



BSc and MSc projects at ASPARI

Using RFID (and other) sensors to measure the energy consumption of Warm Mix and Recycled Asphalt

1. Contact details

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10 Dutch road contractors (ASPARI network)
Sensor suppliers

2. Project content

Sustainability is high on the agenda for governments, regulatory bodies and road authorities. Firms (contractors) respond with strategies to reduce their carbon footprints. Besides optimising their asphalt production and logistics, firms are investing in the development of Warm Mix Asphalt (WMA) and Recycled Asphalt (RA). WMA is a mixture produced at lower temperatures, thereby requiring less energy and RA is used extensively in the Netherlands (up to 50%). While research effort has been put into developing techniques for adjudicating these mixes, optimising their composition and rationalising the design; less effort has been put into the operational handling and consequences regarding energy consumption and durability. This research project focuses on the innovative use of RFID (Radio Frequency Identification) sensors to monitor: (1) compaction temperature and pressure during the laboratory testing process, (2) compaction temperature and pressure during the on-site asphalt construction process and (3) vehicle load pressure and road surface temperature on the constructed asphalt layer over the long-term in terms of energy and durability. RFID uses wireless electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. By placing them into the asphalt mixture, temperatures and pressures can be measured during laboratory testing and on-site construction, and also during usage and maintenance where the RFID sensors can be used to display actual road condition data.



RFID sensors



Lab compaction

Site compaction

Dynamic temperature and pressure display

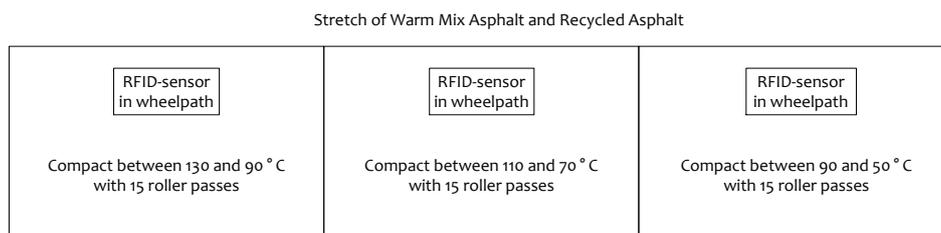
The aim of this research project is:

“To determine the benefits of using RFID-sensors to measure energy consumption during asphalt construction and under traffic conditions.”

The research activities include:

- Monitoring energy consumption for different compaction strategies during three field projects;
- Using RFID sensors to measure the roller pressure, the number of roller passes and the temperature window for compaction during asphalt construction;
- Using RFID sensors to monitor pressure and temperature during laboratory testing for determining asphalt quality characteristics such as resistance to rutting and cracking; and
- Using a combination of RFID sensors and Variable Message Signs (VMS) to monitor and display vehicle load pressure and road surface temperature during normal road usage.

The energy consumption during construction is focussed on: the roller type and pressure; the number of roller passes, and temperature of the asphalt mixture during compaction. An example of experimentation with different compaction strategies is shown in the sketch below.



The tangible results of this research project will be:

- Demonstrate the suitability of RFID-sensors in monitoring asphalt temperatures and compaction pressures during asphalt construction projects and laboratory testing;
- Demonstrate the usefulness of RFID technology in the dual role of Variable Message Signs and long-term data collection instrument;
- Better understanding of the influence of different compaction strategies on asphalt quality characteristics for WMA and RA.

Outlook and ambition:

This research starts with the innovative use of RFID sensors to monitor asphalt temperature and roller pressure during construction related activities and afterwards, during road usage. Given its rapid development, the ambition is to use RFID-sensors to monitor weather conditions, traffic loading and other factors affecting the road's condition over extended periods.

3. BSc and MSc projects within the scope of this exciting project

Interested students are to please contact Seirgei Miller of the ASPARi research unit (s.r.miller@utwente.nl).

Several construction companies within the ASPARi network are providing opportunities for the students to apply new sensor technologies within their laboratory processes and on "live" construction projects. Students are also invited to explore other innovative ways of using new sensors and technologies within road construction processes. We look forward to hearing from you if you are interested in this project or if you have innovative ideas you may want to share with us!!!

