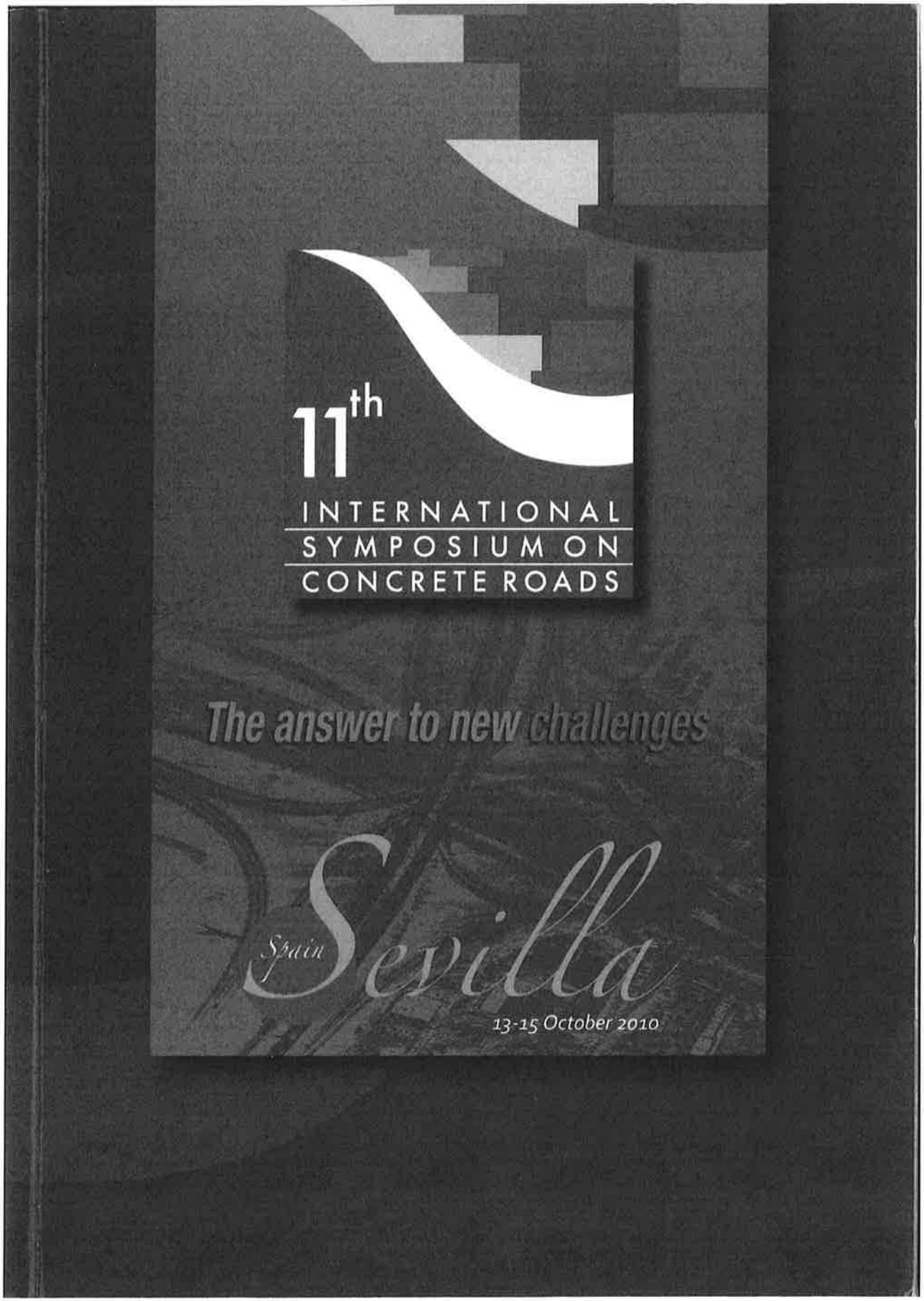
11th
INTERNATIONAL
SYMPOSIUM ON
CONCRETE ROADS
The answer to new challenges
Spain
Sevilla
13-15 October 2010

TEMAS

Tema 1: Diseño, planificación y evaluación de los pavimentos

- Sistemas de tomas de decisión
- Coste durante la vida útil
- Técnicas de evaluación
- Pavimentos de larga duración
- Especificaciones

Tema 2: Construcción sostenible

- Pavimentos respetuosos con el medio ambiente
- Bajas emisiones de CO_2
- Consumo de combustibles
- Reciclado
- Efecto "isla de calor", pavimentos fríos
- Seguridad - Resistencia al deslizamiento
- Bajos niveles de ruido
- Reducción de obstáculos para los usuarios
- Consideraciones energéticas
- Pavimentos compuestos
- Pavimentos permeables
- Cambio climático
- Reducción de contaminantes

Tema 3: Técnicas para un correcto mantenimiento, reparación y rehabilitación

- Pavimentos de rápida apertura al tráfico
- Refuerzo de hormigón ultradelgado
- Refuerzos y cajeados
- Losas prefabricadas

Tema 4: Aplicaciones alternativas especiales

- Pavimentos en túneles y puentes
- Autobús y tranvía
- Aeropuertos
- Pavimentos industriales
- Hormigón estético
- Barreras de seguridad de hormigón
- Puertos
- Carriles bici

Tratamiento y reciclado de materiales para las infraestructuras del transporte

- Suelos estabilizados

THEMES

Theme 1: Pavement design-planning evaluation

- *Decision support systems*
- *Life cycle cost*
- *Evaluation techniques*
- *Long-life pavements*
- *Standards & specifications*

Theme 2: Sustainable construction

- *Environmental-friendly pavements*
- *Low CO_2*
- *Fuel consumption*
- *Recycling*
- *Heat island eff ect - Albedo*
- *Safety - skid resistance*
- *Low noise*
- *Reduction hindrance to users*
- *Energy considerations*
- *Composite pavements*
- *Permeable pavements*
- *Climate change*
- *Pollution reductions*

Theme 3: Techniques for good maintenance, repair & rehabilitation

- Fast-track, early opening
- (Ultra)(Thin) white topping
- Overlays-inlays
- Precast slabs

Theme 4: Alternative & special applications

- *Tunnel & bridge pavements*
- *Bus & tram*
- *Airports*
- *Industrial pavements*
- *Aesthetical concrete*
- *Concrete safety barriers*
- *Ports-harbors*
- *Cycle tracks*
- *New materials (Ultra high performance concrete (UHPC))*
- *Innovative pavements*

Treatment and recycling of materials

- Soil stabilization

ÍNDICE DE RESÚMENES
INDEX OF ABSTRACTS

Conferencias especiales / *Keynote speeches*

Areas dedicated to public transport: bus, tramway. Innovative responses to specific issues of integration, speed and ruggedness 16
Jean-Pierre Christory, Joseph Abdo, Alain Depetrini, Jacques Malod-Panisset, Jean-Paul David

Sustainability opportunities with pavements: are we focusing on the right stuff? 17
L. Wathne

Tema 1 / *Theme 1*

Technical and economical feasibility of pavement widenings in cement concrete in the Netherlands 18
Marc J.A. Stet, Wim A. Kramer, Wilfred A.M.G. Nijssen, George Jurriaans

Working mechanisms of air-entraining admixtures and their subsequent activation potential 18
E. Eickschen, G. Thielen

Latest findings on the construction type "Continuously Reinforced Concrete Pavement" 19
S. Höller

New Hungarian regulations for concrete pavements and their application in Hungary 19
K. Karsai, É. Szántó, Z. Vörös

Nonwoven geotextile interlayers for separating cementitious pavement layers: use in Germany leads to better practice in US 20
S. Garber, S. Höller, R. Rasmussen

Crack behaviour of continuously reinforced concrete pavements 21
P. De Winne, A.S. Poupeleer, L. Rens, F. Feys

Decision-making support model for sustainable road pavements 21
S.B. van Hartskamp, A.J. van Leest

Design of concrete slabs with optimized geometry 22
J.P. Covarrubias Jr., J. Roesler, J.P. Covarrubias

Forty years of life of the hydraulic concrete pavements of the autopistas Aumar (Abertis Autopistas) 23
J.R. Graciani

A long-life continuously reinforced concrete pavement in service since 1976 in Spain. Widening and future 23
I. García-Arango Cienfuegos-Jovellanos, J. Díaz Minguela

Continuously reinforced concrete pavement in the A-7 Mediterranean motorway of Spain 24
F. Ruiz-Hidalgo, R. Marín Peñas

Long-term performance of a concrete pavement in a motorway on plastic soils in Spain 24
C. Jofré, C. Rodríguez

Technical prescriptions for concrete pavements by the Spanish Ministry of Development 25
M. Gómez, M. Megía

Spanish experience in the design of long-life pavements. Case study: northern Orense bypass, connection with the CN-120 at kilometre 573.800 and connection with the CN-525 at kilometre 241.200 25
A. Güell Cancela

The advance of concrete pavements in Brazil 26
R. Vizzoni, M. Dutra de Carvalho

Concrete pavements in Argentina. *Development and evolution* 27
E. Marcolini, E. Souza, D. Calo

Planning and dimensional analysis of block and slab pavements for heavy traffic loads 27
R. Blab, W. Kluger-Eigl

Evaluation of the pavement structure of concrete road constructions using the Falling Weight Deflectometer (Fwd) 28
C. Karcher, K. Kubanek, R. Roos

Concrete and bituminous pavements in the Seville - Cádiz motorway. Comparison of total costs 28
J.M. Morales Sánchez

ÍNDICE DE RESÚMENES
INDEX OF ABSTRACTS

Design and construction of an experimental two layer concrete pavement motorway section in Spain 29
J. Follia, A. Sales, J.P. Ainchil, S. Carrascón, I. Machimbarrena

Initial cost comparison of rigid and flexible pavements: under different traffic and soil conditions 30
T. Akakin, Y. Engin, S. Ucar

Introduction of new requirements for concretes for road and airfield pavements in Russia 30
V.I. Korshunov, I. Basurmanova, Y. Lange, V. Yumashev

A comparative study of test methods for the resistance of concrete to freeze-thaw cycles as described in CEN/TS 12390-9, ISO/DIS 4846-2, and NTN-018 31
O. De Myttenaere, A. Beeldens, C. Pierre, O. Germain, L. Vandewalle, W. Figeys

Improvement of pavement concrete properties using mineral additives 32
D. Popovic

Tema 2 / *Theme 2*

Testing and standardisation of recycling concrete on Cycle Tracks in The Netherlands 33
F. Smits, A. Geerlings

Development of the Next Generation Concrete Surface(s) 33
L. Scofield, R. Bernhard, P. Donavan

Exposed aggregate concrete pavement design, construction, and functional performance: a comparison of European and US experiences 34
R. Rasmussen, S. Garber, H. Sommer, E. Cackler, A. Gisi, G. Fick

Concrete pavement recycling practices in the U.S. 35
M. Snyder, R. Rodden

Competition and its role in pavement type selection in the U.S. 35
L. Wathne, B. Davenport

Study of alternative materials 36
L. Moreno Anselmi, D. Rodríguez Urrego, J. Lee Mariño

New design of exposed aggregate surface for northern entrance of Apeldoorn Constructional and acoustical aspects 36
G. Jurriaans, W. van Keulen, S. Lubberhuizen, T. van Bokhoven

Two-lift construction to address today's challenges 37
J. Grove, P. Taylor

Pervious concrete pavement performance in the Canadian freeze-thaw climate 38
V. Henderson, S.L. Tighe

Sustainability and concrete pavements for real engineers 38
P. Taylor, T. Van Dam

Effect of pavement type on rolling resistance and fuel consumption of heavy-duty vehicles 39
T. Yoshimoto, T. Kazato, I. Hayakawa

Measurements of fuel consumption on an asphalt pavement and a concrete pavement in Sweden 39
B.Å. Hultqvist

Concrete roadways and air quality - Assesment of trials in Vanves in the heart of the Paris region 40
L. Gignoux, J.P. Christory, J.F. Petit

Concrete pavements as a source of heating and cooling 41
P. Keikha, M.R. Hall, A.R. Dawson

A double-layered CRCP: experiences on the E34 near Antwerp (Belgium) 41
L. Rens, H. Keymeulen, I. Van Wijnendaele

Warming of urban street surfaces during summer heat waves 42
M. Peyerl, S. Krispel

Increase of safety of concrete pavements. Bright concrete pavements with dark aggregates 42
S. Krispel

Characteristics of today's concrete surfaces 43
M. Briessinck, L. Rens

ÍNDICE DE RESÚMENES
INDEX OF ABSTRACTS

Investigation and classification of low-noise concrete roads 44
M. Haider

The construction of the Rosario - Cordoba highway. An emblematic project of the road activity in Argentina 44
H. Perret, M. Sanziani

Life cycle assessment for road construction and use 45
C. Milachowski, T. Stengel, C. Gehlen

Finely graded surface concrete (FGSC): a sustainable solution for exposed-aggregate concrete 45
T. Sedran, F. de Larrard

Cettons II Business Park: Birth of a multi-innovative eco-friendly park around an integrated milled-aggregate concrete roadway 46
A. Figéac, F. Batista, J.P. Christory

Innovative photocatalytic cementitious road materials 47
G.L. Guerrini, M. Crispino, S. Vismara

Experiences in the use of siliceous river gravel for concrete pavement construction 47
E. Souza, D. Calo, M. Camueira, J.M. Tobes

Slag usage in concrete pavement 48
I. Bariši , S. Dimter, I. Netinger

Measurements of the emissions of particulate matter (PM10) from a concrete compared to a stone mastic asphalt highway 48
C. Johansson

Concrete pavement design under sustainability criteria 49
G. Sánchez Álvarez

Durability of exposed aggregate pavement 50
J. Skarabis, R. Beddoe, A. Spengler, C. Gehlen

Tema 3 / *Theme 3*

Demonstrating the use of Ultra Thin Reinforced Concrete Pavements to serve residential areas in cities 51
M. Rafeek Louw, A.O. Bergh, A.M. McKay

Experience with the construction of an Ultra-Thin Continuously Reinforced Concrete Pavement 52
A.F. Burger, L.J. Ebels, A.C. Brink

Evaluation by Fwd and faultimeter of concrete slabs stability 52
S. Pérez, C. Van Geem

Whitetopping – a quick and cheap way to resolve rutting 53
S. Riffel

'Whitetopping' with ultra-thin layers of High and Ultra High Performance Concrete 54
M. Schmidt, S. Freisinger-Schadow, U. Stöckert

Thin concrete overlays: US case studies and performance 54
S. Tayabji, K. Smith

A case history of CRCP rehabilitation on the E403 motorway near Bruges – Belgium 55
H. Vanderdonckt, B. Brugghe, L. Rens

Slab Jacking – Development of new materials 55
T. Alte-Teigeler

Ten years of good performance of Ultra-Thin Whitetopping experiment in Brazil – Summary of main learnings 56
J. Balbo, T. Cervo, D. Pereira, L. Khazanovich, J. Abreu

Fast – track concrete for repairs in a continuously reinforced concrete pavement in Spain 57
J. Díaz-Minguela

Influence of temperature on Falling Weight Deflectometer. Test results on concrete pavements 57
A. Szydlo, I. Ruttmar

Mexico city interior loop 58
P. Garza Chapa

The CRCP/BBGA composite structure for the Bassens Building Site (Gironde Department in France) 58
L. Dutruch, H. Kabré

ÍNDICE DE RESÚMENES
INDEX OF ABSTRACTS

A bonded concrete overlay in an urban boulevard in Calviá (Mallorca, Spain) 59
B. Ferrá, R. Rueda

Modern SFHC – Super Fast Hardening Concrete repair system for airfields and roads, based on special cement for infrastructure projects 59
S. Riffel, V. Hanke

Tema 4 / *Theme 4*

Durable futuristic roundabout in the city of Eindhoven, The Netherlands 61
F. Smits, H. van Os

Environmentally friendly and durable concrete barrier (A73) 61
W.A.M.G. Nijssen, G. Jurriaans

The Ekkersrijt sustainable roundabout construction (A50) 62
R.A.M.J. Van der Aa, G. Jurriaans, H.W.A. Vissers

Fibremix concrete for road and industrial pavements 63
G. Jurriaans, W.A.M.G. Nijssen, S.H. Faerber, J. Verwaard, W.C. van den Boom

Three year performance of continuously reinforced concrete pavement with glass fibre reinforced polymer bars 63
D. Thébeau, B. Benmokrane, S. El-Gamal

The design of URC, heavy duty slip-formed concrete pavement for a port environment 64
G. Griffiths

Concrete roundabouts in Switzerland 64
R. Werner, E. Monticelli

Permeability behaviour of recycled SFRC and its implications in the durability resistance of rigid pavements 65
A. Graeff, C. Lynsdale, K. Neocleous & K. Pilakoutas

Roundabouts with concrete pavements: Austrian experiences 66
J. Steigenberger

Precast concrete pavement for intermittent concrete pavement repair applications 66
S. Tayabji, N. Buch, D. Ye

Experiences in local concrete road construction in Poland 67
J. Deja, P. Kijowski

Pavement for a polyvalent area for its use as a fairground in Écija 67
J. Silgado Rodríguez, M. Vera

Contribution of concrete pavements to the safety of tunnels in case of fire 68
C. Jofré, J. Romero, R. Rueda

Continuously reinforced concrete pavement in Marchena bypass 69
L. Quintana, M. Borrego , J. Castilla, M. Vera

Concrete pavements in the province of Almeria. The experience of the Diputación de Almería 69
C. González Sáez, M. Vera

Concrete bus lanes 70
L. Rens, W.A. Kramer

Roundabouts in continuously reinforced concrete design - construction 70
R. Debroux, R. Dumont, C. Ployaert

The cyclo-pedestrian footbridge over the former L160 railway line in Brussels 71
Y. Mosseray

Execution of concrete pavements with a fixed moulds system – The experience of Portuguese air force 71
A. Antunes

High performance cementitious material (HPCM): a long-life wearing course for heavy duty pavement 72
F. de Larrard, J. Chandler, F. Thøgersen

Modern concrete safety barriers. State of the art 2010 72
T. Edl, A. Barnas

Concrete pavements for dedicated lanes for buses 73
R. Rueda

ÍNDICE DE RESÚMENES
INDEX OF ABSTRACTS

Photometric characterisation of the concrete pavement in the SINARD tunnel. Favouring a sustainable concrete pavement 73
S. Horvath, V. Muzet

Joints design in rigid pavement - Octagonal slabs linked with square slabs 74
A. Saragusti

Specifications for the construction of steel fibre-reinforced roller compacted concrete roads 75
K. Koutselas, K. Neocleous, H. Angelakopoulos & K. Pilakoutas

Non-reinforced Concrete Pavements for heavy-load service 75
S. Villaret, L. Pfeifer

Mix designs targeting concrete flexural strength and modulus for airfield concrete pavements 76
J. Gagnon, D. Brill, J. Davis

Development and quality control of concrete mixture design for a tunnel pavement application 77
T. Turgut, Ö. Okyay, Y. Akkaya, A. Şinikoğlu

Recycling center. New concrete overlay for the existing asphalt pavement 77
J. Silgado Rodríguez, M. Vera

Slipform Concrete Barrier – The ultimate Safety Solution 78
A. Erwee

Safety and durability of pedestrian precast concrete pavements 78
O. Nieto Sanz

Posibilities of concrete pavement blocks 79
O. Nieto Sanz

Tratamiento y reciclado de materiales
Treatment and recycling of materials

The Belgian code of good practice for soil treatment with lime and hydraulic binder: update 80
C. Grégoire, B. Dethy

Cyclic CBR test of the natural and improved soils 80
J. Hauser, L. Ševelová, A. Kozumplíková

Special high technology binding materials for stabilization / solidification of contaminated soils 81
S. Lizarraga

Experiences with cement stabilisation in Australia and South East Asia 81
E.Petrie, T.D. Wimot

Assesment of pick-excavability of controlled low-strength materials for trenches 82
C. Morin, T. Sedran, F. de Larrard, H. Dumontet, S. Murgier, M. Hardy, C. Dano

Subgrade stabilization and pavement recycling for the cross section enlargement in the A-495 road in Huelva (Spain) 82
G. Domínguez Guerrero

Main road RN7 between La Pacaudière and Changy (Loire, France): a high performance treated capping layer at the limit of the specifications 83
S. Bernhard, X. Fayoux, R. Contassot, C. Jallet

Mix design and mechanical evaluation of hydraulically bound mixtures made with waste foundry sand and steel slags 84
M. Pasetto, N. Baldo

Replacing the aggregate by rice husk ash in roller compacted concrete for composite pavements 84
J. Villena, G. Trichês, L.R. Prudêncio Jr.

Cement treated base with recycled aggregates coming from C&D Wastes 85
F. García de la Cruz, A. Núñez

CRACK BEHAVIOUR OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS

P. De Winne
Faculty of Engineering Sciences, Department Civil Techniques, Ghent University, Belgium
Flemish Ministry of Mobility and Public Works, Road and Traffic Agency, Road Engineering Division, Belgium
pieter.dewinne@mow.vlaanderen.be
Anne-Séverine Poupeleer
Flemish Ministry of Mobility and Public Works, Road and Traffic Agency
anneseverine.poupeleer@mow.vlaanderen.be
L. Rens
Federation of the Belgian Cement Industry (FEBELCEM)
l.rens@febelcem.be
F. Feys
Faculty of Engineering Sciences, Department Civil Techniques, Ghent University, Belgium
femke.feys@ugent.be

ABSTRACT

The use of continuously reinforced concrete pavements (CRCP) is well spread in Belgium, mainly because of the confidence in its durability. It is used frequently on Belgian motorways and also on other heavily trafficked roads.

The behaviour of CRCP is influenced by a number of specific characteristics such as the crack pattern, the crack distances and crack widths, but also by the movement of the pavement due to temperature variations, both seasonal and day-night.

In the past, several studies and monitoring of performance have led to recommendations in the design of CRCP. In controlling the crack distances and the crack widths in CRCP, which is important, many different reinforcement percentages and tensile strengths of the concrete have been applied in the former and current design characteristics.

Current contribution describes a number of observations and experiments conducted in the last decades with respect to the crack distances for the modern fine exposed aggregate concrete surfaces.

DECISION – MAKING SUPPORT MODEL FOR SUSTAINABLE ROAD PAVEMENTS

Steef B. van Hartskamp
Province of Noord-Brabant, the Netherlands
svhartskamp@brabant.nl
Adrian J. van Leest
CROW Technology Platform, the Netherlands
vanleest@crow.nl

ABSTRACT

The task of calculating road pavements is an easy one. However, reaching the point of choosing a type of pavement one is confronted with many possible solutions. They can all meet to the technical terms, such as bearing capacity, safety and durability.

The growing importance of sustainable building has added a new dimension to the process of decision-making. Not only construction costs, maintenance costs and environmental impact have to