

**In this Issue:**

**Quality of water infiltrated through surface with reclaimed asphalt pavement**

**A Monitoring Study to Estimate Spring Load Restrictions in Iceland**

**Water in Pavements Workshop in Madrid**

Résumé of the workshop organised by the WATMOVE team

**WATMOVE seminar Constantza, Romania, September 13th**  
this page

**Forthcoming Book**  
see page 3

## Find out more

[www.watmove.org](http://www.watmove.org)

is a *portal* to the web sites of the COST Action 351 in Europe. Keep up-to-date about our Action by checking this site from time-to-time. It's the first place that our reports will appear.

### Editors

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*Why not let us have some information about water in road pavements and their earthworks? We'd be very happy to publish details of your case history or re-search study in Issue 3, due out early 2007.*

## WATMOVE KEEPS MOVING!

Chairman Andrew Dawson, University of Nottingham, UK

The WATMOVE project is now in its third year and real progress has been made. Early on we took the decision that the most useful way to get best-practice into routine use, to inform road owners of modern developments in road drainage and to provide engineers with new understanding of material and pavement sensitivity to water content, would be to publish our findings in the form of a text book.

So I'm pleased to be able to say that our book is making good progress. In the box on page 3 you can see the draft chapter headings. We've also found a commercial publisher. We're currently in negotiation with Springer Science + Business Media B.V. of Dordrecht in the Netherlands and expect them to publish the book in Spring 2007.

To gain ideas and to let many of you know of our work we arranged a workshop in Madrid in October last year on the topic of Water in Pavements (WIP '05). More details of the workshop are available on page 4. A pre-publication book and CD are available from CEDEX (contact [Jose.M.Baena@cedex.es](mailto:Jose.M.Baena@cedex.es)) covering the 3 keynote presentations and 9 other papers. Carefully reviewed and revised papers are to be published in journal form later this year (see the box on page 4).

In addition we'll be giving a seminar in Constantza, Romania on September 13<sup>th</sup> this year. One of the strengths of the WATMOVE activity is the input from members in the 'Accession Countries'. With different traditions and constraints from engineers in Western Europe and the opportunity, in many respects, to start afresh in recent years, they're demonstrating their ability to look at old engineering problems from a new perspective and are greatly advancing our work. So we're keen to engage in dialogue both to give and receive expertise. If you'd like to know more about the seminar, please contact me.

This Newsletter is published to let our friends and colleagues know about our work. We hope you find it informative and interesting. The hard-working editors of Wat-Moves, Susanne Baltzar and Cyrille Chazallon deserve a special "Thank you". If you have comments about our study or this Newsletter, please contact me.

Best wishes,

**Mr. Andrew Dawson**

[andrew.dawson@nottingham.ac.uk](mailto:andrew.dawson@nottingham.ac.uk)



*Installation of sensors in one cross section of the low volume Icelandic road described on page 2.*

## Quality of water infiltrated through surface with reclaimed asphalt pavement

Michel Legret,  
Laboratoire Central des Ponts et Chaussées, France

An experimental research program has been conducted by the LCPC in order to evaluate the performance of asphalt pavement containing various rates of reclaimed asphalt. One of the focus areas was the potential of such materials for leaching pollutants into the environment.

Four experimental road sections were built using increasing rates of reclaimed asphalt in the new asphalt mix (from 0% to 30%) in order to study the long-term leaching of pollutants under field conditions. The quality of infiltrated waters was surveyed from October 2001 until January 2003.

The infiltrated waters appeared weakly polluted. The concentrations of heavy metals and hydrocarbons were rather weak. The sub-standard quality of waters was mainly due to de-icing operations and was related to the concentrations of chloride and sodium. Pollution peaks for the COD and the suspended solids also appeared but the concentrations were rather weak.



*Sampling of infiltrated water at the RN76 (Romorantin, France) experimental site. Photo: LCPC*

Measured concentrations were small and numerous sources of uncertainty exist. Nevertheless, it seems that there is no obvious difference in pollutants leaching through surfaces with different contents of reclaimed asphalt, nor compared to the reference road section.

For more information, please contact:

Michel Legret,  
[Michel.Legret@lcpc.fr](mailto:Michel.Legret@lcpc.fr)

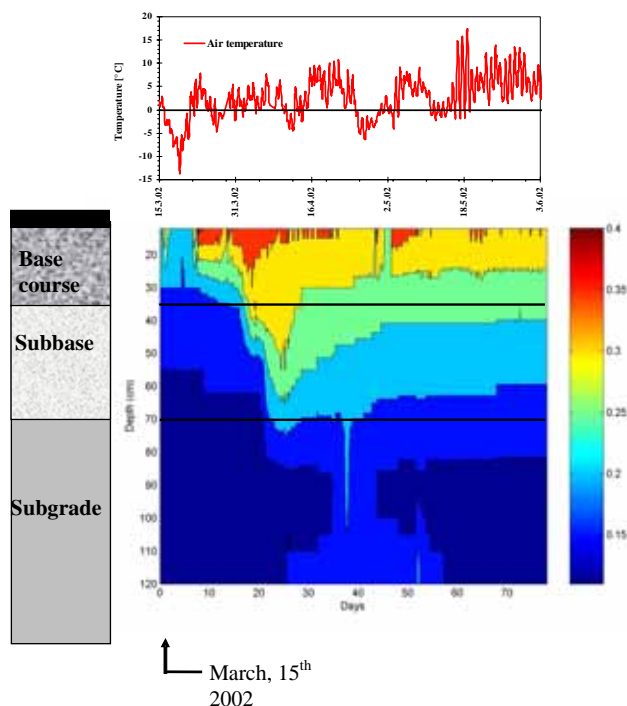
## A Monitoring Study to Estimate Spring Load Restrictions in Iceland

Sigurdur Erlingsson, University of Iceland &  
Gunnar Bjarnason, Icelandic Road Administration

The Icelandic Road Administration (ICERA) has a research project to monitor the environmental effects on bearing capacity of roads. One of the main objectives is to increase our knowledge of the effect of freezing and thawing on the bearing capacity of roads in order to establish a method for axle load restrictions.

The project involves monitoring of road sections where temperature, moisture content and electrical conductivity is measured at hourly intervals. Further, Falling Weight Deflectometer is used to measure bearing capacity.

The figure below shows an example of measurements from 2002, covering a freeze-thaw period. The temperature (air temperature) raises above the freezing point on the 19th of March and that the moisture in the top layer soon after increases. As the thawing period continues the moisture content increases and penetrates deeper into both the sub-base and the subgrade layers. About one month later the moisture content reduces and the spring thaw period ends.



*Volumetric moisture content as a function of depth and time in days after March 15, 2002. The air temperature is also shown, top, as well as a cross section through the low volume pavement structure.*

For more information, please contact:

Sigurdur Erlingsson,  
[Sigger@hi.is](mailto:Sigger@hi.is)

## WATMOVE to produce a book

### The Chairman writes .....

In the Watmove team, we are well advanced in drafting a book to contain the major outputs of our work. It will try to cover all aspects of water and water movement IN roads and their immediate surroundings. We'd like to cover road surface drainage as well, but that would more than double our work, so we've decided to limit ourselves to water inside the road. Of course, a lot of that water comes from infiltrating run-off, so we shall have to cover some aspects of run-off, too.

We aim to look at the effects of moisture on performance, how water moves in the pavement and its surroundings, how it can be controlled, sub-pavement drainage design and to cover the environmental issues associated with the protection of ground and surface water due to seepage of water from run-off or from leaching construction material. Opposite is a draft list of chapter headings. Please let us know if you think there's something missing!

We are in the middle of negotiating a publication deal with the international publishers Springer Science + Business Media B.V. We hope that this will ensure the book's wide availability.

### Conference Announcements

8th Int'l. Conf. Modelling, Monitoring & Management of Water Pollution, 4-6 September 2006, Bologna, Italy,  
[www.wessex.ac.uk/conferences/2006/water06](http://www.wessex.ac.uk/conferences/2006/water06)

6th European Conference on Numerical Methods in Geotechnical Engineering, 6-8 September 2006, Graz, Austria,  
[www.numge06.tugraz.at](http://www.numge06.tugraz.at)

10th IAEG Congress - Engineering geology for tomorrow's cities, 6-10 Sept. 2006, Nottingham, UK,  
[www.iaeg2006.com](http://www.iaeg2006.com).

WATMOVE seminar, 13th September 2006, Constantza, Romania, [www.watmove.org](http://www.watmove.org)

6th Int'l. DUT-Workshop, Fundamental Modelling of Design & Performance of Concrete Pavements, 15-16 September, 2006 in Priorij Consendonk, Old-Turnhout, Belgium,  
[www.tinyurl.com/87stb](http://www.tinyurl.com/87stb)

86th Transportation Research Board, Annual Meeting, 21-25th January 2007, Washington, DC, USA, [www.trb.org](http://www.trb.org)

2nd International Conference on "Mechanics of Unsaturated Soils, 7-9 March 2007, Bauhaus-Universität Weimar, Germany, <http://cns4.de/uss2007/>

Int'l. Conf. Advanced Characterization of Pavement & Soil Eng'g Materials, 20-22 June 2007, Athens, Greece,  
[www.3dfem.org](http://www.3dfem.org).

Int'l. Symp. Asphalt Pavements & Environment, 18-20 August, 2008, Zürich, Switzerland, [www.empa.ch/isap2008/](http://www.empa.ch/isap2008/)

### Draft Chapters

Introduction  
Roads and their hydrological setting  
Water flow theory in saturated & unsaturated soils  
Heat transfer in soils  
Measurements techniques for water flow  
Contaminants of water in the pavements  
Contaminant monitoring and detection  
Water influence on bearing capacity and pavement performance – Field observations  
Mechanical effects and control of water in pavement – Theoretical aspects and modelling  
Mechanical effects– Experimental investigation & dependency on water and moisture  
Coupling of mechanical response with heat & moisture transfer processes in pavement structures  
Control of pavement water  
Pollution mitigation



## Questionnaires provide knowledge on state-of-practice

Susanne Baltzer, Danish Road Institute

In early spring 2005 we sent out a questionnaire to contact persons in most of the world. We are very grateful that as many as 18 countries answered – 16 European and two states in the USA. The answers will provide important input to our final book.

All answers from the questionnaires are structured in two reports that are uploaded on the WATMOVE website. One report concerns "Pavement drainage" and the other concerns "Environmental aspects of water in road pavements and embankments".

Please check out the reports on [www.watmove.org](http://www.watmove.org) - they are very informative and useful.

For more information, please contact:

Susanne Baltzer,  
[sub@vd.dk](mailto:sub@vd.dk)

# Resume of the 'Water in Pavements' workshop, WIP'05

Lyesse Laloui, Swiss Federal Institute of Technology

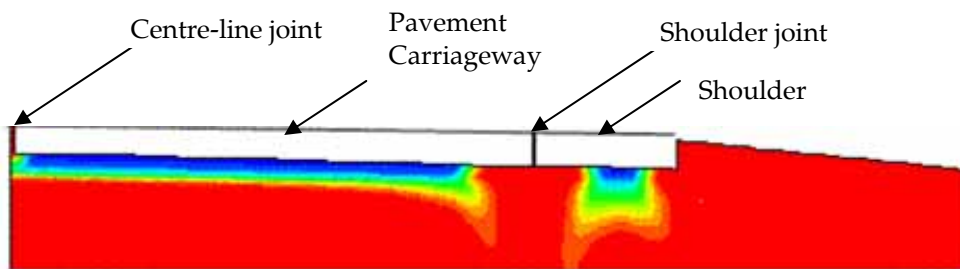


WATMOVE, that is COST 351, organised the workshop Water in Pavements, WIP'05, in Madrid on October 27<sup>th</sup> 2005. The workshop was held at CEDEX' facilities downtown Madrid and members of the scientific committee were José Baena, CEDEX, Spain, Mihael Brenčič, Geological Survey of Slovenia and Lyesse Laloui, Ecole Polytechnique Fédérale

de Lausanne, Switzerland. Invited keynote speakers gave presentations together with authors of accepted papers from the WATMOVE group and external contributors. Both practising engineers and researchers joined the workshop which involved pavement performance in relation to moisture, modelling and monitoring moisture and environmental aspects.

European countries represented among speakers were Switzerland, France, Spain, Belgium, and UK. Accepted non European papers were submitted from Australia and USA. The single Australian paper was presented by the COST 351 chairman but fortunately three speakers arrived from USA to present their papers in person. One of these was Claudia Zapata from Arizona State University who presented a paper co-authored by, amongst others, Prof. Matthew Witczak. Zapata discussed how temperature and moisture distribution within the pavement is modelled in the new AASHTO pavement design procedure. Witczak has been heavily involved in developing the AASHTO procedures over several years and Zapata joined the team a couple of years ago. Defne Apul, University of Toledo, Ohio, gave a presentation on contaminant transport in roads. The figure shows how salts are washed through a shoulder joint while the effect of the centreline joint is negligible as the slope directs precipitation from the centre towards the shoulder.

Information about Proceedings from WIP'05 is available at [www.watmove.org](http://www.watmove.org).



**Aqueous concentrations of salts in a half cross section of a road with two cracks – a centreline joint and a shoulder joint (see box for explanation).**

**Special issue of the International Journal of Road Materials and Pavement Design**

Drawing on some of the highlights of the WIP '05 workshop, a special issue on "Water in Pavements" is currently being prepared by Lyesse and José to be published by the International Journal of Road Materials and Pavement Design (RMDP). There will be six papers (120 pages) devoted to the mechanical and the environmental aspects of water in pavements. In particular the selected original papers address the performance related properties, the modelling and the monitoring of water flow and moisture within pavements and subgrades. This is a part of the dissemination activities of the WATMOVE Action. The special issue should appear by the end of 2006.

For more information, please contact: Lyesse at [Lyesse.Laloui@epfl.ch](mailto:Lyesse.Laloui@epfl.ch)

*Concentrations are normalized to initial values. Blue colour indicates that the concentration at that given point is equal to the initial concentration in the base layer. Results are for after 12 months in Minnesota climate. Rectangular box, in white, represents the surface layer; the base layer with secondary material lies immediately below it.*

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