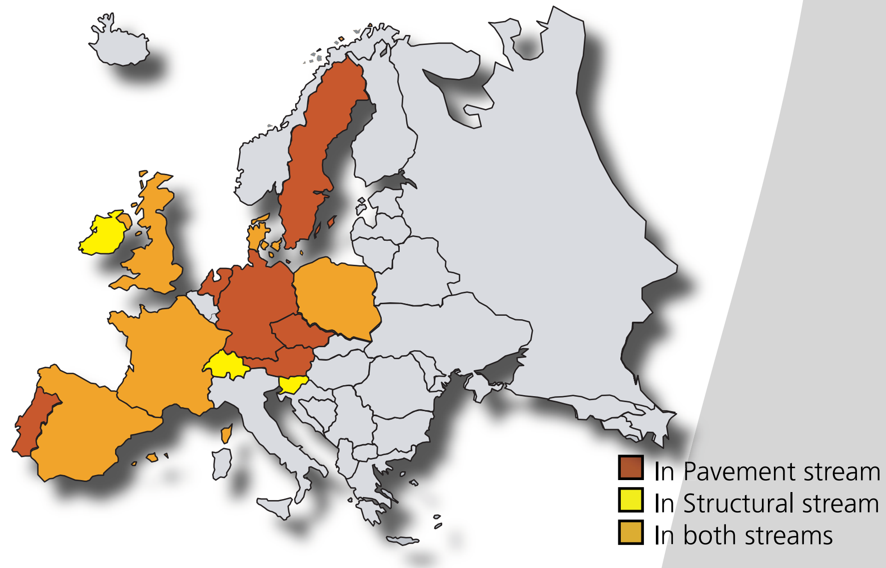
performed in simulated concrete pore water. These tests included:

- exposure of steel specimens in water with analysis of corrosion damage and passive films,
- exposure of steel specimens in a salt-spray chamber and analysis of corrosion damage,
- determination of potentiodynamical polarization curves in simulated pore water,
- determination of electrochemical impedance spectra in simulated pore water,
- measurements of electrochemical noise with digitized imaging of corroded surfaces,
- investigation of passivation mechanism through measurements with ion-selective electrodes and Fourier-Transform Infrared Spectroscopy.

The following interim conclusions have been drawn:

- all tests in simulated pore water solution proved that the inhibitor can reduce corrosion,
- passivation due to the inhibitor is reached by the formation of an adsorbed layer on the steel surface,
- the ratio of inhibitor/chloride concentration is a significant parameter in determining effectiveness,
- the critical concentration ratio is strongly dependent on the steel surface conditions and it needs to be high for the retardation of active corrosion;
- the effectiveness is significantly reduced if the reinforcement is already very heavily corroded,
- the critical concentration ratio needs to be reached to prevent localized loss of protection since localized corrosion spots can be relatively deep,
- the concentration of the inhibitor needs to be maintained above a certain level to prevent reinitiation of corrosion.

These findings are being used to further the goals of other tasks within the corrosion inhibitor work programme of SAMARIS. This work programme includes both laboratory tests on reinforced concrete specimens and full scale field trials.



The SAMARIS consortium

SAMARIS (Sustainable and Advanced MAterials for Road InfraStructure) is a Shared-cost RTD and Demonstration research project from the Growth program of the 5th Framework Programme, partially financed by the European Commission and partially from the partners' national resources. The project was initiated in FEHRL, the Association of European National Highway Research Laboratories.

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SAMARIS NEWS

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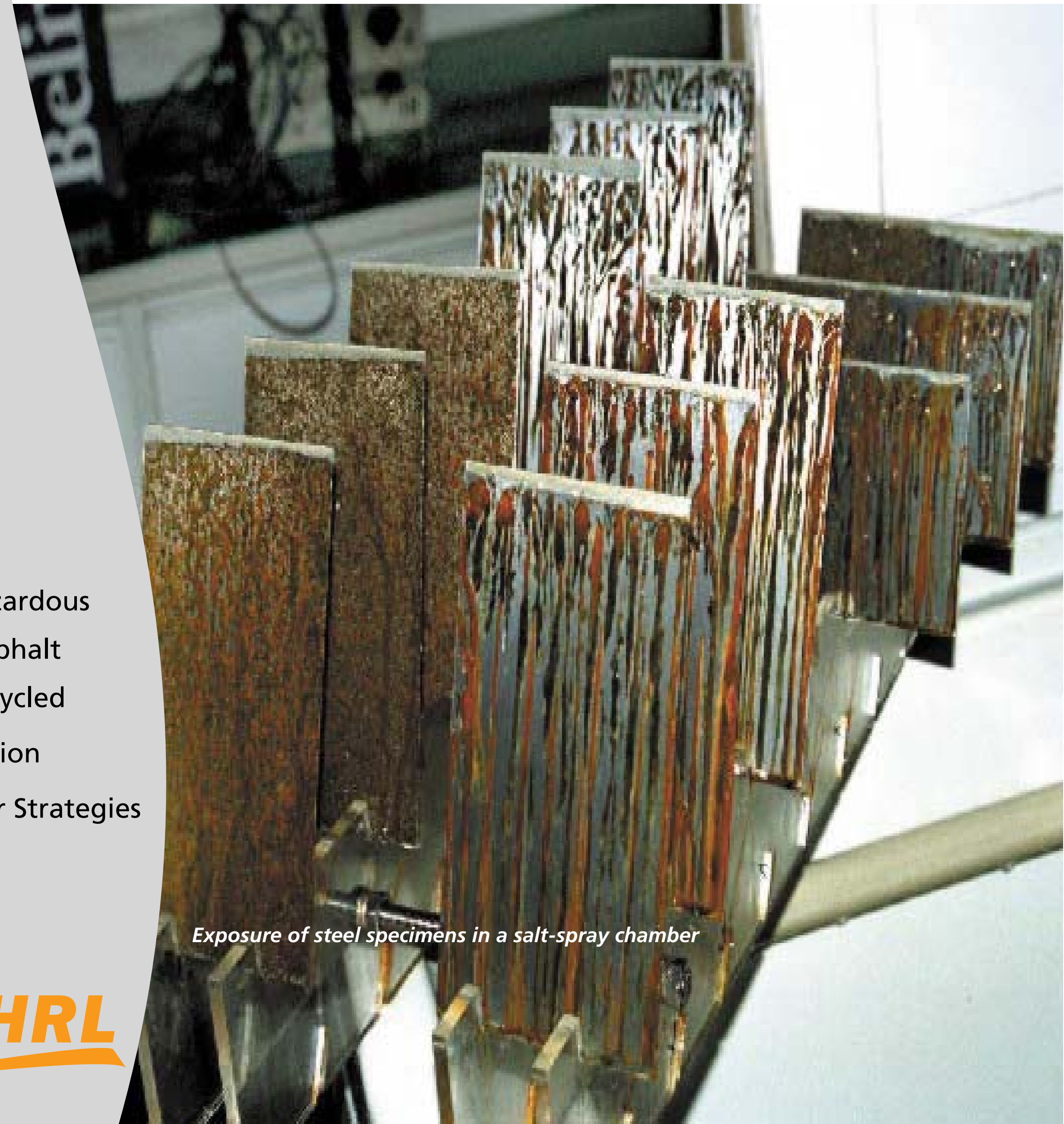
Latest on:

- How to detect Hazardous Components in Asphalt Mixtures to be Recycled
- The Role of Corrosion Inhibitors in Repair Strategies



Exposure of steel specimens in a salt-spray chamber

FEHRL

How to detect Hazardous Components in Asphalt Mixtures to be Recycled

by - Piouslin Samuel, TRL, - Virginie Mouillet , LCPC, - Burgard Koenders, SHELL.

With the increasing trends both to use more secondary materials and to recycle worn asphalt pavements back into asphalt, there is an increased probability of recycling material with component materials that could present a health and safety risk to operatives and/or the general public. Therefore, a review has been undertaken within the SAMARIS project to identify the presence of hazardous components and a procedure is now being developed to provide a coherent approach to checking specific situations for risk. It is hoped that those involved in developing new and/or innovative mixtures, whether as specifiers or producers, will be able to make use of the procedure in order to demonstrate that they have taken a responsible approach.

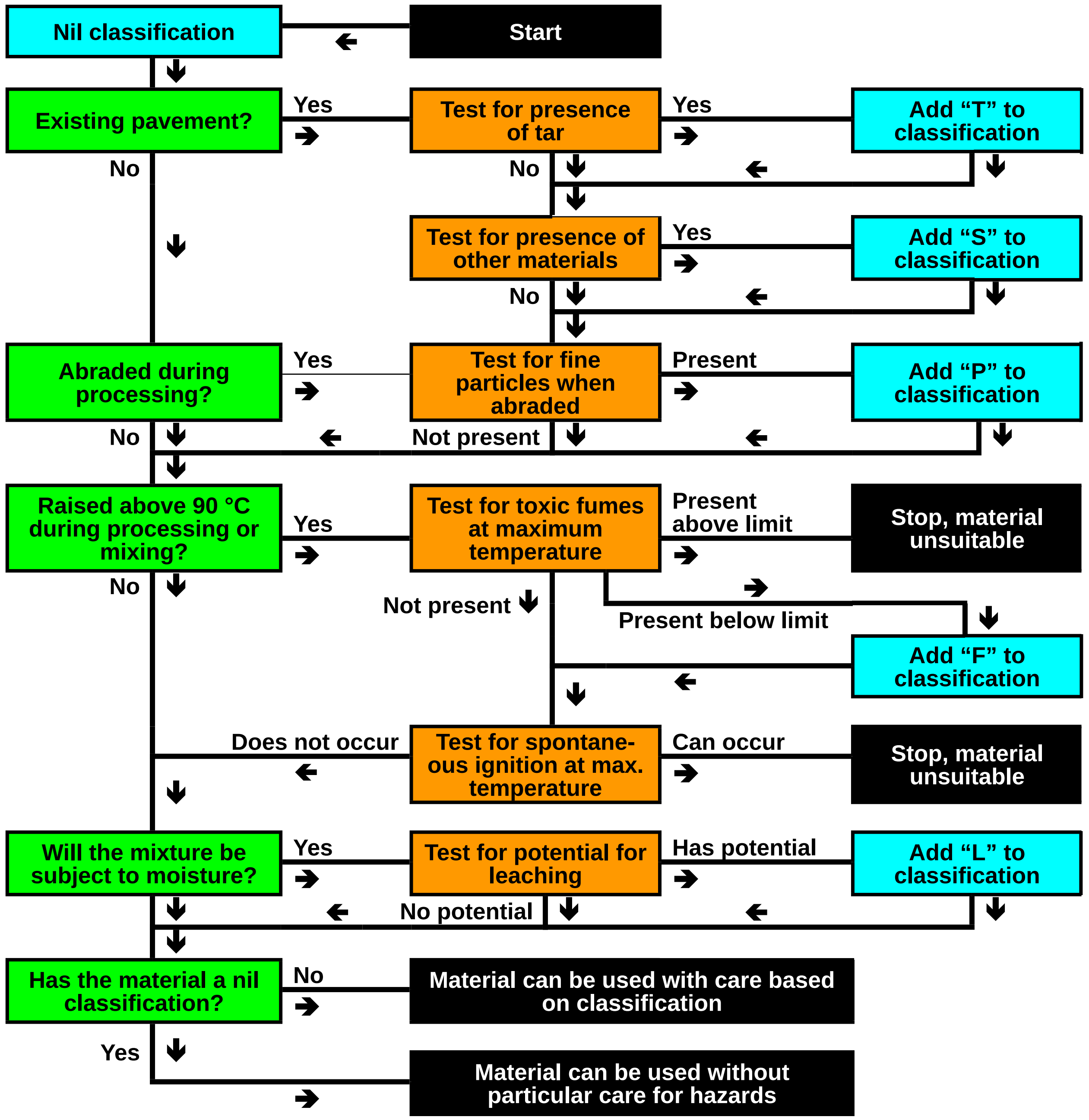
There are several materials that are known to have been used in asphalt which are now known to present a hazard. The most obvious example is tar, which was widely used as the binder during the beginning and middle of the last century but which has since been found to be carcinogenic. Another material that was used on occasions, and in which there is some renewed interest, which could be a hazard is sulphur, a material that presents a risk if particular precautions are not taken during handling. However, trying to build up a procedure based around known dangers can never be totally inclusive – there can always be an alternative hazardous component that has not been included because it was not expected to be put into asphalt or it comes from a contamination during the service life of the pavement. Therefore, the situations where any hazards can develop where considered.

The cycle of milling off worn asphalt, mixing it into a new asphalt material and laying that material, together with the possible influences on that asphalt in situ, lead to identifying several potential hazard and risk scenarios. The scenarios identified were:

- When milling, fine material (dust) could be freed into the atmosphere that can contribute to conditions such as pneumoconiosis and asbestosis. (In the past, asbestos was used in brake systems, insulation and other products but has subsequently been identified as carcinogenic that would present a hazard if found in reclaimed asphalt. However, it has not been explicitly included in the procedure at this time.)
- When mixing at elevated temperatures, components could be broken down and toxic compounds could be formed and expelled as fumes. Such fumes should be avoided whether they are dangerous to human health or are just irritants.
- When mixing, any inflammable component material could self combust at the elevated temperatures that can be reached. The resulting explosion and/or fire could potentially damage the plant and represent a threat to any operatives present.
- In service, any unstable component materials could leach into the water system. Such leaching could happen in the first use of a secondary material, but the additional abrading during milling could exacerbate any weakness and increase the potential.

Tests for these characteristics, together with for the best known potential hazards, have been introduced into a general procedure and is shown in the figure. Work is in progress to identify and develop appropriate test methods. An important feature of the procedure is that a risk analysis can be undertaken before the recycling work starts.

It is envisaged that the procedure should be used for type testing possible new component materials and/or combinations of components. It is not envisaged that the procedure will be part of the mix design procedure for routine mixtures. When hazards are found, finding a potential hazard should not necessarily mean that the relevant component material cannot be used in asphalt. Depending on the nature and extent of the hazard, the appropriate action to be taken, preferably as part of a total risk management strategy, could range from ensuring that, say, a particular temperature is not exceeded or a maximum proportion of the component is not exceeded to the complete avoidance of that component in any asphalt mixture.



Proposed Methodology of Testing for Hazards from Alternative Components

Typical early warning signs of durability problems in a bridge pier.

An elegant example of Europe’s highway infrastructure.

The Role of Corrosion Inhibitors in Repair Strategies

- by Dr. A. Legat, Slovenian National Building and Civil Engineering Institute (ZAG) and
Dr. Mark Richardson, University College Dublin

The application of inhibitors is a most promising technique for the corrosion protection of concrete structures. Corrosion inhibitors are chemical compounds which can reduce, or even prevent, corrosion of metals. In general, these compounds act only if they are present in adequate concentration (otherwise their action is insufficient, or even aggressive localized corrosion may be induced). Their use has proved to be effective in the chemical process and power production industries. It has been proposed that some of this technology be transferred to the rehabilitation of reinforced concrete structures. Mixed organic and inorganic compounds may have a significant role to play as new effective corrosion inhibitors in extending the service life of deteriorated structures. Surface-applied inhibitors, if effective, could greatly reduce the disruption to traffic during repair works by shortening the repair contract period considerably. One of the tasks in the SAMARIS project was an investigation of the basic corrosion properties of mixed organic inhibitors for concrete.

The main goal of the investigation was to assess the efficiency of the inhibitors and to determine the factors which influence this efficiency. Laboratory tests have been