SolaRoad
solaroad.nl

# RESULTS OF
## SOLAROAD CYCLE PATH
## PILOT IN KROMMENIE

**The trial with the SolaRoad cycle path near Krommenie has yielded valuable results. The energy generated is higher than initially expected, the road surface acts just like an ordinary road surface and requires no more than regular road management. Important lessons have been learned with regard to technology. Some of the damage occurring to the top layer of the cycle path, for example, has led to specific improvements in this area. The robustness and durability of the top layer will be further optimised in the development towards the application of SolaRoad on a large scale.**

### About SolaRoad

SolaRoad is a road pavement that converts incident sunlight into electricity: a pioneering innovation in the field of energy production. In the Netherlands there is 600 km2 of road surfacing, which is more than the available roof surface. Solar roads can provide extra capacity for generating green electricity without claiming extra space in the densely populated area and without causing inconvenience to the surroundings. The generated electricity can be used for public lighting, traffic installations, households and electric vehicles.

### Krommenie Pilot

The SolaRoad cycle path pilot alongside the N203 near Krommenie was opened in October 2014. A world first. The pilot section is 90 metres long and 3.5 metres wide. During the course of the project, various versions of the SolaRoad surface were applied and tested here. Trials were carried out with the composition of the top layer, different designs for the solar panels and different types of solar cell technology. A total of 3 different versions of SolaRoad have been tested.

# Key lessons learned from Krommenie:

## ❶ Top layer is crucial to success

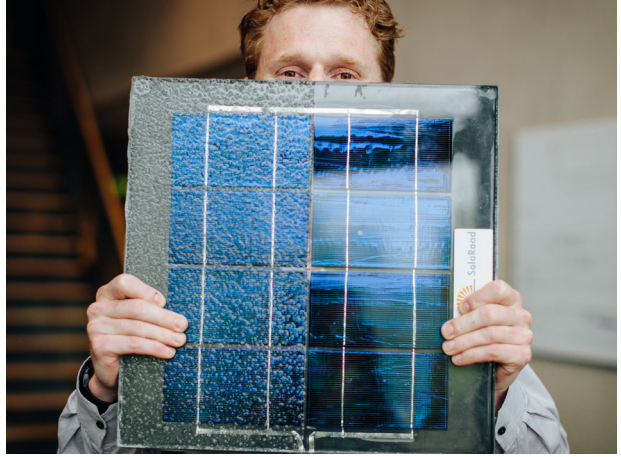
The top layer is crucial. On the one hand, the top layer has an impact on the energy yield: the more transparent to the sunlight, the more energy the road surface can generate. In addition, the top layer has to be sufficiently skid resistant to guarantee safe usage by the road users. The pilot shows that the light transmission of the top layer decreases somewhat over time due to climatic influences. Initally, the top layer showed some local delamination, where smaller sections of the coating chipped off the surface. Major improvements were already made to the development of the top layer during the pilot project. In future pilots and practical tests, the top layer will be further optimised.

## ❷ Safety and comfort first

Riding on a solar road should be no different from riding on a normal road. The road must be safe and comfortable, stiff and not dazzle. Road users have experienced the cycle path as 'normal'.

## ❸ Manageable

The cycle path should be able to be managed just like a normal cycle path. No amended cleaning regime was employed during the pilot project. The regular rain showers washed away the dirt and the road surface remained sufficiently clean. Also, the mowing regime for the road shoulders has not been adapted. This resulted in some roadside growth over the cycle path and therefore a loss of energy yield, a point of attention for the design of the shoulders next to this type of road in the future. As a precaution, a modified de-icing regime was applied, the same regime that applies to bridges. Follow-up research will have to reveal whether additional de-icing is really necessary.




## ❹ Attractive energy yield

At the start of the trial, an energy yield of between 50 and 70 kWh/m2/year was expected but this figure turned out to be higher in the first year, respectively 73 kWh/m2/year (first version, built in 2014) and 93 kWh/m2/year (second, improved version, built in 2016). Due to the decrease in the light transmission of the top layer, the yields decreased in time to values in the expected range. With the application of thin film solar cells in two of the road elements, experience has been gained with this type of flexible solar cell. It is expected that this thin film will eventually be more suitable for use in road surfaces than the brittle silicon cells used in the rest of the cycle path. The current efficiency of the flexible cells is lower as evidenced by the yield measured of approximately 41 kWh/m2/year. This is expected to rise considerably in the coming years.

## Future prospects

The results of the SolaRoad pilot in Krommenie are a confidence builder in the opportunities for solar roads as a valuable building block in a sustainable energy supply. New pilots are being planned for the beginning of 2019. SolaRoad will then be demonstrated on roads exposed to heavy traffic at two locations, in North and South Holland respectively. The pilots also intend to show the implications of a SolaRoad pavement on the daily management and maintenance of the road. In addition, it is being investigated how the energy yield can be further maximised.

## Evolution of the elements

The first version of SolaRoad consists of prefabricated concrete elements of approx. 2.5 x 3.5 metres, laid together to form a 3.5 m wide cycle path. In the pilot project, solar panels were installed on the concrete in one lane. These consist of crystalline silicon solar cells between tempered glass, finished with a transparent, non-slip top layer. The top layer immediately shows an important difference with the traditional road surface. It should allow as much sunlight as possible to pass through and should repel pollution. At the same time, the top layer has to be skid resistant and strong enough to achieve a safe road surface. This is one of the technical challenges of SolaRoad. In the autumn of 2016, the SolaRoad pilot section in Krommenie was extended by 20 metres. The extension consisted of new elements based on improved technology.

The glass in the solar panels has been replaced by plastics and the panels are tailored for use in a road surface. In addition, some elements are equipped with thin film solar cells.

## More information?

For more information about SolaRoad go to **www.solaroad.nl** or contact Sten de Wit: **E:** sten.dewit@solaroad.nl of **T:** 06 12021647

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SolaRoad, the road that turns sunlight into electricity, is an initiative of:

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