Generating electricity from vibrations in road surface works

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A pilot research project into vibration energy on the N34 provincial motorway near Hardenberg in the eastern Netherlands has shown that vibration energy as a local energy source is a sustainable alternative for the batteries of roadside sensors and other applications. The trial project has provided valuable insights into this innovative form of energy production.

In the autumn of 2011, a piezoelectric material that converts vibrations from passing vehicles into energy was applied to the surface of the N34 motorway. The piezoelectric material was applied to the road surface in a rural area where the speed limit is 100 km per hour. The aim of the pilot project was to investigate the feasibility of piezo technology in road

construction. The research was carried out by the Tauw advice and engineering agency and the University of Twente in partnership with the Dutch province of Overijssel.

The aim of the pilot project was to establish whether electrical energy can be generated from traffic vibrations using piezoelectric material and, if so, how much energy can be generated. The trial system was tested in various weather conditions between October and December 2011. A measurement device was used to continually monitor the system and collect data.

Results

Tauw and the University of Twente have concluded that energy can indeed be generated using piezoelectric material in the road surface. The amount of energy generated depends on the number of passing vehicles and the number of piezo elements in the road. Vehicles that are moving more slowly appear to generate slightly more energy than faster-moving vehicles, but further research is needed to confirm this.

The amount of energy generated during the pilot project was too small to be used for traffic lights or street lighting, but it was enough for devices that need less energy, such as wireless motion sensors, which detect vehicles and send a signal to, for example, traffic lights. Currently these are mainly powered by batteries or solar panels. Vibration energy is a sustainable alternative for these power sources.

The project partners also concluded that integrating piezo elements in an existing road surface is problematic. For the pilot research, a narrow groove was cut into the road and a steel housing containing the piezo elements was fitted into it. Ultimately it turned out that the housing was not strong enough to withstand the forces of the passing traffic, and it came loose in December. This did not cause a traffic hazard, but it did

mean that the research ended a few weeks earlier than planned.

Applications

The project partners are hopeful about other applications. Project leader Simon Bos says: “The application of vibration energy in existing roads did turn out to be difficult, but we do see possibilities for existing and new bridges and viaducts, for example at expansion joints. Of course further research into a good, strong design has to be carried out before this can be applied on a large scale.”

Next steps

Following the pilot project, various interested parties have contacted Tauw and the University of Twente to carry out further research into vibration energy. Piezo elements can not only be fitted under bridges and viaducts, but also under concrete road slabs and speed bumps, or alongside railway lines or water drainage channels. The application of piezo elements beneath concrete slabs is at an advanced stage, while the other possible applications are still in the research phase.

Provided by University of Twente

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