

# Laser Road Surface Sensor - LRSS

## Authors:

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## Background:

Scanmatic have been producing Road Weather Stations for more than 15 years and have now our 3<sup>rd</sup> generation of stations in the market. We are producing our own electronics but have an open interface-policy to be able to connect the best sensors to be able to fulfill our customers need.

We have been working together with Goodrich in Minneapolis in the USA for several years, buying Ice-detectors and Pitot-tube anemometers from them.

Goodrich had developed a sensor called IceHack® several years ago for detecting ice on airplane wings before and after deicing the airplanes. The unit could take an image of the hole wing area showing ice as red on a small screen on the unit. The unit was expensive and heavy, but we saw the potential in using the techniques on the road.

Two years ago Goodrich and Scanmatic started a project together to develop a new sensor for the road marked, based on the same principle, but using newer and more modern technology.

Scanmatic have been testing lots of Road Surface Sensors during the last 10 years, all based on a sensor placed in the road surface beside the tire paths. Some of the sensors have rather good performance, but the negative point is that they only measure a very small area in the road, and the surface at the sensor can be different in the tire path.

The big difference with the new sensor is that it is placed away from the road surface and covers a much larger area than other sensors.

The cost of the sensor may seem high, but the user has no cost by changing sensors in the road surface after wearing and when new asphalt is put to the road.

The big advantage is however that the new sensor can see a whole area and not only a very small part of the road (a few cm<sup>2</sup>)

The system illuminates the areas of interest using an eye-safe laser with unique properties.

Using the unique properties of the laser, the system analyzes the reflected energy and is capable of imaging a 20 x 30 degree field of view with ranges up to 23 meters.



Figure 1: Picture of the new Laser Road Surface Sensor (LRSS)

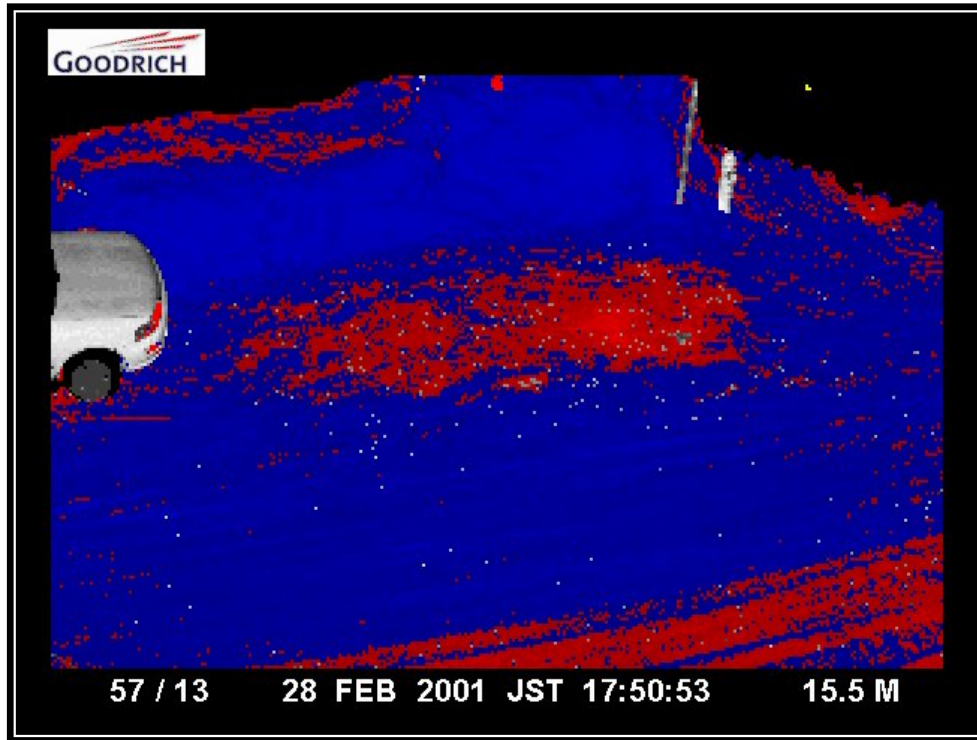


Figure 2: A typical “picture” of a road surface taken by the new type of sensor

## Advantages

- **Non-intrusive: doesn't need to be installed into the roadway surface**
- **Much larger area of detection: above and beyond single spot detectors**
- **Little to no on-going maintenance costs**
- **Can be replaced or upgraded without affecting traffic (pole-mounted, not embedded into road)**

## Applications

- **Road condition monitoring and management**
- **Tracking the quality of ice/snow removal services**
- **Ice alert warnings / speed limit control on roads**
- **Bridge deck monitoring / Automatic spray operation**
- **Airport runways**
- **Portable road condition monitoring in construction areas**

## Technical operation

- **System builds a 200 x 300 pixel image (20 x 30 degree field of view) using an eye-safe infrared beam of light**
- **200x300=60,000 points of detection**
- **Analyzes the reflected energy, classifying each pixel as dry, snow, ice or wet areas.**
- **Displays image in gray scale with red, blue, and cyan colors to highlight dry, ice, snow and wet areas.**
- **Able to calculate percentage of ice, snow or water coverage for alarm based operations**

System installation / operation

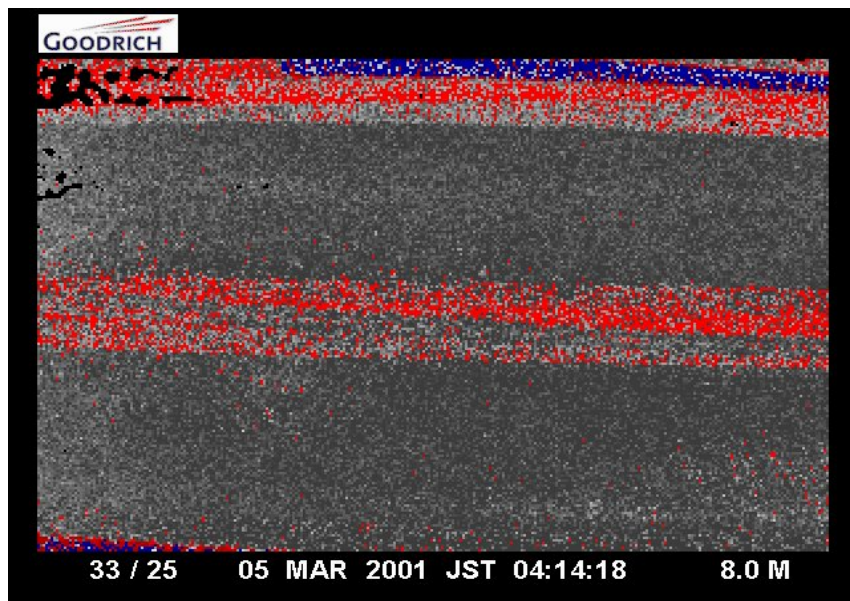
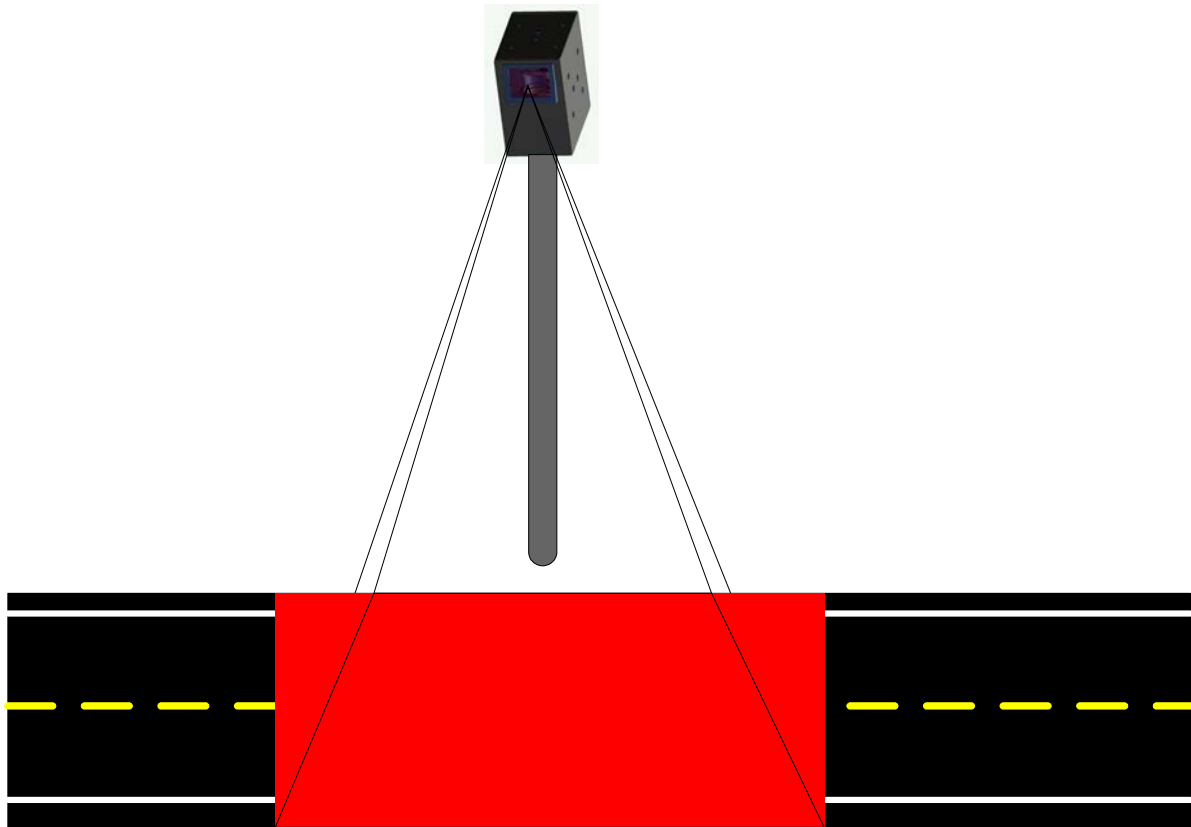



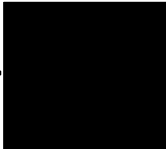


Figure 3: Typical installation an result

**Image classification**

- Red represents areas of ice →   
Ice
- Blue represents areas of snow →   
Snow
- Cyan represents wet areas →   
Wet
- Black represents out of range or not enough information → 

Gray represents areas of no precipitation

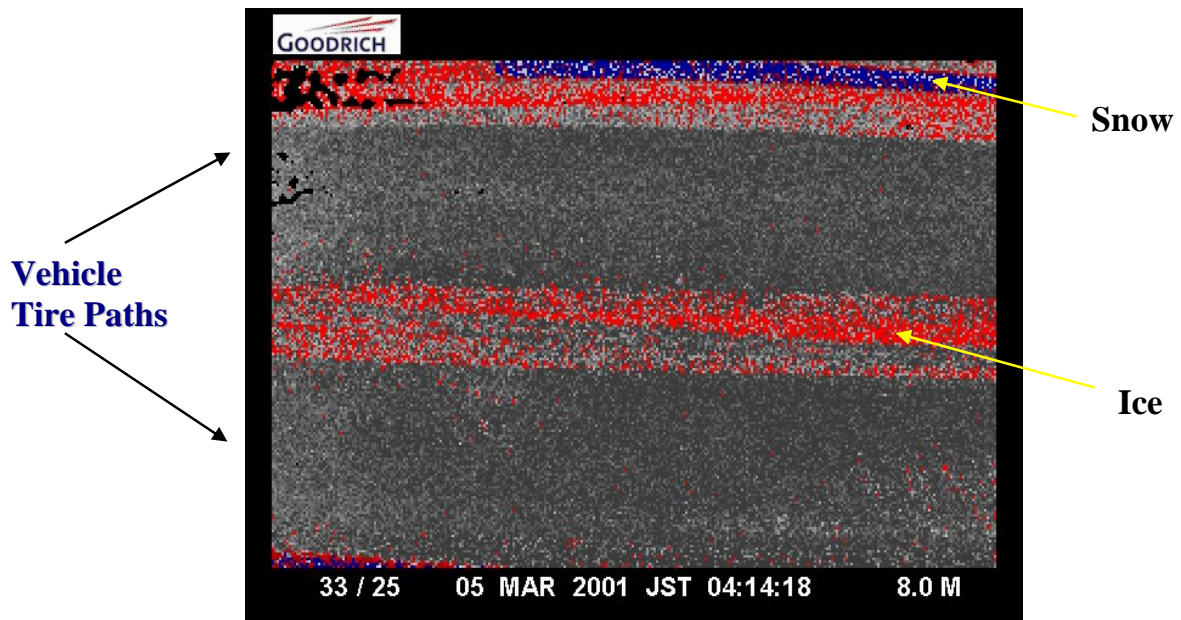


Figure 4: A typical LRSS image and the meaning of the different colors

## System Specifications

- **Field of view: 20° x 30°**                      **Range: up to 23 meters**
- 
- **Dimensions: 23cm x 38cm x 33cm**      **Weight: 9kg**
- **Operating voltage: 10-14 VDC**
- **Temperature range: -30 to +50 °C**
- **Connectivity: Ethernet (TCP/IP) or RS232**
- **Image storage capacity: up to 2,000 images**
- **Windows® software compatible**
- **Additional I/O ( for future expandability)**
- **Alarm (automatic) or manual operation capable**
- **User-friendly configuration software allows for a multitude of applications**

## Informational Contacts

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