Driving Forward: Exploring the Options for Smart, Sustainable Motorways

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In an attempt to make driving safer and more energy-efficient, countries around the world have begun experimenting with the installation of smart motorways. These advanced roadways come in many forms. Some focus on driver safety and surveillance. Others seek out alternative ways to generate energy for street lamps and local businesses. At the moment, the development of these smart motorways is largely dependent on the goals of individual corporations. As their effectiveness in the fields of safety and sustainability are tested, though, there is potential for their greater integration in the next decade.

Safety and a Smarter Road

The United Kingdom has seen the installation of a number of smart motorways thanks to Highways England. Sometimes, these motorways are separate from more traditional motorways, but other times they are extensions of the roads that already exist. Regardless, these smart roadway networks attempt to limit traffic congestion in particular areas through the use of a hard shoulder running lane, CCTV speed cameras, and frequently varying speed limits.

There are three different ways that a smart motorway can operate. These options are:

All Lanes Running

A smart motorway that makes use of all of its lanes removes the hard shoulder as a place for drivers to pull over. Instead, the shoulder is converted into a running lane. This lane can be closed if two cars are in an accident or if a police pursuit is in process. Typically, a hard shoulder lane closer will be indicated by the flashing of a red X on the gantry above the lane.

Dynamic Hard Shoulder

Similarly, a smart motorway operating with a dynamic hard shoulder uses the shoulder as a lane in which cars can drive. The use of these lanes is primarily temporary, though, whereas 'all lanes running' smart motorways use their shoulders at all times. Dynamic hard shoulder motorways shut down their shoulders when traffic is no longer congested.

Controlled Motorway

Controlled motorways, comparatively, maintain their hard shoulders. Instead, CCTV safety cameras are used to monitor the three or more lanes that drivers have available to them. Most often, varying speed limits will be posted on the overhead gantries. If a speed limit is not displayed, then drivers should assume that they must abide by the national speed limit.

International Use of Smart Motorways

As of early 2019, smart motorways have appeared in varying forms in the United Kingdom, France, the United States, and China. However, the United Kingdom seems to be the country keenest on spreading the CCTV system it utilizes in its larger cities to its roadways. France, the United States, and China have pursued smart motorways with what has been advertised as a more sustainable intent.

Smart, Sustainable Motorways

Two types of green, smart motorways have come into the news in recent years. Piezoelectric energy capture and solar energy have both been integrated into international motorways, to varying degrees of success.

Piezoelectric Energy Capture

California, in particular, looked to make use of the vibrations released by moving cars when the state installed its 'rumble road.' The nickname stems from the process through which piezoelectric energy converts the movement of cars into electricity. Crystals embedded in piezoelectric roads are deformed when driven over. When this 'rumbling' occurs, the energy released in that distortion is placed into batteries. These batteries are, in California, then used to power the street lights on the side of the road.

Solar Power

China seeks to do much the same but has opted, in the creation of its first smart motorway, to make use of the sun. Solar panels inside the road are said to generate enough energy to

power more than just street lights, though. It's been reported that nearly 800 homes can be lit thanks to the energy generated on this 1080-meter-long road. France and Bouygues SA, a construction company, have pursued a similar installation in Normandy.

Looking at the Bigger Picture

Recent research in Denmark, for example, showed that currently, their total greenhouse gas emissions from road infrastructure stood at approximately 2200 kilotonnes of CO2 equivalents per year. After learning this information, ten innovative developments and new materials were evaluated. The results showed that the combination of both could decrease carbon emissions from construction, maintenance and recycling or disposal of road infrastructure by 30%.

This, in total could sum up to a reduction of 660 kilotonnes of carbon emissions each year. The assessed processes included: materials meant to increase the lifespan of binder materials in asphalt such as moisture-activated, limestone-producing bacteria, and LED or other sustainably powered road lighting, which could decrease harmful emissions coming from supplying the energy by 84%.

So what does this mean on a larger European scale? The results suggest that by using innovative materials and procedures in road infrastructure projects, the emission savings similar to those produced by passenger cars driving 125 million kilometres could be made over the span of a year. This reduction potential shows that sustainable developments can have a strong impact on the pollution infrastructure can cause.

Financing a Smart Motorway

Money, of course, is the unspoken concern many drivers have when it comes to the installation and integration of smart motorways. However, the matter of paying for these smart motorways is complex. In the United Kingdom, the majority of smart motorways are funded by a private company working with the government. In China, the case is much the same. California saw state funds and contractors work together to install its 'rumble road.' As such, payment for these sustainable alternatives to traditional motorways comes in part from government resources and part from private enterprise.

How these roads and the payment for them will continue to evolve remains to be seen. With more countries around the world seeking to integrate smart and sustainable technologies into their motorways, though, the methods through which energy is gathered and safety is ensured will surely only improve.

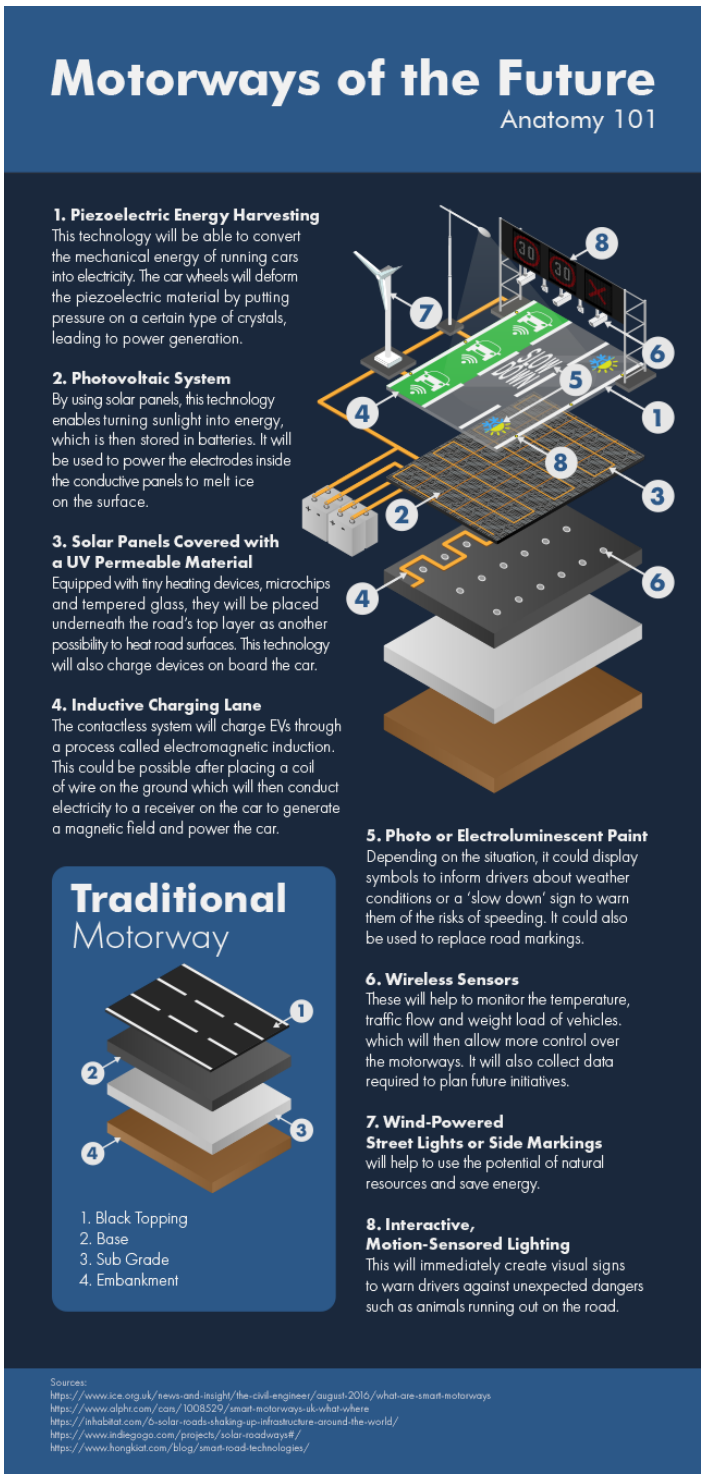

Image source: https://www.oponeo.co.uk/tyre-article/motorways-in-europe-and-the-uk

Resources

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