# HIGHWAY A58: THE FIRST ENGINEERED SELF HEALING ASPHALT ROAD

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## ABSTRACT

It is well known that asphalt is a self healing material. The self healing capacity increases with increasing temperature. Many cracks that form in the road in winter, close by themselves during the summer; however, the system only works if there is no traffic circulation on the road. As a simplification, bitumen could be considered as a very dense oil; when a crack occurs in it, it will close by itself. This closure mechanism will take place much faster if the "liquid behaviour" of bitumen is increased. That can be done by increasing the temperature locally. For this reason, induction heating was explored in earlier investigations by the authors [1-3] as a method to increase the lifetime of asphalt pavements. The idea consisted of adding conductive fibres to the pavement. Then, if this magnetically susceptible and electrically conductive material is placed in the vicinity of a coil, eddy currents are induced in the fibres, with the same frequency of the magnetic field. Heat is generated through the energy lost when eddy currents meet with the resistance of the material and, finally, bitumen is melted and the crack is closed.

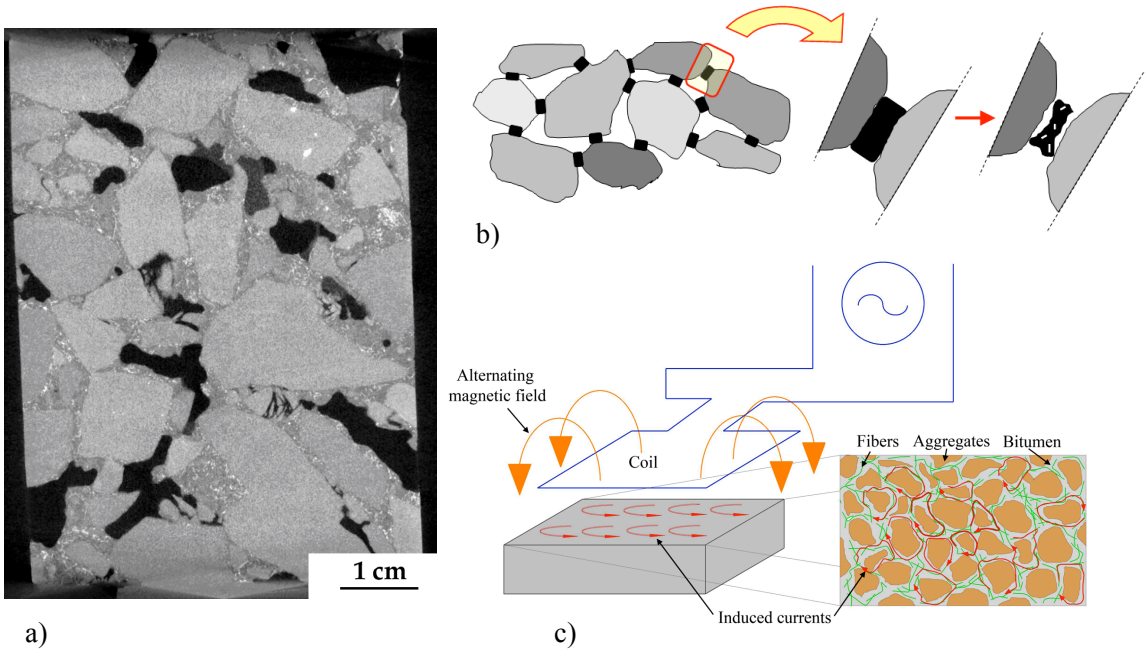


Figure 1 (a) CT-scan of porous asphalt containing steelwool fibres, (b) mechanism of ravelling in porous asphalt and (c) principle of healing the asphalt with steelwool fibres using induction energy.

The first application of this system has been built on Highway A58, near Vlissingen in the Netherlands. The material used for this pavement is a special type of porous asphalt concrete, containing small steel wool fibres. Figure 1a shows a CT-scan of porous asphalt with steelwool fibres

(amount is 4% by volume of the bitumen) distributed through the bitumen. In normal porous asphalt, without the fibres, the main damaging mechanism is ravelling: aggregates at the surface coming off in time due to micro cracking in the binder, see figure 1b. This ravelling can be avoided by adding steelwool fibres and heating them with induction energy every several months. The hot steel wool will then melt the bitumen, the bitumen will flow into the micro cracks and close them (figure 1c) and with that extend the service life of the road.

a) b)

Figure 2 (a) Production of the test section on Highway A58 in the Netherlands, (b) Laboratory testing on sample from the road.

Figure 2a shows a picture of the production of the test section on the A58, which was realized in December 2010. The road is being inspected regularly since then. At the time of writing this paper (March 2011) no damage is observed. The expectation is that the road surface will need the first treatment with induction energy only after 4 or 5 years. To determine the moment when a treatment is needed an extensive laboratory investigation is started. In this research, specimens from the road will be artificially aged and subjected to various mechanical loading regimes, i.e. RSAT (Rotating Surface Abrasion Test), bending fatigue loading and indirect tension. Furthermore CT-scanning will be used to check for material degradation inside the specimens and nano-indentation to determine the change of mechanical properties of the bitumen due to the ageing. In figure 2b the laboratory set-up is shown where specimen taken from the road and tested in the RSAT-machine is heated with induction energy to stimulate the healing process. The temperature increase in the specimen is monitored with an infrared camera and the result is visualized on the computer screen in the figure.

This project shows an example of a real application of self healing material research. The material is engineered in such a way that it is self healing, although some help is needed by applying the induction energy. The proof of the principle is already given in the lab-research [1-3]. A few years are required to show whether the application in practice is also successful. More info on the project and the research in the lab is and will be explained in detail also in the future on [4].

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## REFERENCES

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