Hrvatsko asfaltersko društvo Croatian asphalt association

Europska istraživanja u području asfaltnih kolnika

European Research Activities in Asphalt Pavements

Rudi Bull-Wasser, Federal Highway Research Institute (BASt), Germany

Međunarodni seminar ASFALTNI KOLNICI 2016

International seminar ASPHALT PAVEMENTS 2016

Opatija, 06. – 07.04.2016

Content

- Introduction
- Funding bodies & programs
- Selected research projects
- Summary

Presentation objectives:

- Make aware of EU research opportunities
- Indicate possible impacts
- Encourage you to participate

Who is funding research across Europe?

– **National bodies**

Example: Germany 

- Ministry of Transport and Digital Infrastructure
- Ministry of Education and Research
- Ministry for Economic Affairs and Energy

- German Federation of Industrial Research Associations - AiF
- DFG - Deutsche Forschungsgemeinschaft

Who is funding research across Europe?

– **National bodies**

Example: Croatia 

hrzz
Hrvatska zaklada za znanost

- Croatian National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia

  Funds research projects, laboratories and research groups of all fields, including Civil Engineering

- Croatian Ministry of Science, Education and Sports
- National Civil Engineering Research Institute: Institut IGH

Example of national funded reseach project: PAST

Norbert Simmleit

EAPA SYMPOSIUM 2014

PAST

- Supported by German Ministry of Economy and Technology
- Project leader:

  Hermann Kirchner GmbH (Member of STRABAG SE)
- Partners:

  5 equipment and component suppliers

  2 Universities

  German Federal Highway Research Institute (BASt)
- Project period: 2008 – 2012
- Total costs: 4 Mio. €

Bundesministerium für Wirtschaft und Technologie

KIRCHNER

CARNEHL FAHRZEUGBAU

MOBA MOBILE AUTOMATION

TÜVRheinland

DEUTSCHE ASPHALT

DYNAPAC Part of the Atlas Copco Group

Fachhochschule Köln University of Applied Sciences Cologne

bast

TECHNISCHE UNIVERSITÄT DARMSTADT

TPA

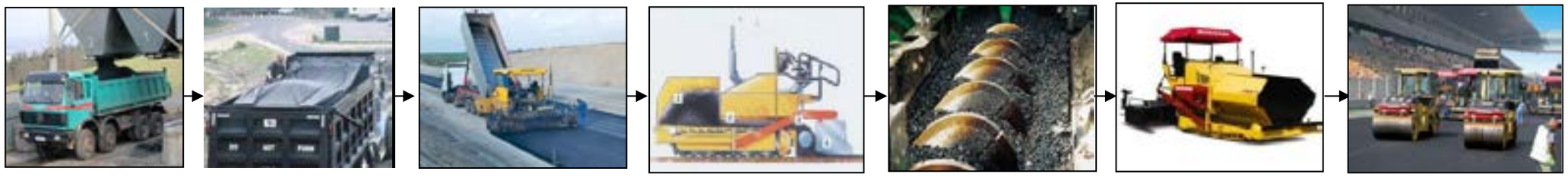
STRABAG

7

„Prozesssicherer Automatisierter Straßenbau“ (PAST 1)

(Automatic, process-reliable road construction)

Problem analysis → Development of solutions → Demonstrators



Segregation

Temperature level and temperature distribution

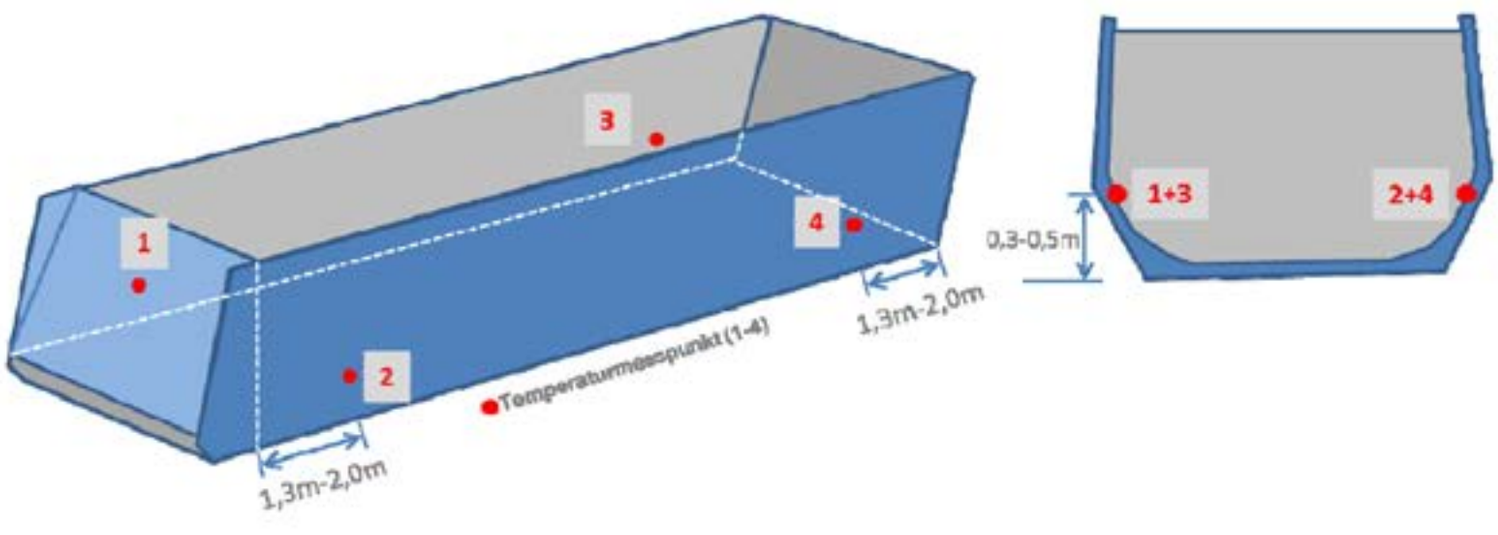
Evenness

Information and data transmission

Requirements for the transport of asphalt mixtures with thermo isolated trucks

The use of thermo isolated trucks is mandatory for the transport of asphalt mixtures for surface, binder and base course. This will be applied in 3 stages:

- Stage 1 (01.01.2015 till 31.12.2016)
  →mandatory for asphalt surfaces >18.000 m^2 till 60.000 m^2
- Stage 2 (from 01.07.2017 till 31.12.2018)
  →mandatory for asphalt surfaces >18.000 m^2
- Stage 3 (from 01.01.2019 onwards)
  →mandatory for all asphalt surfaces



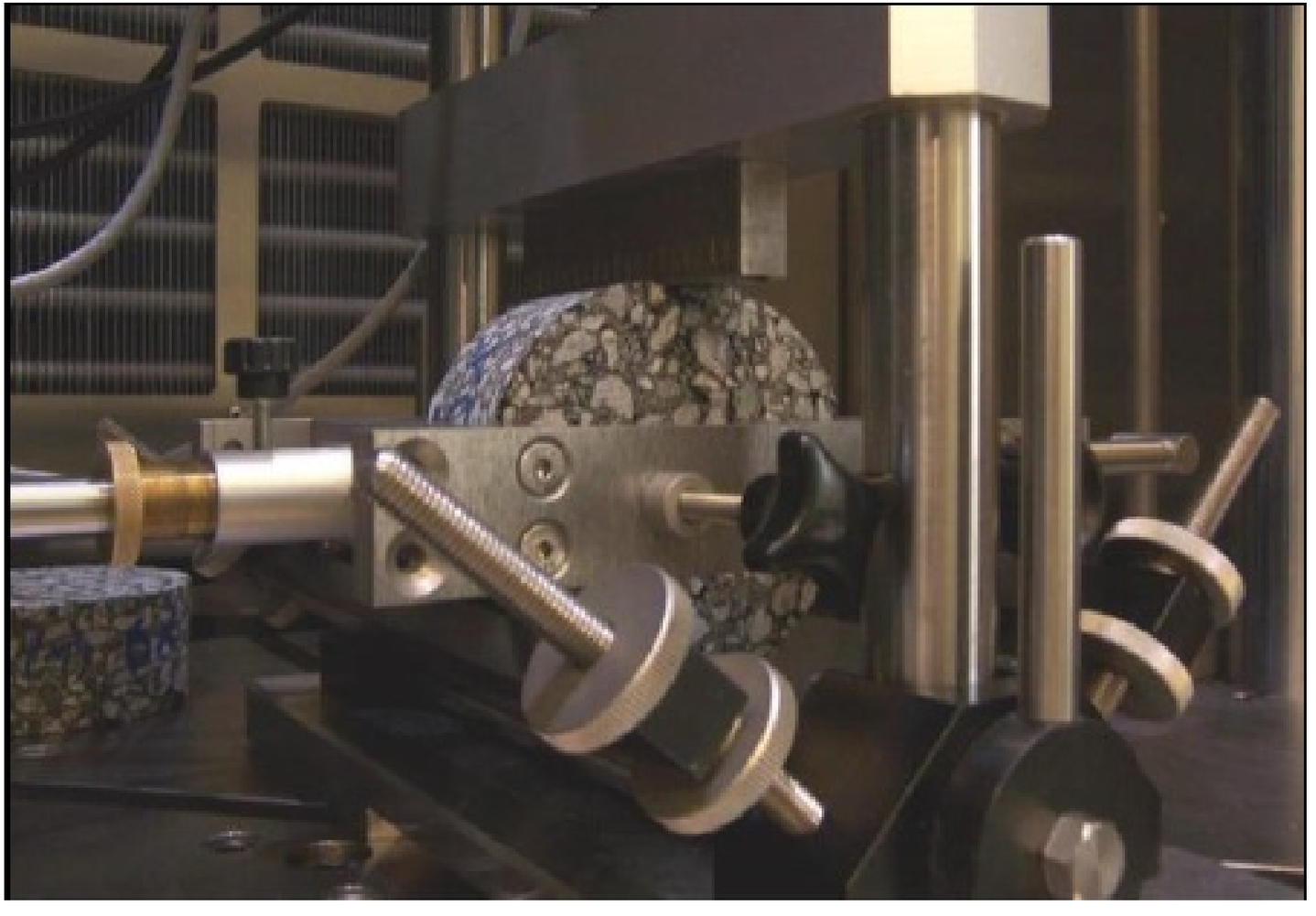
Construction equipment improvements

Construction companies nowadays use leveling devices, equipment to measure layer thickness and devices that automatically “remember” and restore the paver’s setup parameters to achieve better overall construction quality

Example of national funded reseach project: PerformA

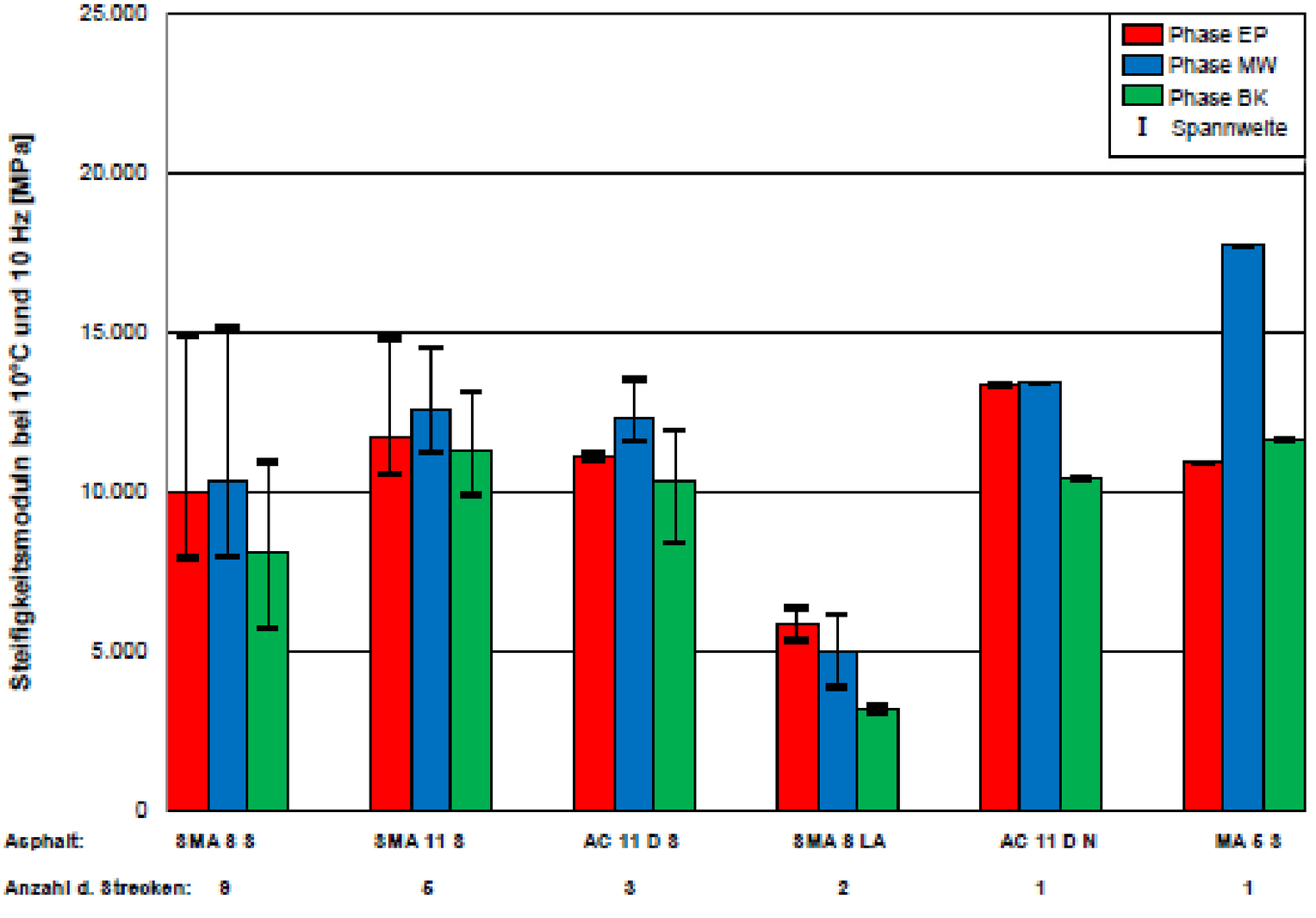
-Objective: Determine all performance-relevant characteristics of currently-manufactured asphalt mixtures during all phases: design, production and construction.

PerformA

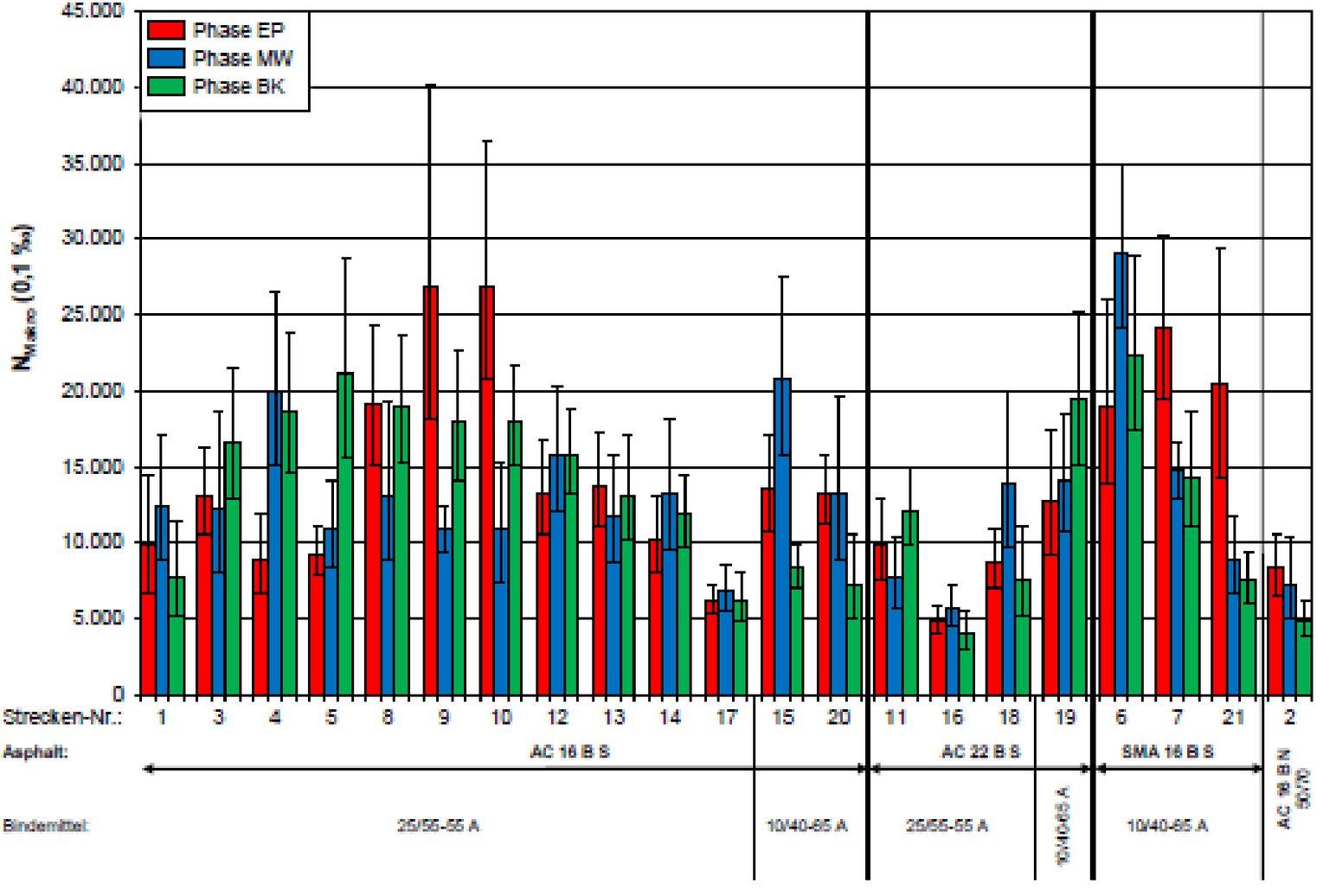


Stiffness/fatigue: Cyclic indirect tensile test (CITT)

PerformA
Results: Stiffness



PerformA
Results: Fatigue



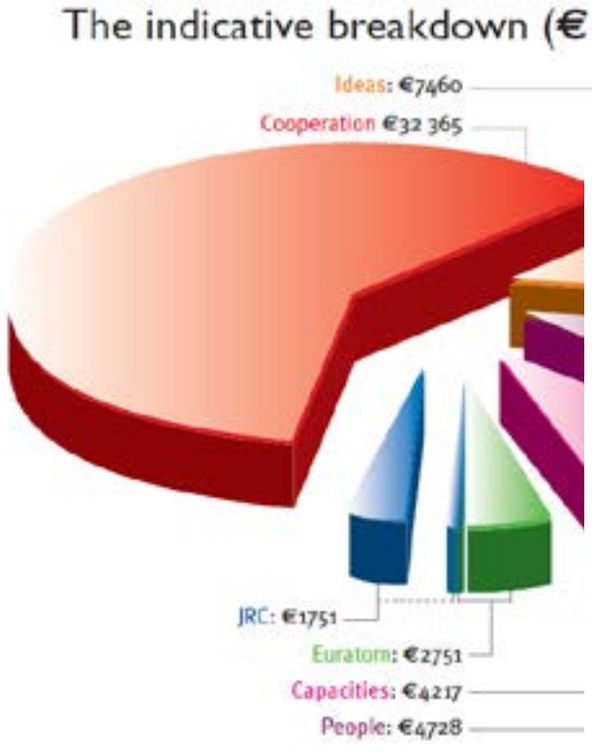
Who is funding research across Europe?

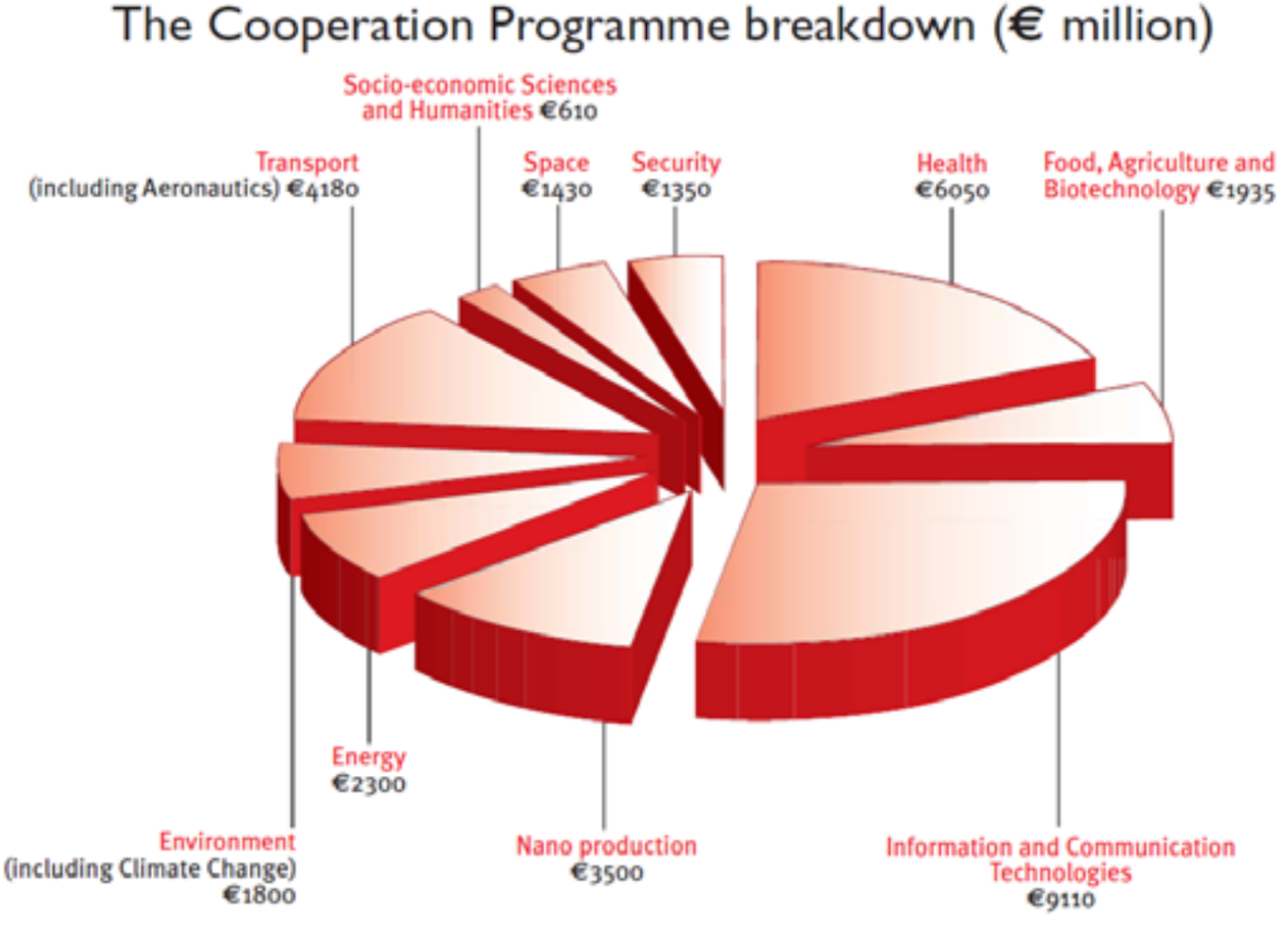
- National bodies
- **International organizations**
  - **European Commission**
    - Framework Programs (FP1 – FP7)
    - Horizon 2020

EU Commission FP 7

- Lasted 2007 until 2013 (some projects are still ongoing)
- Total budget of over **€ 50 billion**
- Either **EU-based** and **extra-EU institutions**
  (public and private) could apply
- Aim is ….. to provide
  scientific based results for their activities of the EU-Commission

Budget of FP7





DURABROADS

Cost-effective **DURAB**le **ROADS** by green optimized construction and maintenance

- Ongoing Project, EU contribution € 2,5 million
- 9 participants (industry, university, and research institutes) from 7 countries
- Objectives:

  Design, development and demonstration of cost effective, eco-friendly and optimized long-life roads.

  Use of greener materials: nano-carbon modified binders, PmB, WMA, RAP)

  Two trial sections for new asphalt materials

  LCA and LCC study

APSE

Use of eco-friendly materials for a new concept of
Asphalt **P**avements for a **S**ustainable **E**nvironment

- Ongoing Project, EU contribution € 2,5 million
- 10 participants (industry, university and research institutes) from 5 countries
- Objectives:

  Replacement of bitumen with greener materials from renewable raw sources (vegetable oil, bioethanol, etc.)

  Replacement of aggregates with materials coming from demolition and maximization of Reclaimed Asphalt pavement

SHARP

Self **H**ealing **A**sphalt for **R**oad **P**avements

– Ongoing Project, EU contribution € 250.000

– 1 participant (Marie-Curie fellowship, TU Delft, Netherlands)

– Objectives:

Development of a unique **self-healing pavement with encapsulated rejuvenator**

The rejuvenator is embedded in the pavement in the form of micro-capsules which are opened and released when the pavement cracks.

ROSANNE

ROSANNE
ROlling resistance, Skid resistance, ANd Noise Emission measurement standards for road surfaces

Objectives

- Advanced harmonization/standardization of measurement methods for
  - skid resistance
  - noise emission
  - rolling resistance

  of road pavements

- Prenormative research creating the technical basis for draft standards
- Adapted strategy for each parameter
- Close cooperation with CEN TC227/ WG5

ROSANNE

Example of rolling resistance test

Symbol	Surface Type	Location	Remarks	MPD
PERSr17	Poroelastic road surface	Drum Facility 1.7m	Porous surface made on the basis of mineral and rubber aggregate and polyurethane resin. Pavement suitable for roads and drum use, very smooth and flexible. Still in developing stage.	
DAC16r20	Replica of dense asphalt concrete with 16mm aggregate	Drum Facility 2.0 m	Polyester laminate replica made on the basis of a typical DAC 16 mm (rather high texture).	
ISOr20	Replica of ISO reference surface	Drum Facility 2.0 m	Polyester laminate replica made on the basis of the reference road surface ISO 10844 (average texture).	
APS4r17	Replica of surface dressing 8/10 mm aggregate	Drum Facility 1.7 m	Polyurethane /mineral replica of a single layer surface dressing 11 mm (very high texture).	
STEELr20	Plain steel surface	Drum Facility 2.0 m	Smooth steel surface of the drum 2.0 m	

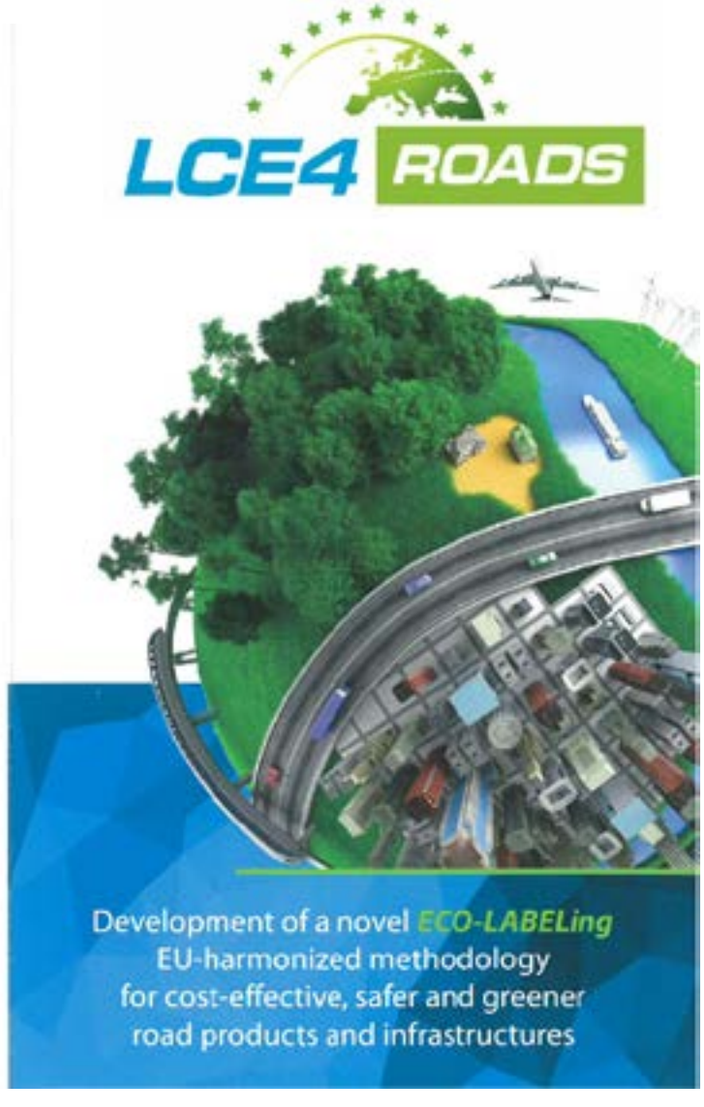
ROSANNE

Example of rolling resistance test results

Tyre	Speed	Pavement	Tyre load [kG]		
			200	350	600
T1077	50	APS4r17	0.0142	0.013	0.0119
T1077	80	APS4r17	0.0151	0.0132	0.012
T1077	80	PERSr17	0.0103	0.0098	0.0095
T1077	80	DACr20	0.0066	0.0074	0.0077
T1077	80	ISOr20	0.0069	0.0073	0.0076
T1063	50	APS4r17	0.0168	0.0165	0.0161
T1063	80	APS4r17	0.017	0.0168	0.016
T1063	80	PERSr17	0.0125	0.0138	0.0143
T1063	80	DACr20	0.0102	0.0115	0.0123
T1063	80	ISOr20	0.0094	0.0111	0.0120

LCE4ROADS

bast	Bundesanstalt fuer Strassenwesen (BASt), Germany
circe	Fundacion CIRCE (Centro de Investigacion de Recursos y Consumos Energeticos), Spain
	Chalmers Tekniska Hoegskola AB, Sweden
ERF	European Union Road Federation (ERF), Belgium
FEHRL	Forum of European Highway Research Laboratories (FEHRL), Belgium
IECA	Instituto Espanol del Cemento y sus Aplicaciones (IECA), Spain
IFSTTAR	Institut Francais des Sciences et Technologies des Transports, de l'Amenagement et des Reseaux (IFSTTAR), France
TNO	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Netherlands
	Karayollari Genel Mudurlugu (KGM), Turkey
AENOR	Asociacion Española de Normalizacion y certificacion (AENOR), Spain
investeko	INVESTEKO, Poland
NAPE	Narodowa Agencje Poszanowania Energii S.A. (NAPE), Poland



Life Cycle Engineering approach to develop a
novel **EU-harmonized sustainability certification system** for cost-effective, safer and greener road infrastructures

Table of **“Key Performance Indicators”**

Domain	KPI		List of requirements for certificate	
			Light	*complete*
Environmental	Material	Materials consumption	X	X
		Recycled materials used	X	X
		Materials suspected to be recycled	X	X
		Energy demand (use of renewable energy sources/non renewable energy sources)	X	X
		Waste (Hazardous waste/non hazardous waste/ radioactive waste)	X	X
	Environmental Impact	Global Warming Potential	X	X
		Photochemical Ozone Creation Potential	voluntary	X
		Ozone Depletion Potential	voluntary	X
		Acidification Potential	voluntary	X
		Eutrophication Potential	voluntary	X
		Abiotic Depletion Potential	voluntary	X
		Abiotic Depletion – fossil fuel	voluntary	X
		Human Toxicity	voluntary	voluntary
		Ecotoxicity	voluntary	voluntary
Economic	Agency Cost	Initial cost	X	X
		Maintenance cost	X	X
		Salvage value	voluntary	X
Social	Comfort	Confort Index	X	X
			X	X
	Safety	Safety audits & safety inspections	X	X
	Noise		voluntary	X
			voluntary	X
Technical	Structural	Resilient modulus values from FWD	voluntary	voluntary
		Roughness	X	X
		Skid resistance	voluntary	voluntary
		Macrotexture		
		Rut depth	X	X
		Resilience to climate change	voluntary	voluntary

All sustainability domains: environmental, economic, social, technical

EU Commission Horizon 2020

- 7 years (2014-2020)
- Total budget of over **80 billion €**

  (40% more than in FP7)

Three priorities

- Excellent science
- Industrial leadership
- Societal challenges

Horizon 2020

Levels

- Overall programming
- Work Programs
- Calls

Types of Supported Actions

- Research and Innovation Action
- Innovation Actions
- Coordination and Support Actions
- Co-financing

Example of H2020 call

MOBILITY for GROWTH 2014-2015

H2020-MG-2015-Singlestage-B — Sub call of: H2020-MG-2014-2015

Planned Opening Date	24-06-2015	**Deadline Date**	15-10-2015 17:00:00 (Brussels local time)
Publication date	11-12-2013	**Total Call Budget**	€18,500,000
Programme	Horizon 2020		
Status	**Forthcoming**	**Main Pillar**	Societal Challenges
		OJ reference	OJ C361/9 of 11 December 2013

Topic: **Smart governance, network resilience and streamlined delivery of infrastructure innovation** **MG-8.4b-2015**

Topic Description | Topic Conditions & Documents | Submission Service

Specific challenge: Infrastructure owners and operators need to ensure the best possible return from increasingly limited transport infrastructure investment funds. The main challenge is to overcome the lack of a common framework for governance, management and finance of transport infrastructure projects (including methodologies and modelling) with the aim to enable transparent, risk-based optimisation of investments within and across the modes. This includes issues such as resilience against climate change and other disturbances. Additionally, it is necessary to enhance the industry's practices and capacities in order to raise the productivity, quality and timeliness of infrastructure projects.

FOX-USE-iT Project (H2020)

USE-iT partners

FEHRL	FEHRL	IBDiM	IBDiM
TRL	TRL	VGTU	VGTU
AIT	AIT	DNDI	DNDI
LNEC	LNEC	TNO	TNO
EURNEX	EURNEX	CEDEX	CEDEX
IFSTTAR	IFSTTAR	CDV	CDV
dgac STAC	STAC	vti	VTI

FOX partners

FEHRL	FEHRL	IBDiM	IBDiM
bast	BASt	NETIVEI ISRAEL	NETIVEI
ZAG	ZAG	DNDI	DNDI
IFSTTAR	IFSTTAR	CDV	CDV
TNO	TNO	VGTU	VGTU
EURNEX	EURNEX	AIT	AIT
dgac STAC	STAC	LNEC	LNEC

Forever Open Infrastructure across all modes

Who is funding research across Europe?

- National bodies
- **International organizations**
  - European Commission
    - Framework Programs (FP1 – FP7)
    - Horizon 2020
  - **Conference of European Directors of Roads (CEDR)**

CEDR
Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

CEDR

Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

- **Conference of European Directors of Roads**
- Members are **European Road Ministries** or **Road Agencies**
- **“Research calls”**: each call has a different focus (e.g. road safety, asphalt, ITS…)
- **Croatia is not a member**

ERA-NET ROAD I

– Two Fast Track Pilot Projects

- FTP1: Life-cycle analysis of open-graded asphalt pavements
- FTP2: Performance management for low-noise pavements

– Three Project Opportunities

- PO2: Optimisation of Thin Asphalt Layers
- PO3: …
- PO4: …

ERA-NET ROAD II

has strengthened the European Research Area in road research by coordinating national road research programmes and policies, to:

- establish a permanent structure
- manage transnational collaborative road research
- broaden joint research procurement/research support
- work towards a transnational expenditure of 10 %
- liaise with other stakeholders

ENR-CEDR Call 2011 Design

POTHOLE

Durable **Pothole** repairs

- Finished project, € 315.000
- 7 participants (universities and research institutes)

  from 6 countries

RECYPMA

Possibilities for high quality **RECY**ling of **P**olymer **M**odified **A**sphalt

- Finished project, € 315.000
- 4 participants (universities and research institutes)

  from 3 countries

ENR-CEDR Call 2012 Reycling

CoRePaSol

Characterization of Advanced
Cold-**Re**cycled Bitumen Stabilized **Pa**vement **So**lutions

- Ongoing project, € 350.000
- 5 participants (universities, industry and a research institute) from 4 countries
- Objectives:

  Harmonization of **mix design of cold-recycled bitumen stabilized materials** following the existing scientific and engineering experience and approaches

  Recommendation of mix design by studying compaction methods, curing procedures and performance tests

ENR-CEDR Call 2012 Reycling

EARN

Effects on **A**vailability of **R**oad **N**etwork

- Ongoing project, € 300.000
- 6 participants (universities, industry)

  from 4 countries
- Objective:

  Assess the effect on **durability due to use of Reclaimed Asphalt**

ENR-CEDR Call 2013 Energy Efficency

FunDBitS

Functional **D**urability-related **Bit**umen **S**pecifications

- Ongoing project,
- 11 participants (universities, industry and a research institute) from 9 countries
- Objectives:

  Propose changes in EN 12691, EN 14023 and 13 924 to introduce performance-based specifications

  Propose changes in bitumen test procedures

  Propose changes in EN 13108 including suitable bitumen performance characteristics

cont. CEDR Calls

Call 2014 involved **two separate research programs:**

1: Asset Management and Maintenance

I: Road Asset Management

A) – C)…

II: Road Maintenance

D) Use of standard raveling tests to predict pavement durability

E) Recommendations for maintenance procurement by investigating current practices

2: Mobility and ITS

…

DRaT

Development of the **Ra**veling **T**est

- Objectives:
  - Comparison of existing devices
  - Recommendation for standardization

Call “Infravation” 2014

- **ERA-NET+ “Infravation**: advanced systems, materials and techniques for next generation road infrastructure”
- **€ 9 million** for co-financing
- **14 funding bodies** (7 EU CEDR Members, EU Commission, USA FHWA, TÜV Rheinland, Iceland Road Authority, Norway Road Authority, Israel Netivei)
- **Participants** from all across the **EU-EEA, USA, Turkey and Israel**

Call “Infravation” 2014

Infravation

An Infrastructure Innovation Programme

TRANSNATIONAL COLLABORATION OF 11 COUNTRIES AND THE EC ON ROAD INFRASTRUCTURE INNOVATION

An ERA-NET Plus Call to support development of advanced systems, materials and techniques for road infrastructure under seven defined challenges:

Rijkswaterstaat
Ministry of Infrastructure and the Environment

Federal Ministry of Transport and Digital Infrastructure

Road Directorate

Statens vegvesen

TRAFIKVERKET

VEGAGERÐIN

Centro para el Desarrollo Tecnológico Industrial

ANAS

NETIVEI ISRAEL
NATIONAL TRANSPORT INFRASTRUCTURE COMPANY LTD

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

FEHRL

TÜVRheinland®
Precisely Right.

CEDR
Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

An ERA-NET Plus with funding from the European Union under grant agreement no 618109.

Project HEALROAD

–**HEALROAD**

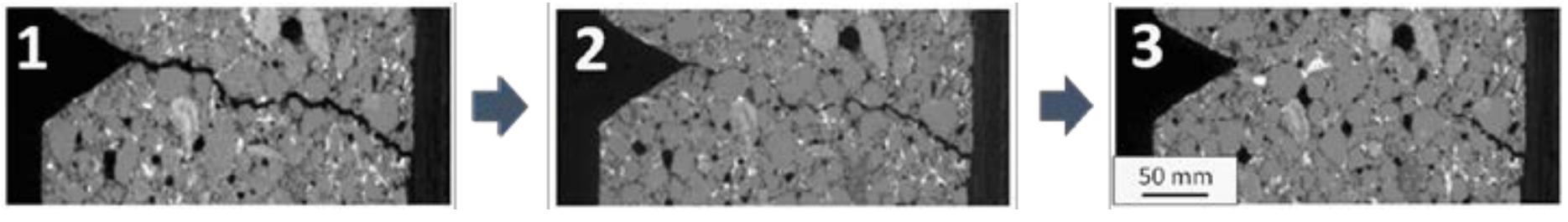
Induction heating asphalt mixes to increase road durability and reduce maintenance costs and disruptions

– Partners

Project HEALROAD

– Asphalt mixture is a natural self-healing material. When a crack is open in the road structure, it can close (heal) when enough temperature and time without traffic are provided.

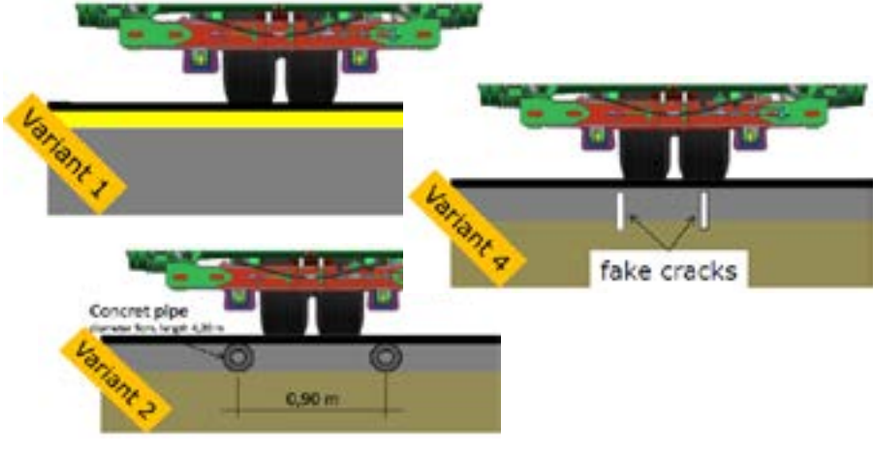
– However, this process requires days for a complete healing, which in practice is impossible due to continual traffic flow.



– Self-healing of asphalt mixes can be accelerated by means of induction heating, a technique used to increase the temperature of electrically conductive and magnetic susceptible materials.

HEALROAD – Project -> WP5 (Leader BASt)

- In-situ characterization of the two test sections:
  - Adaptation of the induction-heating machine.
    - ✓Reach approx. 0.5 m/s
  - Creation of cracks with the Mobile Load Simulator MLS10.
    - ✓Different construction-types will be tested by BASt to facilitate the creation of realistic micro-cracks.
  - Life Cycle Analysis and Life Cycle Cost Analysis.



HEALROAD – Main outcomes and deliverables

- Description of factors in the chemical composition and rheology of the bitumen that most affect healing properties.
- Assessment of the influence of the air voids content and the type, size and amount of magnetic particles in the healing and the mechanical properties of the mixture.
- Quantification of unknown parameters associated with the healing of asphalt mixes:
- Maximum lifetime extension of the asphalt mixture.
- Effect of aging on the healing capacity of the asphalt mixes.
- Identifying the optimum time for healing in the lifetime of the road.
- Up-scaling of the production process of the mixes.
- Technical, economic and environmental validation of the technology.

Conclusions

Research on European Level is a substantial contribution

- additional funding
- fostering cooperation
- addressing common problems

Interesting topics are addressed

- recycling technologies
- questions of sustainability

Some duplication of work

Room for improvement

Interested to participate?

Cons

- No big business case for industry
- Not easy to navigate in the system
- Some paperwork

Pros

- Improve the content and results
- Gain knowledge
- Have influence

My recommendation:

- Get in contact with somebody who knows