

COLLABORATION PROJECTS

ASSET MANAGEMENT: MAKING BRIDGE MAINTENANCE SMARTER AND CHEAPER



The application of new technologies has made the maintenance of the many steel bridges in the Netherlands both cheaper and easier. TNO worked together with businesses on the development and application of this technology, opening up new markets for these businesses and providing a useful cost saving for the bridge managers, such as the Directorate General for Public Works and Water Management (Rijkswaterstaat) and county councils.

We demonstrated to the Directorate General for Public Works and Water Management how the installation of highly-sensitive acoustic sensors in the Van Brienoord Bridge could give early warning of cracks or other damage. We can remotely monitor the information these electronic 'ears' provide and analyse it with our models to predict whether and when maintenance or renovation is needed in order to guarantee safe use. This method thus also prevents costly, unnecessary maintenance.

We subsequently formed a consortium with businesses and carried out a test on the Kruithuis Bridge in Delft. With its movable steel road surface, this bridge serves as a model for many other bridges in South Holland. Together with the businesses we installed acoustic sensors that showed whether cracks appeared due to fatigue. We measured the loads the bridge was subjected to by the traffic. Calculations made with our models accurately determined when each section of the bridge was in need of replacement.

As a result of our detailed knowledge of steel constructions, sensor technology, computer models and data processing, we have been able to develop a way to project the measurements from the Kruithuis Bridge onto other bridges. We enter all relevant details for each bridge and we can then accurately predict the safety inspection periods and the replacement needs of the surfaces. We are working with national and international parties in Shared Research Programmes to further perfect the sensors, inspection methods and computer models.

Are you interested in the results or would you like to know what TNO can do for you?

Please contact Willy Peelen (willy.peelen@tno.nl).

[Monitoring Civil Works](#)

MOTORIST TEMPTED TO GO CYCLING DURING RUSH HOUR



Traffic is busy between Zaanstad and Sloterdijk everyday during rush hour. But you have a choice: you can sit in traffic for a while every morning and evening or you can hop on your bicycle. In the time you would otherwise spend waiting in traffic, you could cycle from your house to your work and vice versa. In fact, over four hundred people are already doing this. They have joined the Fietscoalitie (bicycle coalition), a partnership between Havenbedrijf Amsterdam, TNO, Amsterdam Smart City, Ring-Ring, Count & Create and BRIGHT UP. The cyclists use the Ring-Ring app which registers where, when and how quickly they travel. This information is displayed on a website as a map, with the results broken down by road, area or work day. Of course, all details are anonymous. This web service was developed by TNO.

Insight into cycling behaviour

The information on this website will also deliver insights which will allow us to better understand bicycle use and to stimulate it further. We have already started this by allowing participants to exchange their accumulated kilometres for discounts in shops, cycle path improvements, a renovated cycle tunnel, and a centrally-located repair facility, useful for fixing a puncture for example. This project facilitates a healthy lifestyle while at the same time reducing congestion.

Interested? Please contact Natascha Agricola (natascha.agricola@tno.nl)

Dutch website defietscoalitie.nl

AEcoTwin

AUTOMATED AND COOPERATIVE DRIVING

6 April 2016: a historic day. Convoys of two or three trucks will drive from Sweden, Germany and Belgium to Amsterdam with less than half a second's distance between them. The second and third trucks will follow automatically, in terms of acceleration, braking and steering. This EU Truck Platooning Challenge is organized by the Ministry of Infrastructure and the Environment and the Directorate General for Public Works and Water Management (Rijkswaterstaat) in honour of the Netherlands' European Union Presidency for the first half of 2016. It will be the first large-scale demonstration of truck platooning on public roads, so it will also be a world première. Six truck manufacturers are taking part. TNO and ECOTwin are the founders of this innovation. We have previously demonstrated truck platooning in the Netherlands in partnership with DAF Trucks. Comprehensive tests are needed to demonstrate that automated trucks can make road transport more efficient, cleaner and safer and that they can also improve traffic flow.

Automated driving has been spreading worldwide for some time, but TNO has added the dimension of cooperative driving. We have also applied this combination to passenger cars, which can communicate with each other and can thus literally move together. Minister Schultz van Haegen from the Ministry of Infrastructure and the Environment has experienced this in one of our cars during a practical test on the A10 around Amsterdam.

Cooperative automated transport technology will enable a new type of 'virtual carpooling'. We will no longer travel together in one car but instead allow our automatic cars to drive themselves behind one another. We demonstrated this to the media at the end of February.

Some ministers from EU member states will travel in one of the TNO cars on their way to the Innovation Expo. That will be an extraordinary experience for them: they will automatically connect to the first car, which will have a driver, and during the journey they will be joined by a third car. They will travel on the motorway in the middle of all the other traffic through the city centre to the Expo. This demonstration will give Europe a taste of virtual carpooling as the cars will communicate with each other and drive themselves.

For more information about Automated driving please contact Maurice Kwakkernaar (maurice.kwakkernaat@tno.nl)

[Truck platooning on government.nl](#)

[TNO and DAF demonstrate truck platooning during AW15](#)

SOLARROAD: THE ROAD THAT GENERATES ENERGY

Sunlight falling on the road surface is captured by solar cells and converted into electricity. SolaRoad is a ground-breaking innovation for energy production. It is a unique concept - the road network as an inexhaustible supply of green energy. SolaRoad is a project by TNO, the province of North Holland, Dynniq (formerly Imtech Traffic&Infra) and Ooms Civiel.

The road network in the Netherlands consists of almost 130,000 kilometers with a surface area approximately twice as much as the surface area of all the roofs combined. For the last one and a half years we have been conducting an initial pilot on a public cycle path along the Nieuwrommenie (North Holland). Over the coming years we also want to install this technology in other road types such as bus lanes. The results from the first year of the pilot are encouraging: the electricity yield was higher than expected and more than 100,000 cyclists have cycled along SolaRoad without any problems. There is also a lot of international interest in this world premiere.



Would you like to see SolaRoad for yourself?

The GPS data for the area where SolaRoad can be found is: 52.493968, 4.766399.

[Click here](#) for the location on Google Maps.

Call to action: For more information about SolaRoad, please contact Gerrit Jan Valk (gerritjan.valk@tno.nl).

[Website SolaRoad](#)

[SolaRoad combines road and solar cells](#)

[Solarroad goes California](#)

[SolaRoad: the road that generates power \(TNOTIME\)](#)

ELECTRIC TOUR BOATS: NO MORE TOXIC EMISSIONS



Using electricity could be very beneficial for tour boats on the canals in Amsterdam and other cities in the Netherlands in terms of fuel consumption and limiting toxic emissions. In the 'Nota Varen Amsterdam 2.1' Amsterdam City Council and Waternet declared that the entire tour boat fleet in the inland waterways in Amsterdam has to be travelling emission-free before 1 January 2025. Together with Delft University of Technology and Waternet, TNO conducted research into how this can be realized both technically and commercially in a project called 'operatie boeggolf' (operation bow wave).

We worked in close partnership with Amsterdam's society of tour boat companies. The project was financed by the EU's European Funds for Regional Development, since the things we design and utilize here in the Netherlands can also serve as models for other European cities or sectors. We have done research into the amount of fuel the boats use, how much CO₂, NO_x and particulate matter they emit, and how to configure an electric powertrain and battery pack. Investment is needed for the electric powertrain, mainly for the battery pack it requires. However, our calculations show that this can be recouped in approximately twelve years. By bundling boat owner demands (launching customership) we can stimulate development of the lithium-ion battery systems and reduce purchasing costs. TNO would then expect a payback time of six to eight years in 2025. Currently no battery supplier can guarantee this lifespan.

In mid-April European ministers of environment and transport are going on an electric boat tour in Amsterdam during an informal environment and transport council.

For more information about Electric tour boats please contact Pim van Mensch (pim.vanmensch@tno.nl)

www.innovatie.waternet.nl: ero emission concept of a future Amsterdam canal boat

URBAN STRATEGY: INTEGRAL APPROACH FOR HEALTHY METROPOLITAN AREAS



An integral approach is needed to ensure that our cities are ready for the future. Accessibility, quality of life, sustainability, air quality, noise, energy, health and economic vitality are inextricably linked to each other. TNO's research instrument, Urban Strategy, shows the interconnections between these demands. We have combined our expertise in areas such as mobility, the environment, healthy living, construction and infrastructure, safety, and energy with real-time data created by the city itself, such as data from induction loops, floating car data, Bluetooth and air quality sensors.

There used to be separate models for the elements (a model for noise, a model for emissions, a model for traffic, etc.). Now we are able to quickly analyse all possible variations of all the factors and their interactions. TNO processes all the data into information which the town and city councils can use to evaluate the effects of certain measures and even for making predictions. We also have tools at our disposal which allow policy makers to gain insight into diverse future scenarios. We are continually expanding our integral research instrument with new indicators. It is therefore extremely suitable for establishing a vision of the surrounding area or as support for the European Union's Sustainable Urban Mobility Plans (SUMP).

For more information about Urban Strategy please contact Roel Nassink (roel.nassink@tno.nl)