

## Design of Highway Icing Warning System

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### Abstract

**This design discloses a real-time safety device for warning road surface icing, including solar ground lamp (1) and solar LED display (2). This design adopts the facility device composed of solar ground lamp and solar LED display screen. The solar ground lamp is equipped with solar photovoltaic cell, charging and discharging battery, red and green LED lamp, temperature and humidity sensor and D data processing and transmission chip circuit; The solar LED display screen is equipped with solar photovoltaic cell, charging and discharging battery, LED graphic display screen, P data processing transmission chip circuit and red flashing warning light; According to the technical scheme of sending out red light and graphic warning according to the freezing critical data collected from the ground, and transmitting the data to the traffic control center through the Internet, it overcomes the problems and shortcomings of the existing technology that it is difficult to issue the pavement freezing warning in real time, so that the expressway can achieve the purpose of real-time and real-time pavement freezing warning.**

### Keywords

**Real Time Warning; Road Surface; Icing.**

### 1. Preface

In the severe winter with rain and snow, the road surface of expressway is easy to freeze and freeze, which seriously endangers the driving safety of vehicles. It is necessary to send out the warning of road icing to the driving vehicles in time. According to the weather situation and weather forecast, the existing technology releases the warning to the driving vehicles through the LED information display screen set along the highway; Due to the meteorological phenomenon of "ten miles of different days" in mountainous expressway, and the information release center of expressway is far away from the mountainous expressway area where the road surface is freezing due to freezing rain, it is difficult to issue the pavement freezing warning in real time. In addition, the bridge surface of highway bridge is easy to freeze before the highway pavement due to lack of geothermal energy, If there is no real-time freezing warning, it will bring great safety risks to the driving vehicles; Therefore, the existing technology is difficult to release the pavement freezing warning in real time.

### 2. Design Content

In view of the problems and deficiencies of the existing technology, this design adopts the facility device composed of solar ground lamp and solar LED display screen. The solar ground lamp is equipped with solar photovoltaic cell, charge and discharge battery, red and green LED lamp, temperature and humidity sensor and D data processing and transmission chip circuit; The solar LED display screen is equipped with solar photovoltaic cell, charging and discharging battery, LED graphic display screen, P data processing transmission chip circuit and red flashing warning light; In the application, the solar LED display screen is set on the right side of the road along the road direction, and the ground lamp array composed of evenly

distributed solar ground lamps is embedded on the road surface 50 ~ 300 meters in front of the solar LED display along the road direction; When the road surface is frozen, the temperature and humidity sensor of the solar ground lamp will process the critical freezing data collected from the ground by the D data processing transmission chip circuit. The D data processing transmission chip circuit will turn the LED light of the solar ground lamp from green to red, and send out the flashing warning red light. At the same time, the warning data will be transmitted to the solar LED display, Through the P data processing and transmission chip circuit of solar LED display screen to process and turn on the LED graphic display screen to send graphics and text warnings to the driving vehicles, and at the same time, turn on the warning light to send out flashing warning red light, and transmit the data to the traffic control center through the Internet, providing a safety device for real-time warning of road icing, The purpose of this paper is to send out red light and graphic warning according to the freezing critical data collected from the ground, so that the expressway can achieve the purpose of real-time and real-time road freezing warning.

The purpose of this design is to achieve: a real-time warning road surface icing safety facilities device, including solar floor lamp, solar LED display, in which: the solar ground lamp is equipped with a closed stainless steel shell, and the inside is equipped with solar photovoltaic cells, charging and discharging batteries, LED lights. The device is composed of temperature and humidity sensor and D data processing and transmission chip circuit; The top of the shell is provided with transparent toughened glass; The detection end of the temperature and humidity sensor is exposed and flush with the upper part of the shell; The LED is red LED; D data processing and transmission chip circuit is a circuit board which can process the data of temperature and humidity sensors, control the on / off of LED lights and the flashing warning red light from green to red, and has the function of wireless data transmission with P data processing and transmission chip circuit of solar LED display screen; Solar photovoltaic cells and charge discharge batteries are devices for providing power to d-data processing transmission chip circuits and LED lamps;

The solar LED display is composed of P solar photovoltaic cell, P charging and discharging battery, LED graphic display screen, P data processing transmission chip circuit and red flashing warning light; The LED graphic display screen is a rectangular flat box type LED display screen, and the warning light is located on the outside of the LED graphic display screen; P data processing and transmission chip circuit has the function of processing the data transmitted by the D data processing transmission chip circuit of the solar ground lamp, controlling the on / off warning light flashing on or off, and driving the LED graphic display screen for graphic display. It has the function of wireless data transmission with the D data processing and transmission chip circuit of the solar ground lamp and through the Internet, The circuit board that transmits data to the function of traffic control center; P solar photovoltaic cell and P charging and discharging battery are devices used to provide power to P data processing transmission chip circuit, LED graphic display screen and warning light; The solar LED display screen is set on the right side of the road along the road direction, and the solar LED display screen faces the road driving direction; The solar ground lamp array is called the ground lamp array. Several ground lamp arrays are arranged at intervals on the road surface 50 ~ 300 meters in front of the driving direction of the road from the solar LED display screen.

### 3. Working Principle and Beneficial Effect

In case of road freezing, the critical freezing data collected from the ground by the temperature and humidity sensor of the solar ground lamp are processed by the D data processing transmission chip circuit, and the LED light of the solar ground lamp is turned from green to red by the D data processing transmission chip circuit, and the warning data is transmitted to

the solar LED display screen at the same time, The P data processing and transmission chip circuit of the solar LED display screen is used to process and turn on the LED graphic display screen to send out graphic and graphic warnings to the driving vehicles. At the same time, the warning light is turned on to give a flashing red light warning, and the data is transmitted to the traffic control center through the Internet.

According to the freezing critical data collected from the ground in real time, the device sends out the pavement knot

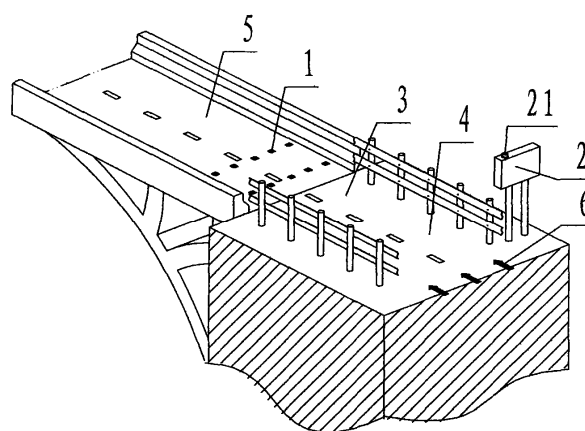
The red light of ice and graphic warning can release the warning of road freezing in real time and in real time

The freezing of the road surface is harmful to the passing vehicles.

Beneficial design development

The solar ground lamp and solar LED display screen of this facility can also transmit wired data through data lines.

The solar floor lamp is equipped with solar photovoltaic cells, charging and discharging batteries, red and green LED lights, temperature and humidity sensors and D data processing and transmission chip circuit; The solar LED display screen is equipped with solar photovoltaic cell, charging and discharging battery, LED graphic display screen, P data processing transmission chip circuit and red flashing warning light; In the application, the solar LED display screen is set on the right side of the road along the road direction, and the ground lamp array composed of evenly distributed solar ground lamps is embedded on the road surface 50 ~ 300 meters in front of the solar LED display along the road direction; When the road surface is frozen, the temperature and humidity sensor of the solar ground lamp will process the critical freezing data collected from the ground by the D data processing transmission chip circuit. The D data processing transmission chip circuit will turn the LED light of the solar ground lamp from green to red, and send out the flashing warning red light. At the same time, the warning data will be transmitted to the solar LED display, At the same time, it can transmit the data to the traffic warning center through the LED display screen which is hard to turn on, and send out the red warning signal to the traffic control center through the existing LED chip, According to the freezing critical data collected from the ground, the device can send out red light and graphic warning, so that the highway can achieve the purpose of real-time and real-time road freezing warning.



**Fig 1.** Schematic diagram of structure

In the picture: solar ground light 1, solar LED display 2, warning light 21, road 3, highway 4 Bridge 5, driving direction mark 6.

## 4. Specific Implementation Mode

Refer to figure 1, this design of a real-time warning road surface icing safety facilities device, including solar floor lamp, solar LED display, in which: the solar ground lamp is a device composed of a closed stainless steel shell, a solar photovoltaic cell, a charging and discharging battery, LED lights, a temperature and humidity sensor and a D data processing and transmission chip circuit; The top of the shell is provided with transparent toughened glass; The detection end of the temperature and humidity sensor is exposed and flush with the upper part of the shell; The LED lamp is red and green LED light emitting tube; D data processing and transmission chip circuit is a circuit board which can process the data of temperature and humidity sensors, control the on / off of LED lights and the flashing warning red light from green to red, and has the function of wireless data transmission with P data processing and transmission chip circuit of solar LED display screen; Solar photovoltaic cells and charge discharge batteries are devices for providing power to d-data processing transmission chip circuits and LED lamps; The solar LED display is composed of P solar photovoltaic cell, P charging and discharging battery, LED graphic display screen, P data processing transmission chip circuit and red flashing warning light; The LED graphic display screen is a rectangular flat box type LED display screen, and the warning light is located on the outside of the LED graphic display screen; P data processing and transmission chip circuit has the function of processing the data transmitted by the D data processing transmission chip circuit of the solar ground lamp, controlling the on / off warning light flashing on or off, and driving the LED graphic display screen for graphic display. It has the function of wireless data transmission with the D data processing and transmission chip circuit of the solar ground lamp and through the Internet, The circuit board that transmits data to the function of traffic control center; P solar photovoltaic cell and P charging and discharging battery are devices used to provide power to P data processing transmission chip circuit, LED graphic display screen and warning light;

The solar LED display screen is set on the right side of the road along the road direction, and the solar LED display screen faces the road driving direction; The solar ground lamp array is called the ground lamp array. Several ground lamp arrays are arranged at intervals and embedded on the road surface ~ m in front of the driving direction of the road from the solar LED display screen.

## 5. Conclusion

In case of road freezing, the critical freezing data collected from the ground by the temperature and humidity sensor of the solar ground lamp are processed by the D data processing transmission chip circuit, and the LED light of the solar ground lamp is turned from green to red by the D data processing transmission chip circuit, and the warning data is transmitted to the solar LED display screen at the same time, The P data processing and transmission chip circuit of the solar LED display screen is used to process and turn on the LED graphic display screen to send out graphic and graphic warnings to the driving vehicles. At the same time, the warning light is turned on to give a flashing red light warning, and the data is transmitted to the traffic control center through the Internet.

According to the freezing critical data collected from the ground in real-time section, the facility sends out red light and graphic warning of road freezing, so that the expressway can release the warning of road freezing in real time and reduce the harm of road freezing to passing vehicles.

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