Welcome to Campbell Scientific, world leaders in monitoring solutions for road weather applications

From complete turnkey solutions through to individual dataloggers and sensors with supporting software and peripherals, Campbell Scientific has the solution for any road weather monitoring application.

Our clients include national and local authorities and airports as well as private companies who service extensive road infrastructures.

Over the years we have become well known for robust, reliable and low power systems and as a leading innovator in road weather applications.

Our systems are fully configurable and can use any type of sensor and communications options.

For **further information**
call our weather team on
+44 (0)1509 828888 or email:
weather@campbellsci.co.uk

Measurements Matter in Road Transport

Local, ground based weather monitoring is essential for keeping the traffic flowing on our roads. Real time weather data facilitates informed decision making on whether remedial action is required and when and where to implement it. Relying on forecast information alone reduces effectiveness and efficiency – for example, frosty roads may go untreated if not forecast, putting road users in danger, or action may be taken on routes which subsequently turn out to stay above freezing wasting time, money and materials and causing an unnecessary environmental impact.

Campbell Scientific solutions capture vital weather data and are utilised in a variety of meteorological applications worldwide. Beside road weather monitoring, our systems are used in aviation, hazard identification (such as lightning and wild fires) as well as in hydrometeorology & climatology, solar and wind energy and the agriculture sector; providing us with extensive experience of all aspects of weather monitoring. Over the last four decades Campbell Scientific has used this experience to feed into our innovative products and customised solutions. A typical road weather monitoring system encompasses the following measurements:

» Wind speed and direction
» Temperature and Relative Humidity
» Dew Point
» Precipitation
» Barometric Pressure
» Visibility
» Present Weather
» Road Surface State
   o Surface conditions such as wetness, ice, snow, or frost
   o Water film height
   o Ice percentage in water and determination of freeze temperature
   o Friction
» Road Surface & Sub-Surface Temperature
» Day & Night Camera records

Road state sensors are available either in contactless or embedded variants. Due to the high flexibility and compatibility of all our products we are able to offer tailored solutions which meet exactly your requirement and budget. Let us advise on the best set-up for your application.

Applications

Snow and ice are perhaps the most obvious road weather hazard

Road Weather Information Systems (RWIS)

Our Road Weather Information Systems can be as simple as a single roadside sensor or stand-alone Environmental Sensor Station (ESS) or a complex network of stations complete with data collection and bureau service with online display capability. Our systems provide real time warning of impending or actual ice, fog, snow, flooding, freezing rain and lightning as well as providing a 24/7/365 continual record of weather data which can be called up at any time.

Utilisation of road weather information can improve the effectiveness of winter road maintenance programmes by allowing operators to concentrate action only when and where required based on real time data rather than uncertain forecast information. This improves road safety, maximises traffic flow, reduces costs and lessens the environmental impact of using grits during winter weather conditions.

Measurements: *Wind speed, wind direction, air temperature, relative humidity, barometric pressure, visibility, road surface temperature, sub-surface temperaure, dew point, road surface state.*

Reduced visibility due to mist or fog is a hazard to road users

Visibility and Present Weather Monitoring

Reduced visibility due to mist, fog or snow makes for dangerous driving conditions. Roadside visibility sensors with present weather capability provide a 24/7 monitoring capability of current visibility conditions and precipitation type.

Data can be reported back to a central location, fed into a networked system or can directly activate warning signs based on customer configurable alarm conditions being met.

Measurements: *Visibility, present weather*

Wind warning systems can be directly controlled by a weather station

Bridge Warning Systems

Large suspension bridges can experience very different weather conditions from those experienced even in the locality around the bridge. Often very exposed and/or with wind being channelled down a valley means that bridge users can be particularly at risk in high wind or freezing conditions. Speeds may need to be reduced, lanes closed or high sided vehicle usage restricted.

Our systems can monitor conditions and either feed that information into a control centre or directly control automated warning signs when customer configured conditions are met.

Measurements: *Wind Speed, Wind Direction*

Roads close to streams and rivers may be prone to flooding.

Flood Warning Systems

Some roads are prone to flooding either due to locality to a nearby water course, or because the location and layout of the road happens to form a natural collection point in heavy downpours. Either of these situations can be monitored automatically through water level sensors and rain gauges.

Local data collection systems can either transmit the data to a central operations centre or locally switch on warning signs, open sluice gates or send out SMS text messages automatically when preset criteria are met.

Measurements: *Water level and flow, rainfall, groundwater pressure, soil moisture.*

www.campbellsci.eu/road-weather

Road Weather Case Studies

Channel Tunnel IceWatch

The 31 mile (50 km) long Channel Tunnel connects the United Kingdom with France with a set of three tunnels that pass beneath the seabed of the English Channel. Because of the huge amount of road and rail traffic at the large terminals at each end of the tunnels, it was crucial to install a Campbell Scientific road-weather information system (RWIS) for a safe and efficient operation.

The installed IceWatch system includes seven automated weather stations (AWS), a server and multiple displays at the terminal in each country. Six of the AWS were set up with RWIS features, including embedded road surface sensors and infrared road surface sensors as well as present-weather sensors for precipitation type classification. Furthermore, Campbell Scientific provided all the necessary documentation, training and utilised RTMC Pro Software to run graphical displays in real-time.
http://www.campbellsci.eu/chunnel-ice-warning

Road Weather Modelling & Ice Formation Forecasting in Perugia

The Italian Province of Perugia set up a programme for forecasting of ice formation on road surfaces. The project is operated by the University of Perugia and Ecosearch, a Campbell Scientific systems integrator based in Italy. A variety of sensors, including a number of precision thermometers, GPS tracking devices and odometers were mounted on road maintenance vehicles which fed the information into a ruggedized datalogger. The mobile stations took measurements and the information was used to feed into on-board displays and into the forecasting system. Due to the close collaboration of all parties it was possible to install a proper system within the extremely narrow budget. This solution comprises three mobile stations which monitor the main meteorological parameters, together with soil temperature, conductivity and heat flux.

http://www.campbellsci.eu/perugia-italy

Upgrade of the Welsh Government Road Weather Monitoring System

In 2014 the Welsh Government decided to upgrade their existing nationwide trunk road weather monitoring systems to ensure a high safety level. Their existing network of stations had been in use for over 10 years and were becoming difficult to maintain and repair. The requirement for the upgraded network was for a reliable system that also allowed for quick fault diagnostics, maintenance and calibration. All commissioned parties decided to base the weather stations on existing sensors and on new Campbell Scientific supplied sensors to capture meteorological data. The acquired readings are used by the Welsh Government to operate regional trunk roads securely and efficiently with the data offered to a weather bureau service for weather forecasting to commercial customers. Campbell Scientific software solutions were also applied in this project to support data transmission and run graphical data displays.

ALERT Network, Douglas County, Colorado

Douglas County in Colorado, in conjunction with Denver's Urban Drainage Flood Control District (UDFCD), operates an extensive ALERT network to monitor potential flood conditions. In 2008, the county decided that the next ALERT site they set up should also have a camera to monitor stream and road conditions, and a road-temperature sensor to aid the Public Works department with winter maintenance. This would give the station the abilities of a road-weather information system (RWIS).

The new system has a variety of features including:

- The immediacy of an ALERT station
- Real-time and historical weather data for meteorologists
- A cellular router for remote data access and transmission to Weather Underground (WU)
- A camera to send images to WU and to the Public Works department
- Power efficiency, which means they can be powered by solar panels.

Not only are Campbell Scientific dataloggers great foundations for ALERT systems, but they are also flexible enough to meet expanding needs and interesting challenges to meet the needs of all potential stakeholders.
http://www.campbellsci.eu/colorado-alert

Freezing Roads Preventative Maintenance in Korea

The Korea Expressway Corporation (KEC) constructs and manages expressways throughout South Korea. To reduce the cost related to repairing and repaving their network, KEC developed a systematic maintenance and management strategy that includes the conversion from post-maintenance management to preventive maintenance management.

As part of their preventive maintenance management, KEC focused on preventing paved roads from freezing during the winter. They developed an anti-freezing layer that could be embedded under the road. The next step was to test 45 sites, which supplied with a field measurement system equipped with Campbell Scientific gear, including dataloggers, relay multiplexers, and water-content reflectometers, thermocouples, linear variable differential transformers (LVDTs), and load cells.

For three years, the sensors at the test sites were monitored using CR1000 dataloggers connected to a central PC running Campbell Scientific's LoggerNet with real-time monitoring and control (RTMC) software. The Campbell monitoring system enabled KEC to accomplish two objectives: to continuously monitor the 45 test sites; and to assess, over time, the effectiveness of the antifreezing layer in preventing winter damage to KEC's expressways.
http://www.campbellsci.eu/korea-road

Turnkey Systems and Solutions

Campbell Scientific products are highly flexible and compatible with third party equipment allowing easy integration and customisation of systems. Our dataloggers are able to measure virtually every commercially available sensor and support various communication options. Campbell Scientific optical sensors can be either applied stand-alone or as part of a complex weather monitoring network. Our software packages are extremely powerful and can be used self-contained or in conjunction with other interfaces. This adaptability allows us to integrate with existing infrastructure and offer the best solution at a competitive price.

Optical Weather Sensors

Optical weather sensors provide outstanding features and exceptional value for money. The following sensors are popular in road weather applications:

CS120A Visibility Sensor – An infrared forward scatter sensor which reports Meteorological Optical Range (MOR) up to 75,000m. It features user-configurable alarm outputs which can trigger relays.

CS125 Present Weather Sensor – reports visibility as per the CS120A and additionally reports present weather. This means that the CS125 identifies precipitation particles from their scattering profile, and combines this with a temperature measurement to identify the precipitation type.

Both the CS120A and CS125 use the well-established forward scatter system for visibility measurement, utilising a 42° scatter angle which gives accurate estimates of Meteorological Observable Range. They have downward pointing optics that reduces the risk of contamination of the optics and blockage with snow. Their hoods incorporate low power dew prevention heaters as well as higher power anti-icing heaters as standard. These heaters are automatically controlled to ensure operation in all weathers.

CC5MPX - HD Digital Still & Video Network camera. This camera, capable of delivering up to 5MB HD still images and video footage, is designed to operate in extreme environments to capture images in locations no ordinary camera could cope with. Image capture is triggered either by time, movement detection or by remote trigger, such as a datalogger.

Datalogger

Campbell Scientific offer a range of dataloggers to cover all applications and budgets. Our dataloggers share similar measurement and programming capabilities but vary in channel count and scan speeds. Selection of the appropriate datalogger depends mainly on the type, number, precision, and speed of measurement required. Here is a short overview of relevant datalogger models:

CR200X – Our entry level but highly capable logger, ideal for smaller projects requiring just a few sensors to be measured.

CR800/CR850 – A similar specification to our most popular logger, the CR1000, with slightly fewer channels and lower price tag. The CR850 features an integrated keyboard/display.

CR1000 – Our most popular datalogger offers a large channel count; 100Hz scan rate, low power, high reliability and supports a wide range of peripherals.

CR6 – Our latest logger, featuring universal channels, integrated Ethernet, integrated MicroSD card and true 24 Bit A/D resolution. Available with WiFi option.

CR3000 – For demanding applications requiring a high channel count or fast scan rate.

Konect Software

Konect Global Data Service is a highly secure cloud based data collection, archive and display system that allows a user to simply access their station data with minimal technical knowledge.

Konect will routinely collect data, apply any of the integrated quality checks selected and store the data securely on Microsoft's Azure platform in the cloud. Data is accessed 24/7/365 using any suitable browser on any suitable internet enabled device (laptop, tablet, phone etc.).

Tabular or graphical views are provided and configurable alarms can easily be set to notify via SMS, email or on the Konect GDS interface.

Additional users can be added and managed allowing simple data sharing with authorised third parties.

Customers wanting to arrange their own data collection but who wish to simplify the process will be interested to hear about Konect Data Routing service which allows easy configuration of firewall issues.

LoggerNet

LoggerNet is our main datalogger support software package. It supports programming, communication, and data retrieval between dataloggers and a PC LoggerNet consists of a server application and several client applications integrated into a single product. It can support connection to a single datalogger, but it is especially adept in applications that require telecommunications or scheduled data retrieval used in large datalogger networks.

Additional software for display and analysis includes:
RTMC Pro – used to create and run graphical screens that provide real-time monitor and control capabilities. RTMC Pro is an enhanced version of the RTMC client included with LoggerNet, LoggerNetAdmin, and RTDAQ.

We also offer a free software package, PC200W, which supports direct connection to a datalogger and PC400, providing extended communications support for projects that do not require full blown LoggerNet.

Measurement Solutions
for Road Weather Applications

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