintenance operations are the result of a lamp breakage

Other maintenance operations are much less frequent and can often be carried out during lamp replacement:

- Dirty or scratched prisms
- Small leakages
- Minor mechanical damages

LEDs are the solution to strongly reduce the maintenance costs (by more than 90%)

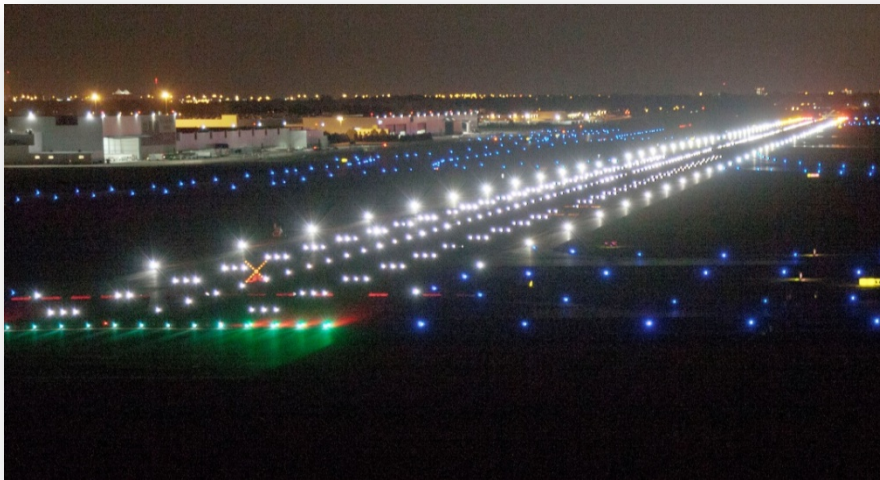
But the other causes for degradation remain and must be cared for

Why maintenance remains key even with the fast transition to LED.

LED means less maintenance but not no maintenance:

- Degradation of the photometry
- Mechanical degradation
- Impact of lightning
- Electrical breakdowns

To get this:



Degradation of the photometry

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The rule:

Annexe 14, Para. 10.4

Limits the number of unserviceable lights

Specifically:

10.4.1 A light shall be deemed to be unserviceable when the main beam average intensity is less than 50 per cent of the value specified in the appropriate figure in Appendix 2.

How to know?

By regular photometric measurements

Key causes of degradation:

- Rubber and dirt deposits
- Wear of the prisms



The decrease in performance of the LEDs over time is negligible!

How to keep lights serviceable? Important design criteria

Avoid the reduction of the photometric performances:
The light must remain serviceable at all times!

A few criteria:

Design

Well protected prisms,
deep in a narrow optical channel



Sapphire coating reduces
scratches on prisms...

Strongly !!!

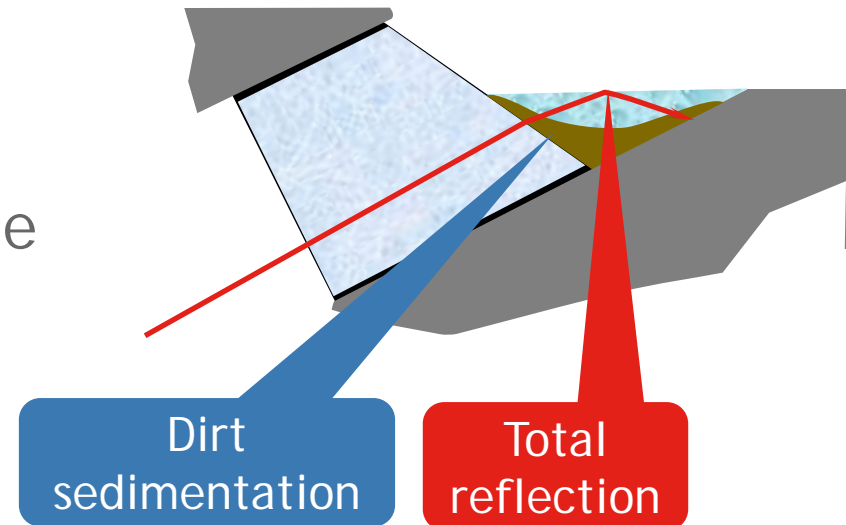
(result of sand blasting test)

How to keep lights serviceable? Important design criteria

Design

No part of the prism below ground level

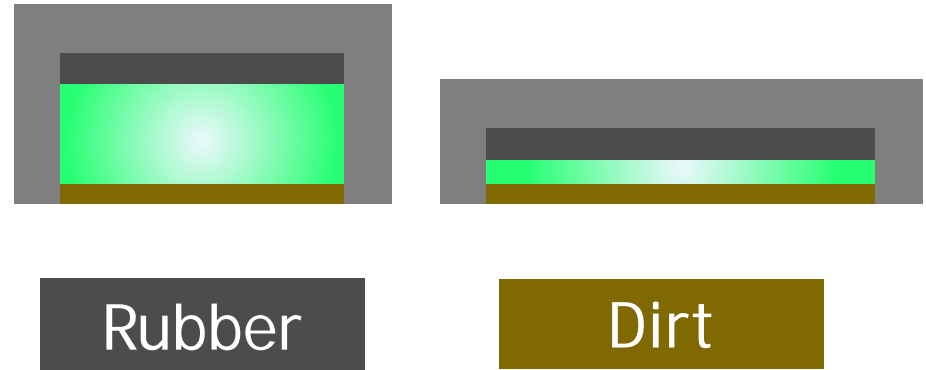
A serviceable light might become unserviceable under heavy rain!



... and remain unserviceable when
the water evaporates!

Low protrusion lights?

- Yes because they reduce damages by snow ploughs, push-backs,



... but ...

- No because the prism gets quicker dirty

Hence: customers' choice, depending on local conditions

Could even be a mix:

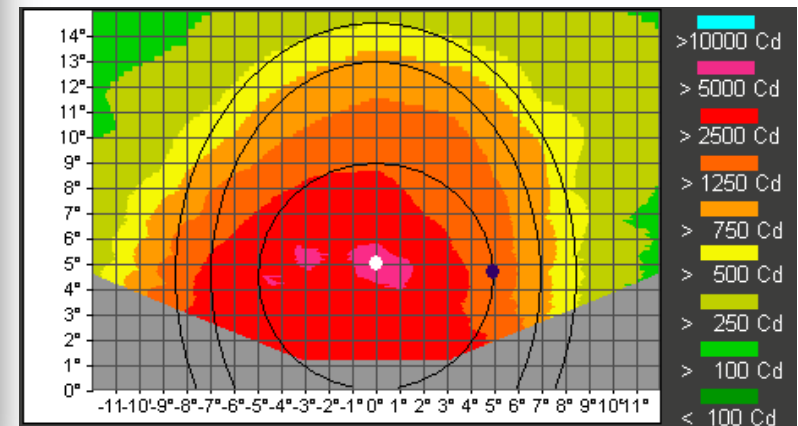
- Low on the apron
- Normal elsewhere

How to keep lights serviceable? But also...



...a bit of cleaning
does not hurt...

- Especially when photometric output is deteriorating, maintenance should be increased
- In-field photometric testing allows to foresee and to cure



Mechanical degradation

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Mechanical degradation

Causes and consequences

Causes

- Violent shocks: push-backs, heavy trucks during refurbishment works, snow plows,....
- Constant vibrations

And further accelerated by

- Bad installation
 - Badly installed (vertically or horizontally) or badly glued base
 - Base or ring of bad quality or wrong dimensions
 - Presence of gravel between base and light
- Wrong maintenance
 - Use of aggressive products that impact the aluminum, gaskets ,...
 - Wrong torqueing or loosening of the tightening screws

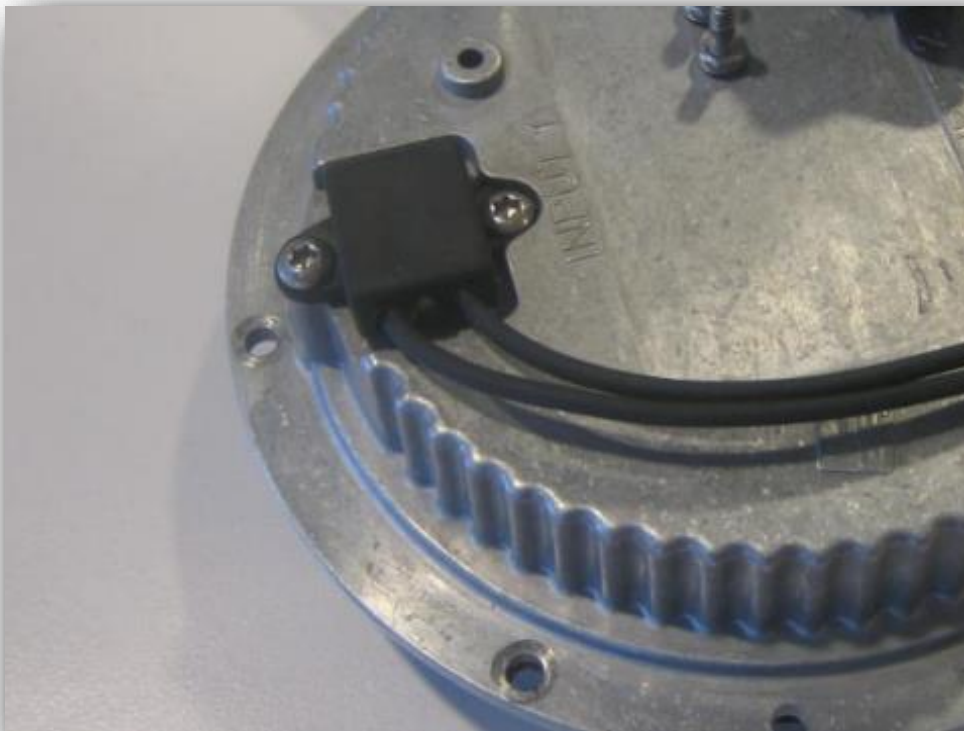
Consequences

- Destruction of the cover
- Broken prisms
- Water penetration
- Components failures



How to keep lights serviceable?

An example, how design matches serviceability at ADB



Outstanding protection

- Small, well protected prism
- Second watertight compartment with LEDs, electronics, cables and connectors
- Watertight cable entry

How to keep lights serviceable?

An example, how design matches serviceability at ADB

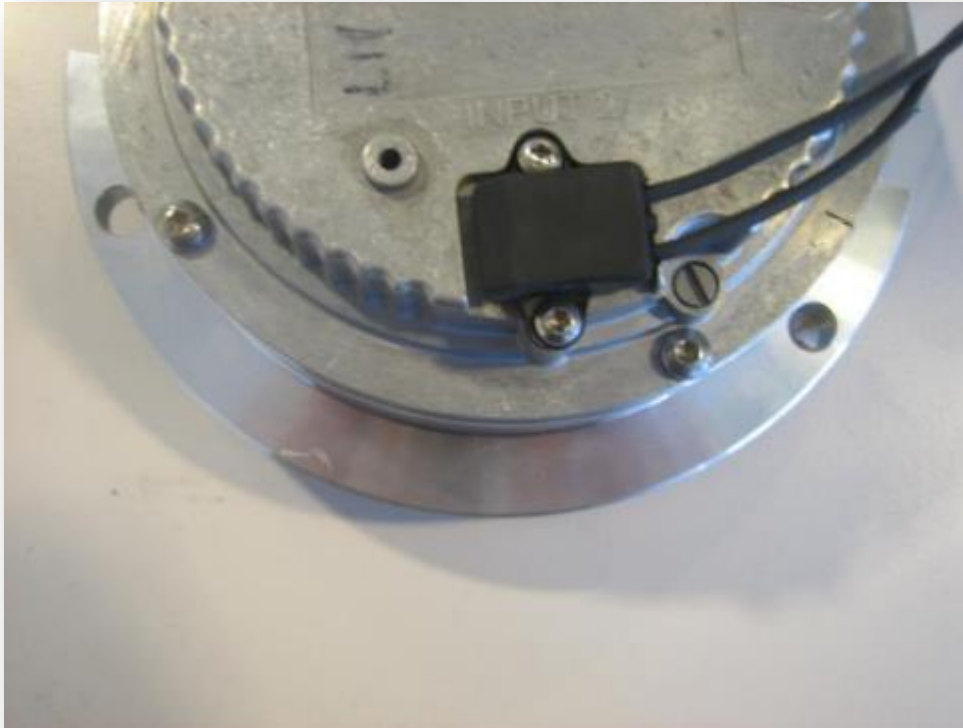


Easy maintenance

- Replaceable leads - without opening the light
- Easily replaceable prisms thanks to shape and...
- ...Torx screws

How to keep lights serviceable?

An example, how design matches serviceability at ADB



And more...

- Tangential cable input
- Re-design of electronics for better reliability in adverse conditions

One principle: avoid increasing shocks and vibrations

Do not install too high

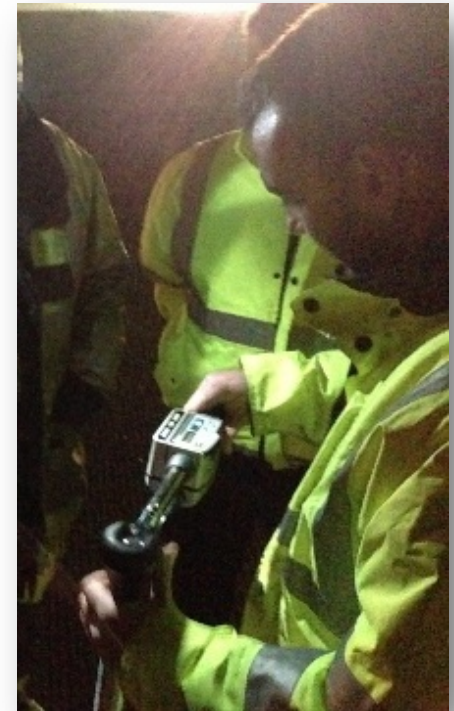


Clean the supporting flange from gravel, sand or dirt before installing the light

Make sure the base is correctly glued



Make sure the
specified tightening
torque is applied



Tips

Lights and bases are designed as an assembly, with optimum tolerances that reduce the effect of external shocks and vibrations, so:

- **Avoid mixing products from different sources**
The labyrinth gasket ensures horizontal shock absorption:
- **Always use the gasket, even on drained bases**
Due to the reliability of the LEDs, the maintenance intervals have a tendency to become longer but...
- **Verify regularly the torqueing and the bolt fixation**

Impact of lightning

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The Impact of Lightning

What?

Phenomenon difficult to control on a horizontal system

Solutions are never fully guaranteed

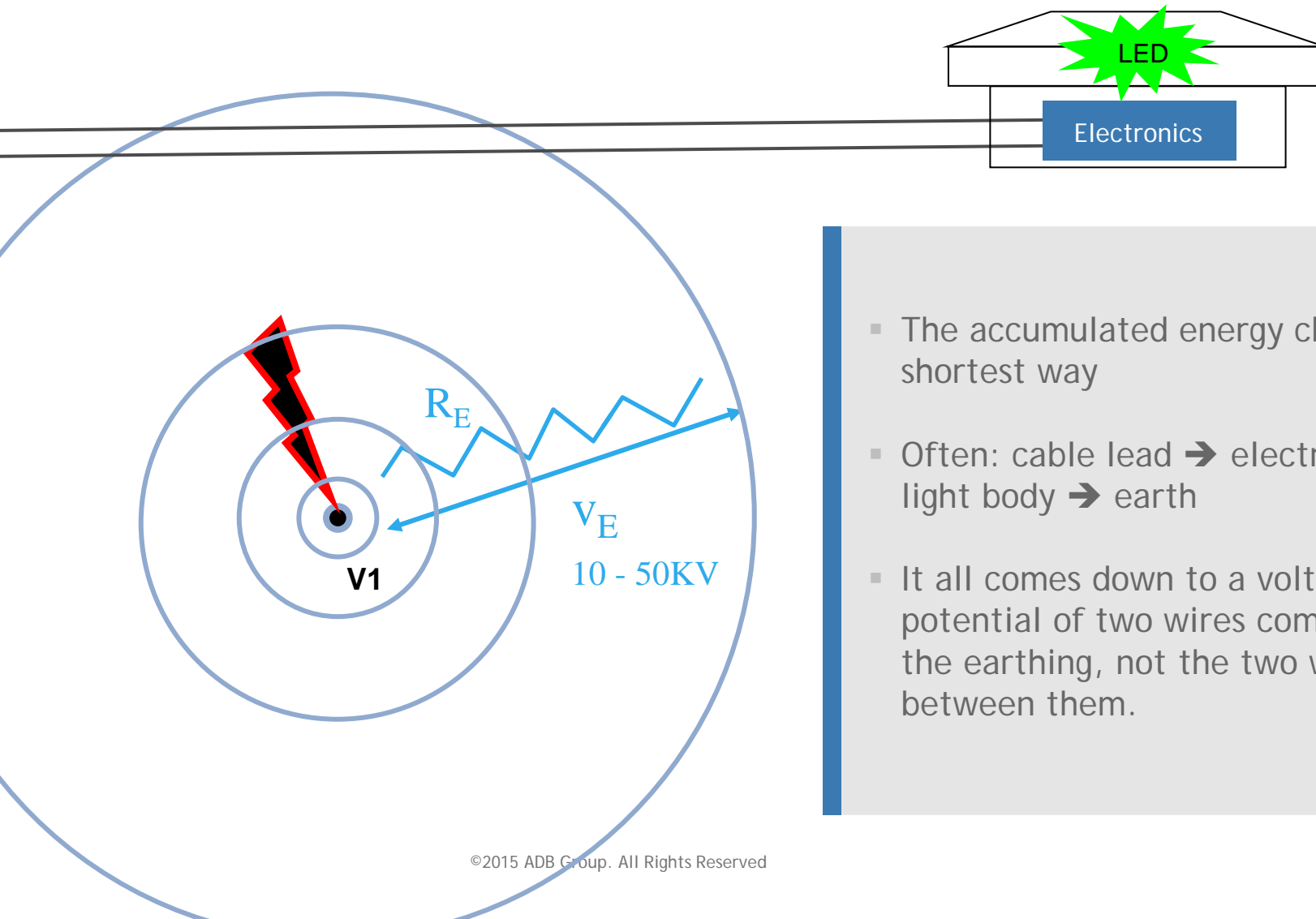
On the good side: an inset light is like a Faraday's cage, protecting the inside against external overvoltages

Entry level: **the secondary cable lead**



The Impact of Lightning

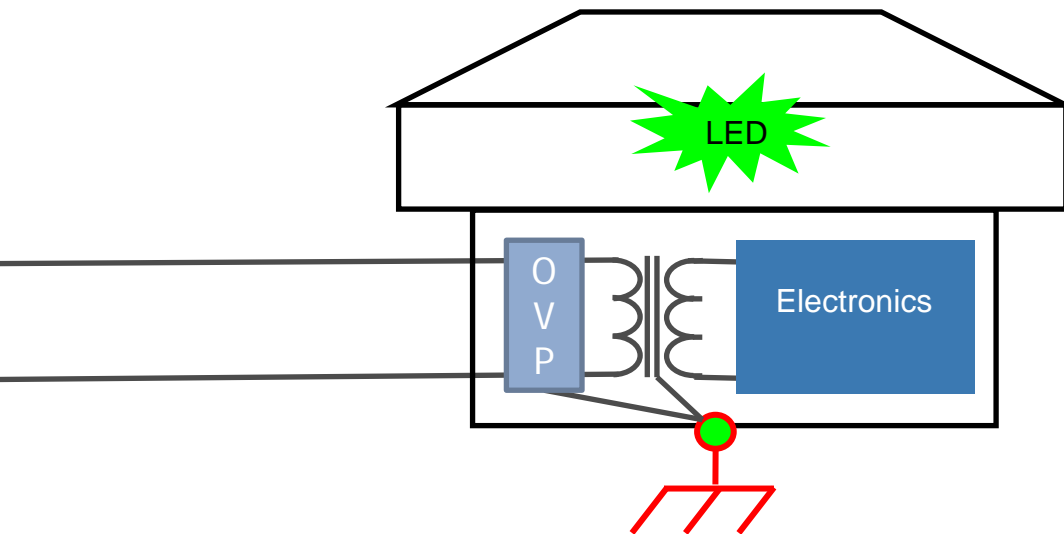
How it works?



- The accumulated energy chooses the shortest way
- Often: cable lead → electronics → light body → earth
- It all comes down to a voltage potential of two wires compared to the earthing, not the two wires between them.

How ADB limits the impact of lightning:

- Transformer at the entrance of the light ensures a first galvanic insulation
- If the overvoltage exceeds +/- 3 kV, the “controlled discharge way” runs via the light body to the base to the earth



Critical:
a good earthing

The Impact of Lightning

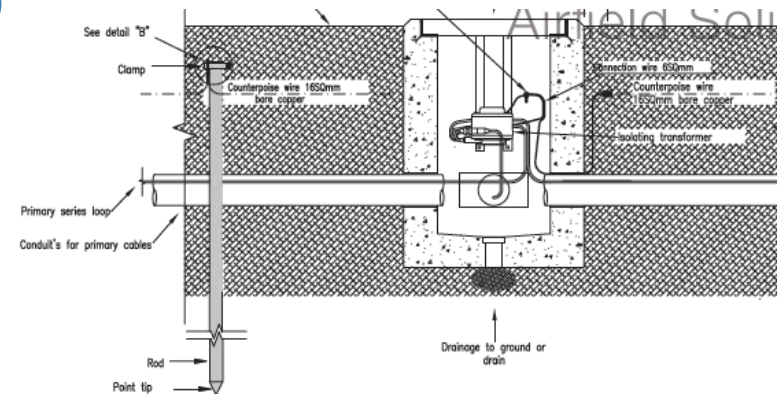
How to protect?

Where to find useful information:

- ICAO design manual, Part 5
- FAA advisory Circular AC 150/5340-30
- ADB Design Manual

Important considerations (min. requirements for normal conditions)

- 16 mm² Counterpoise wire ABOVE the primary circuit
- An earthing rod every 2 transformer pit or every 300m max.
- A 6mm² earthing wire between the fitting and the counterpoise



Electrical breakdowns

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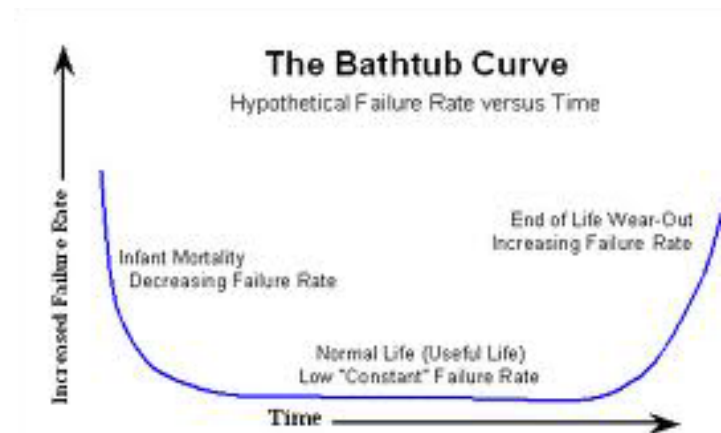
Lifetime of LEDs

- In general, lumen output decreases with time
- L70 conventionally used as end of life
- The L70 lifespan lies between 50 to 100.000 hours
- With an average brightness of 10%, the lifetime passes the 500.000 hour mark
- The question however is not with the lifetime but in the (statistical) breakdowns of all electronic components, including LEDs

Mean Time Between Failures

Or to put it more correctly:

Mean Time To Failure



Design

- Thanks to a careful design of the electronic boards (including LED PCBs), the measured MTBF of ADB inset lights installed all over the world averages more than 200,000 hours
- Solutions like the double watertightness barrier and the watertight cable entry protect the electronics and the LEDs against water damages

Installation

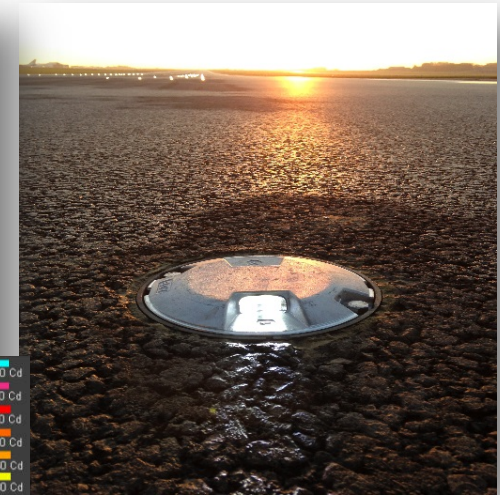
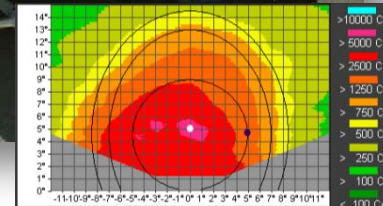
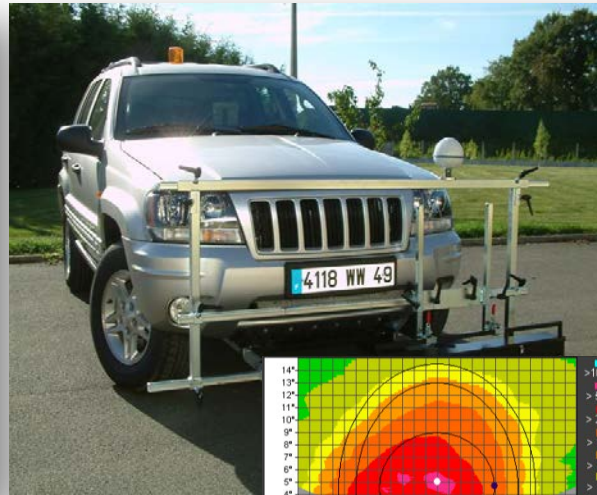
- Careful installation, by reducing the shocks and vibrations, reduces the failure rate of components

The importance of great maintenance

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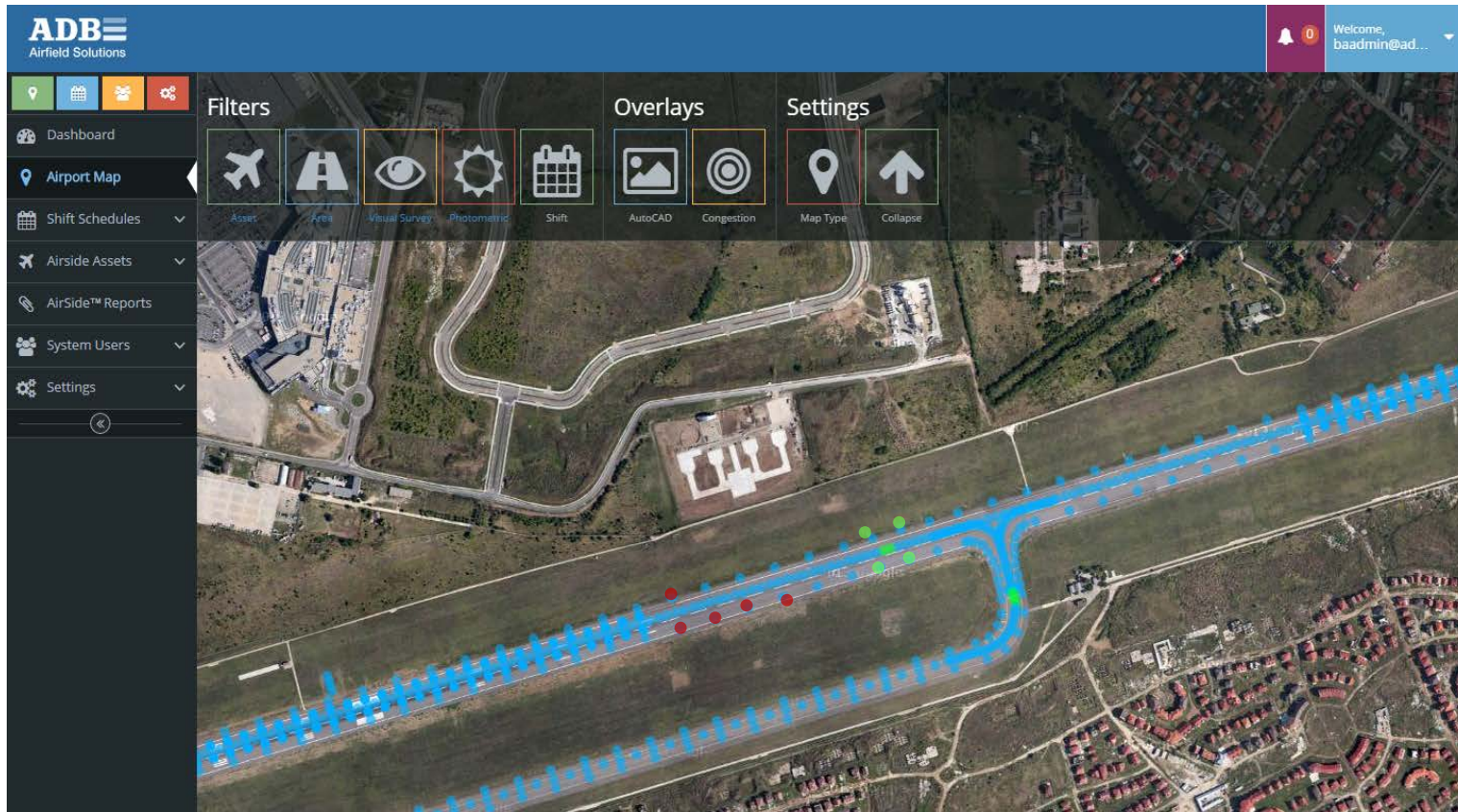
For the longevity and the correct functioning of the lights maintenance is key

1. Set up a full preventive maintenance
2. Regular visual inspection
3. Regular maintenance to inspect torqueing and prisms
4. Regular photometric measurements as defined by ICAO/FAA



AirSide™ Asset Management & Maintenance

Maintenance made easy: Web Interface - Heatmap

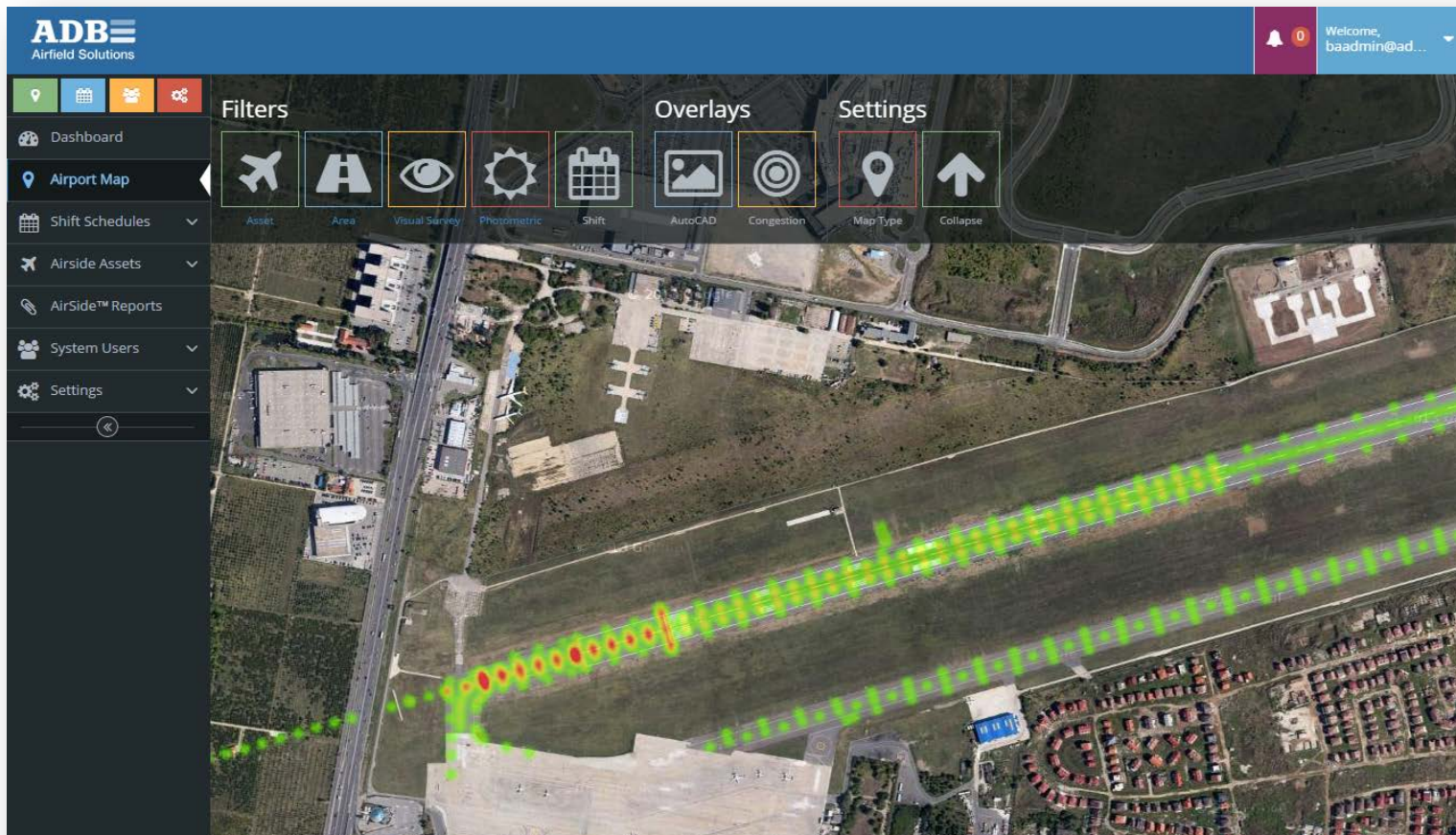


Asset heatmap provide visual status of the assets:

- No data (blue)
- Need maintenance (red)
- OK (green)

AirSide™ Asset Management & Maintenance

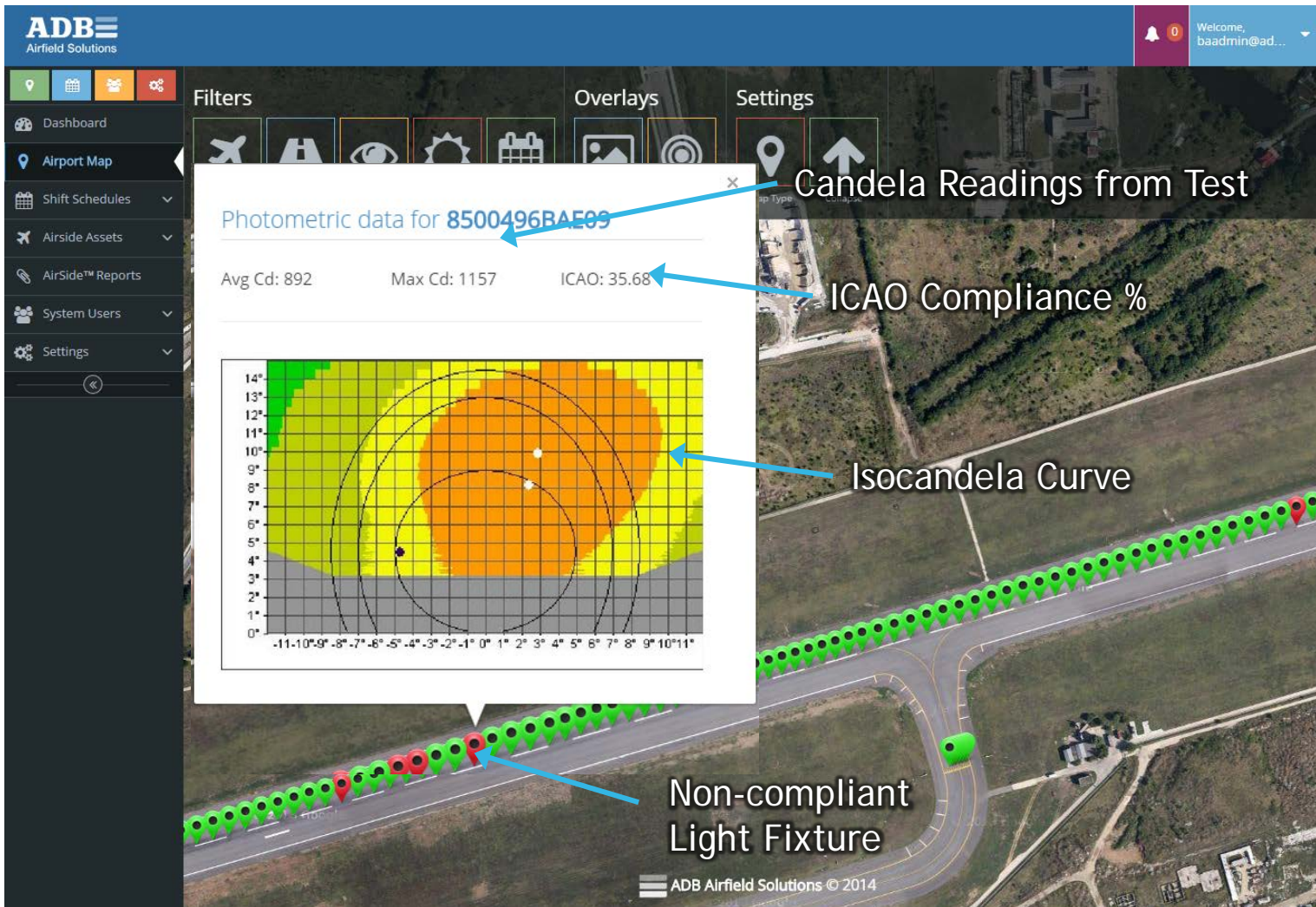
Maintenance made easy: Web Interface - Congestion Map



The congestion map indicates where high concentration of assets exists

AirSide™ Asset Management & Maintenance

Maintenance made easy: Incorporating Photometric Data



- Our LED products are suited for all weather conditions, from -40C to +55C (75C pavement) and 100% humidity
- Our LED solutions have by design a longer MTBF
- Our LED products are designed for easy and low maintenance thereby increasing availability of run- and taxiways
- Environmental footprint reduction and higher energy efficiency are part of our strategy, in an end to end process (from design to production are fully controlled)
- Superior quality of our LED products owing to our extensive experience, testing and validation

**Thanks to our
experience with LEDs
our lights are
much more than
lights with LEDs**

All ADB LED lights feature common benefits

- **High MTBF**
 - Generally above 200,000 hours
- **Significant reduction in maintenance costs**
 - Only 1 to 2% of the lights need to be serviced each year
- **Drastic reduction in energy consumption**
 - Typically 70% reduction
- **Increased availability of the airfield**
 - Less closures for maintenance
- **Increased safety**
 - Fewer unserviceable lights
 - Less maintenance vehicles and staff on the field
- **Better conspicuity**
 - Saturated colors or crystal clear white
 - Same color in all directions, at all brightness step
- **Direct replacement of halogen lights**
 - Same base or mounting support
 - Same CCR, same transformer

They address
market expectations:
More than
800,000
lights installed
the world over!

**Thank you for your
attention!**

Airfield. Our Field.