
Sustainability policies in Europe : challenges and opportunities for concrete pavements

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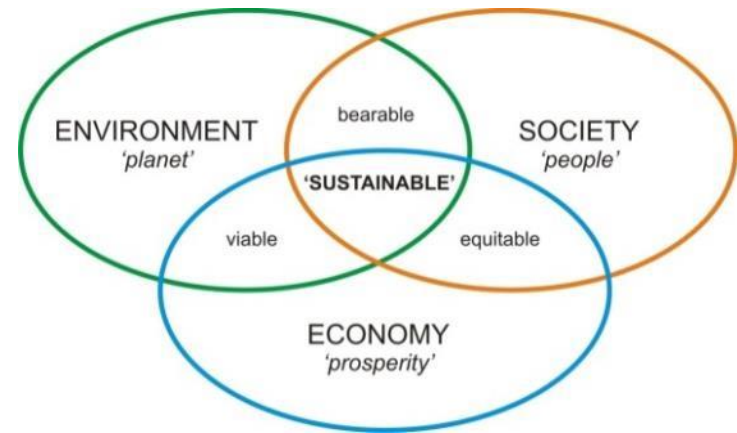


Managing Director



Introduction

- Sustainable development

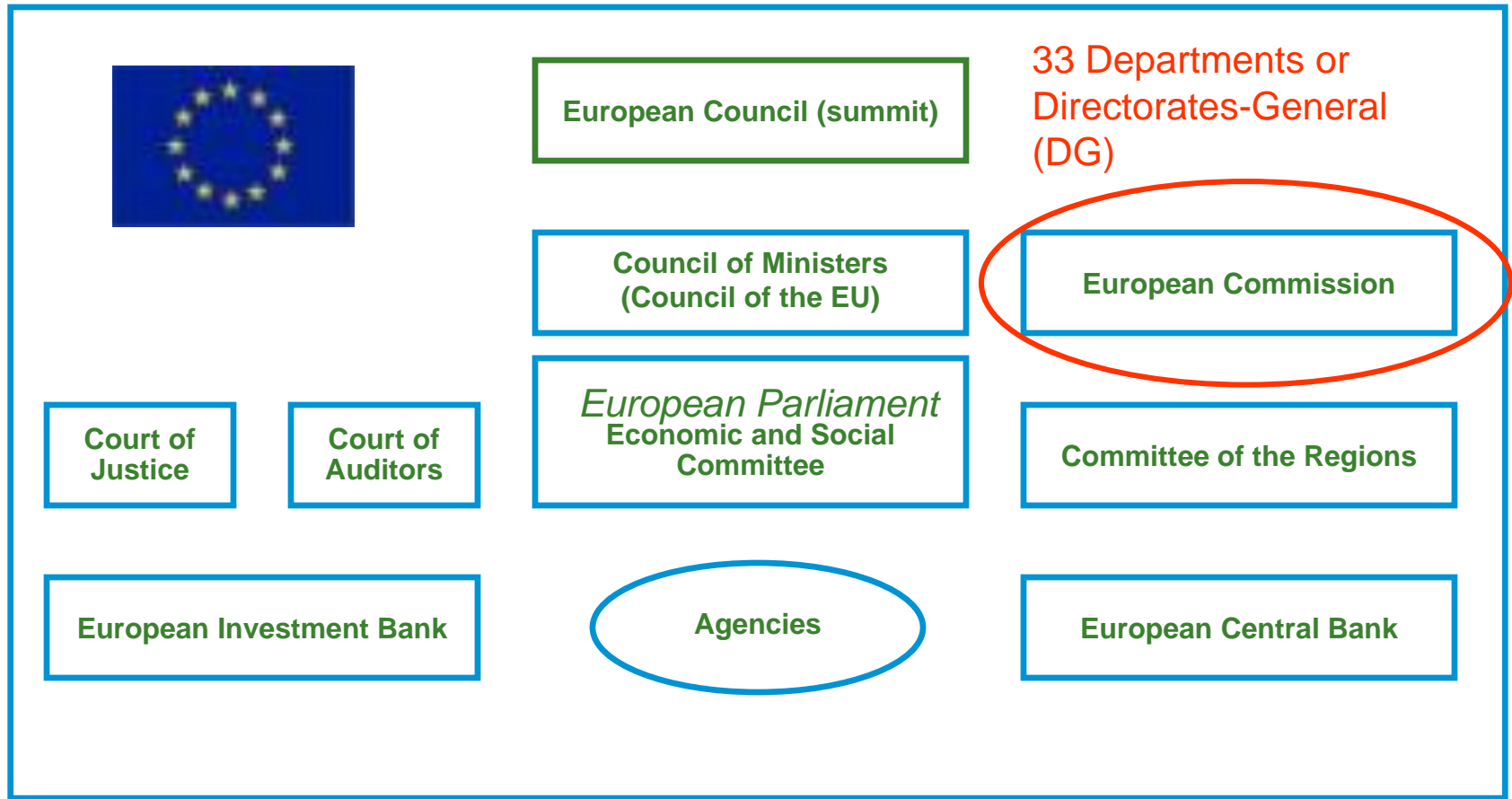


Introduction



"United in diversity"

The EU institutions



Some of the EC Programmes

■ DG ENV

- ❑ Green Public Procurement – revision of the criteria for road construction
 - ❑ The Environmental Noise Directive
 - ❑ The initiative for a Resource Efficient Europe
 - ❑ Sustainable Urban Transport
-

Some of the EC Programmes

- **DG CLIMA**
 - The Climate Action Plan
 - **DG MOVE**
 - White Paper for transport
 - **DG RESEARCH & INNOVATION**
 - Research Programmes
-

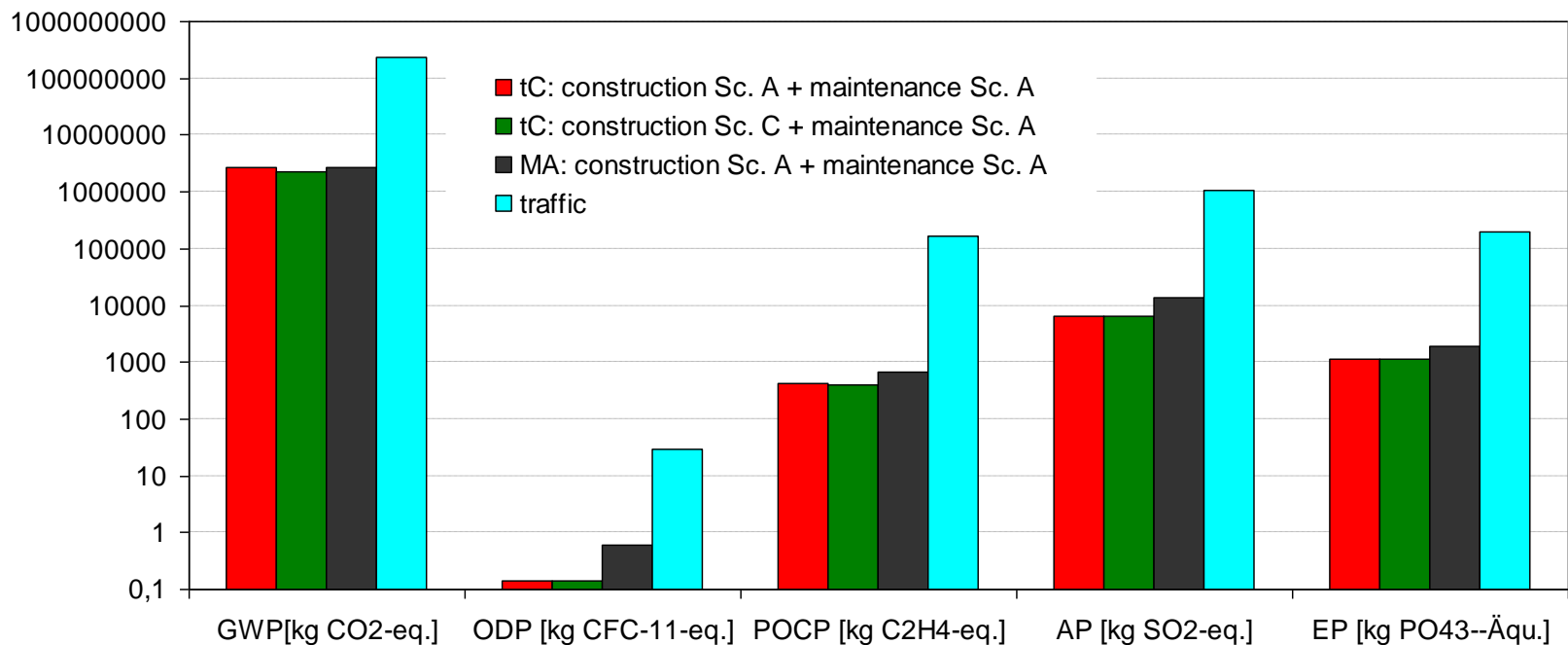
GPP

- Green Public Procurement (GPP) means that public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life-cycle compared to goods, services and works with the same primary function that would otherwise be procured.
- ≠ Sustainable Public Procurement
- Criteria for « Road construction » under revision by JRC (Joint Research Centre of European Commission)
- Active participation by



GPP - LCA

- Holistic approach : consideration and evaluation of all relevant environmental impacts : LCA including use/operational phase
- Example : TU Munich, presented in the 11th ISCR, Seville, 2010



Reduction of fuel consumption and emissions

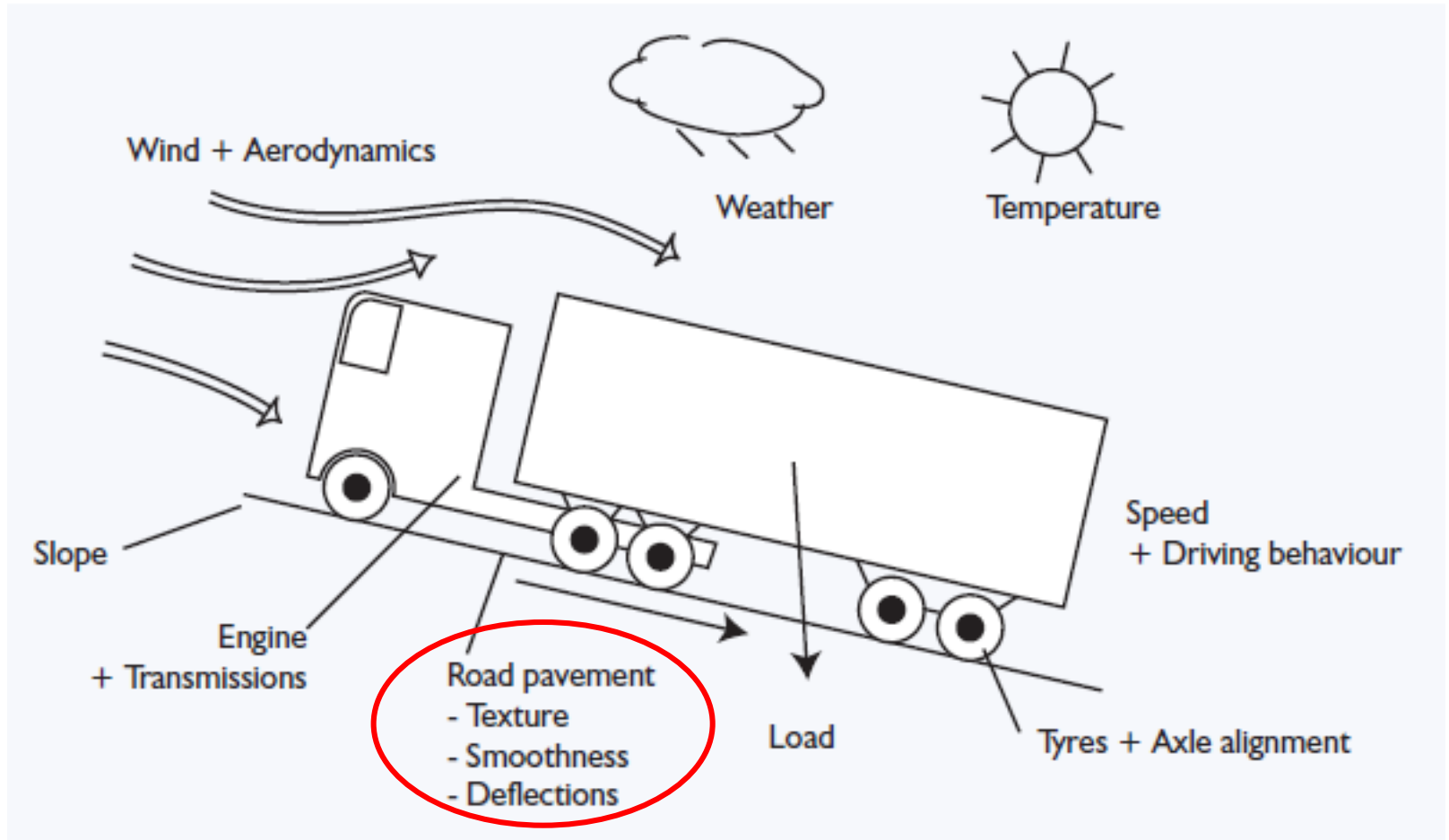


Concrete pavements contribute to decarbonising of transport



*« UP TO 6% FUEL SAVINGS
for heavy trucks riding
on concrete pavements.
This can already make
the difference today ! »*

Factors influencing fuel consumption



Freight transport in Europe

- Europe : 1 878 billion tonne-kilometers (2006)
 - Assuming average load of 10 tonnes : distance covered by HGV is 188 billion kilometers.
 - *According to the findings of the aforementioned Canadian research, the saving of 0.45 litres/100 km of diesel leads to the following savings :*
 - *636 millions of litres diesel per year*
 - *€ 1 269 million per year*
 - *2.25 million tonnes CO₂ per year*
-

GPP – Alternate bidding

- Compare alternative types of pavement structure
 - Maximize economic, societal and environmental performance of road infrastructure over its entire life-cycle
 - Design- Build – Operate with long enough period for operation (30 to 40 years)
 - See examples of PPP
-

Poland – A2 motorway

- PPP and DBFM lead more often to the choice for concrete
- Segment II of the A2 motorway = Poland's largest concession project, using PPP model for a toll motorway.
- Maintenance period of 30 years
- Concrete despite higher initial costs.
- 2009-2011, 105 km



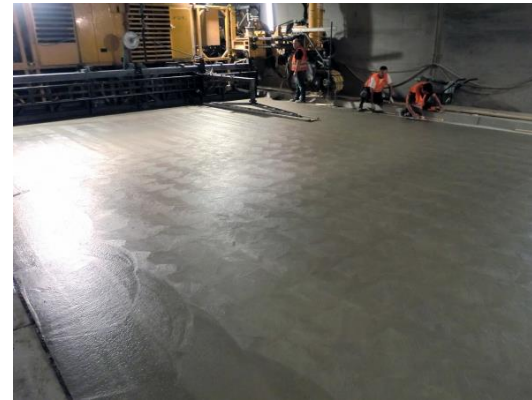
Ontario Highway 407

- 1995
- ETR (Express Toll Route)
- First electronically operated toll highway opened in the world
- PPP
- Choice for concrete
- Followed by more recent examples of PPP projects with concrete pavements



GPP – Tunnel pavements

- Safety aspect : non-combustible surface
- Free of maintenance
- Savings in lighting energy
- Examples in several countries, e.g. Italy



GPP – Noise

Environmental Noise Directive (END)

- Monitoring the environmental problem
 - Drawing up strategic noise maps (day and night levels)
- Informing and consulting the public
- Addressing local noise issues (action plans)
- Developing a long term EU strategy

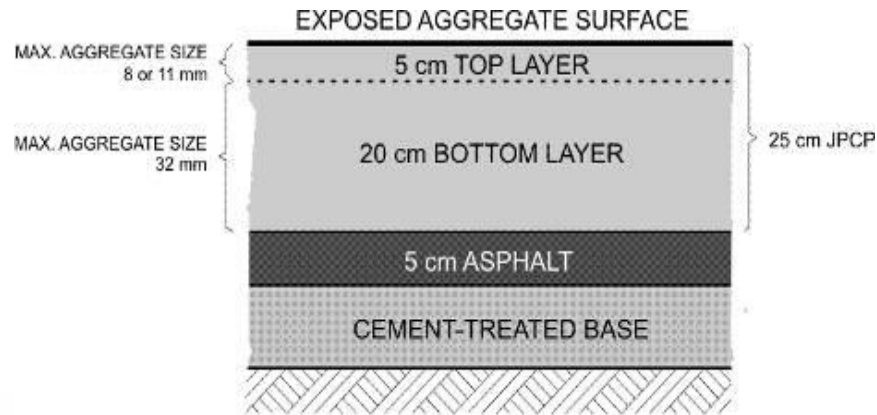


Action plans for traffic noise consist of :

- Construction of noise barriers
 - Development and implementation of low noise surfaces
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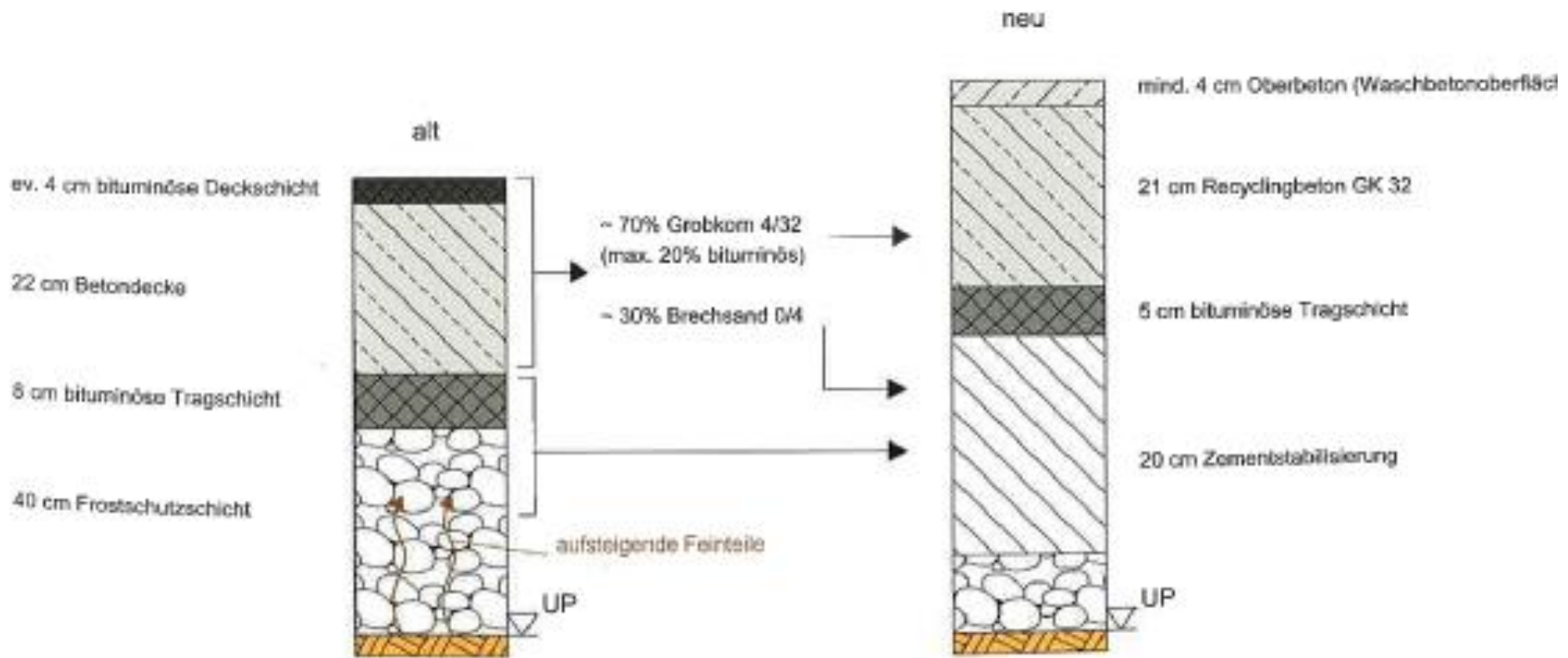
Two lift paving – European experience

Austria – Germany :
2-layered concrete placed with a “double” slipform paver



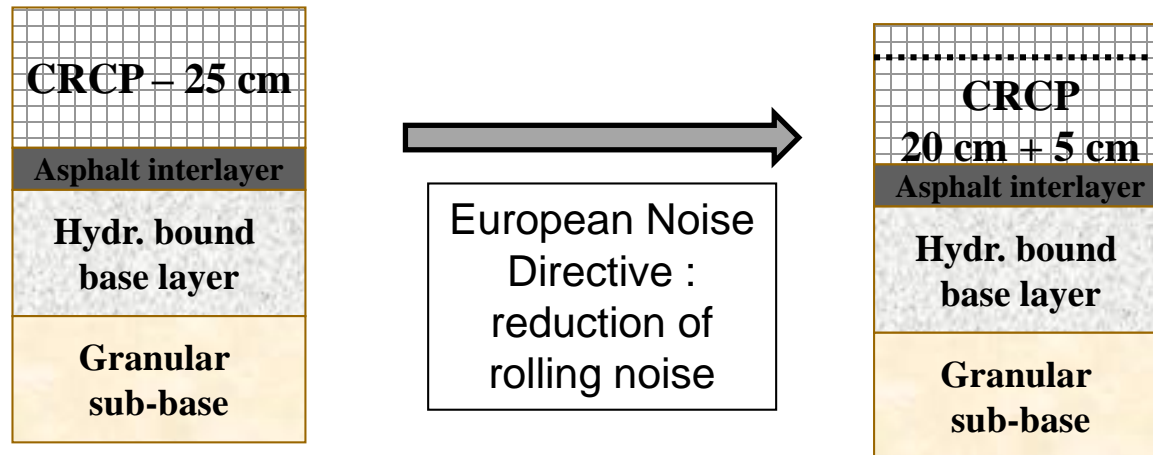
Two lift paving – European experience

- Austria : use of recycled concrete aggregates in the bottom layer



Belgian solution in CRCP

- > 40 years experience with CRCP on Belgian motorways



- Comparison
 - Common aspects
 - Design
 - Construction
 - Surface characteristics

Presentation of the worksites

- A14 (E17) Gent-Kortrijk

- A13 (E313) Hasselt – Antwerp

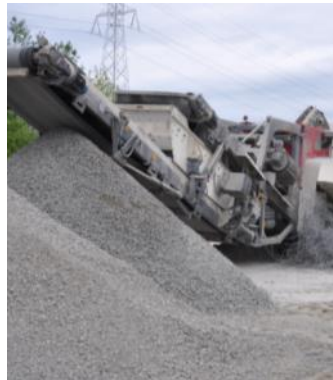


- 55000 vehicles/day
- 20% heavy traffic
- > 40 years old
(concrete + asphalt)
- 2 carriageways
- 11,4 km

- 60 to 70 000 vehicles/day
- 23% heavy traffic
- > 50 years old
(concrete + asphalt)
- 1 carriageway (to Antwerp)
- 7 km

Common aspects

- Reduction of nuisance
 - Phased work – short construction time – penalties for delays
 - Limited space for construction (lanes with reduced width, use of hard shoulder, reduction or elimination of central reserve)
- Old structures : new base layers needed
 - RCC : strong, resilient, fast, recycled aggregates



- Asphalt sandwich layer : protection, bond, working platform
- Exposed aggregate concrete surface

CRCP design

- Minimal differences between single layered and double layered concept
 - Two layers : wet in wet = one monolithic slab
 - Extra concrete cover for double layered concept
 - Total of 95 mm concrete cover from the surface of the top layer
 - 35 mm concrete cover from the surface of the bottom layer (interface)

	A14 - 2011- single layer	A13 – 2012 – double layer
Total thickness	250 mm	
Thickness bottom layer	-	200 mm
Thickness top layer	-	50 mm
Steel amount	0,75 %	
Longitudinal reinforcement	Steel bars diam. 20 mm spaced at 170 mm	
Transverse reinforcement	Steel bars diam. 14 mm spaced at 700 mm	
Concrete cover of the steel on top	80 mm	95 mm

Construction aspects

- Concrete batching plant

- A14 : 2 mobile plants
- A13 : 2 permanent plants



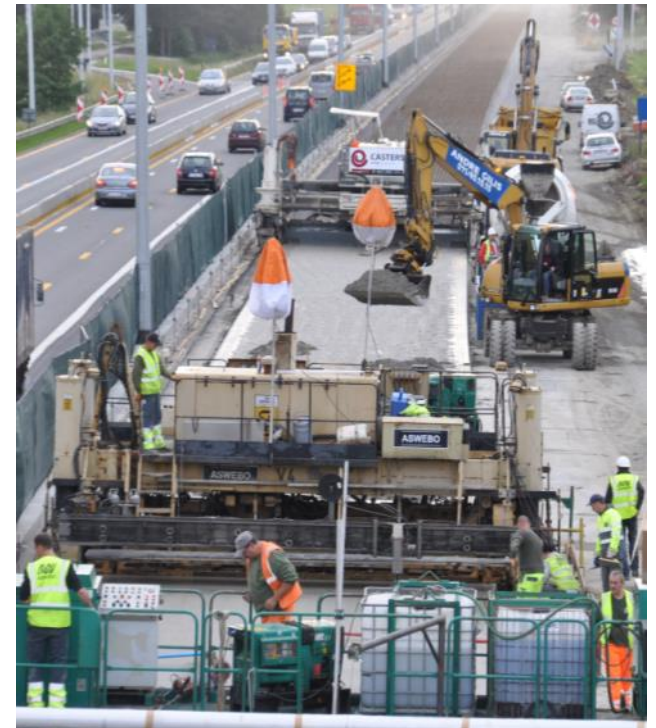
- Supply of the concrete

- A14 : dumper trucks
- A13 :
 - Bottom layer : dumper trucks
 - Top layer : truck mixers
 - Coordination (max. 30 minutes between two layers)



Construction aspects

- **Compaction and finishing**
 - ❑ 2 slipform pavers for 2 layered concrete at short distance
 - ❑ No surface finishing or curing for bottom layer
 - ❑ Careful compaction of top layer avoiding the appearance of the bottom layer on the surface
 - ❑ Easier spreading and levelling of the thinner top layer



Surface characteristics

- Evenness (ARAN) & Skid resistance (SCRIM)

	Evenness – 2,5 m wavelength	Evenness – 10 m wavelength	Evenness – 40 m wavelength	Skid resistance (Transverse friction coefficient)
Requirements	≤ 35	≤ 70	≤ 140	≥ 0,48
A14 – single layered	13	33	111	0,67
A13 – double layered	13	35	137	0,69

Construction related – extremely good results !!

Surface characteristics

■ Rolling noise

- CPX measurements at 80 km/hr
- 2layered concrete only slightly better than single layered
- Comparable to stone mastic asphalt

Road section	Pavement type	Year of construction	Rolling noise d(B)A
A14 – Deerlijk-Gent	Stone Mastic Asphalt 0/10	2003	100,3
A14 – Courtrai – France border	Stone Mastic Asphalt 0/10	2011/2012	98,8
A14 – Courtrai – France border	Stone Mastic Asphalt 0/6,3	2008	97,8
A14 – Temse – Sint-Niklaas	Single layered CRCP 0/20	2008	101,8
A14 – De Pinte-Kortrijk	Single layered CRCP 0/20	2010	99,7
A14 – De Pinte-Kortrijk	Single layered CRCP 0/20	2011	99,0
A14 – Deinze - Gent	Single layered CRCP 0/20	2011	98,8
A13 – double layered	Double layered CRCP 0/6 3	2012	98,0

Surface characteristics

- Influence of mix design and construction
 - Exposed aggregate concrete :
adequate long lasting skid resistance
 - Smoothness :
 - Right concrete mix
 - Continuous supply
 - Slow and steady speed of machine
 - Skilled worksmen
 - Noise :
 - EAC
 - Texture : homogeneous pattern of closely spaced small stones (6-10 mm)



CRCP – exposed aggregate concrete

- Optimized combination of skid resistance, smoothness and rolling noise through the concept of CRCP/EAC – single and double layered
- Key factors to success :
 - Study of concrete mixes
 - Certification and inspection procedures
 - Efforts of highly skilled craftsmen on site
 - Highly performing machines
 - Collaboration between parties
- Choice for the future : 1 or 2 layers ??



Active crack control of CRCP

- Sawcut at the edge of the concrete strip :
 - 40 cm long
 - 3 to 6 cm deep
 - spaced at 1.20 m
 - within 24 hours after concreting (when brushing off the concrete mortar for exposed aggregate finishing)



Active crack control of CRCP

- Simple and efficient technique
 - Depth and timing of sawcut are important
 - Up to 80% of the cracks are initiated by a sawcut (6cm)
- Faster crack development, straighter and more regular cracks with significantly reduced risk of clustering
- Some problems still need to be solved, e.g. presence of a water gutter, built together with the pavement



Further trials on diamond grinding and NGCS, based on U.S. experience



Composite solution

- The Netherlands :
CRCP + Porous Asphalt
 - + : cheaper aggregates
 - + : noise, splash & spray
 - : maintenance (cost, material, ...)

 - CRCP + thin bituminous wearing course
 - + : sealing of the surface
-

DG Environment (ENV)

- Urban environment
 - Sustainable Urban Transport Plans
 - Marching
 - Biking
 - Public Transport



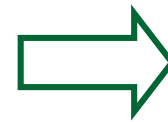
Another challenge for the concrete pavements' society

DG Mobility and Transport (MOVE)

- White Paper for Transport
 - By 2050, key goals will include:
 - No more conventionally-fuelled cars in cities.
 - A 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport.
 - All of which will contribute to a 60% cut in transport emissions by the middle of the century.
-

Public Transport : basic requirements

- Reliability
- Economy
- Safety
- Comfort
- Aesthetics



CONCRETE



Concrete bus lanes – The Netherlands

- Eindhoven



Concrete slab track for light rail

■ CONCRETE SLAB TRACK

- = a modern form of railway track construction which uses concrete in stead of ballast to provide stability to the track structure (@Britpave)
- Used for all types of railway systems, including high speed lines, heavy rail, light rail and tram systems



UK : Nottingham Express Transit

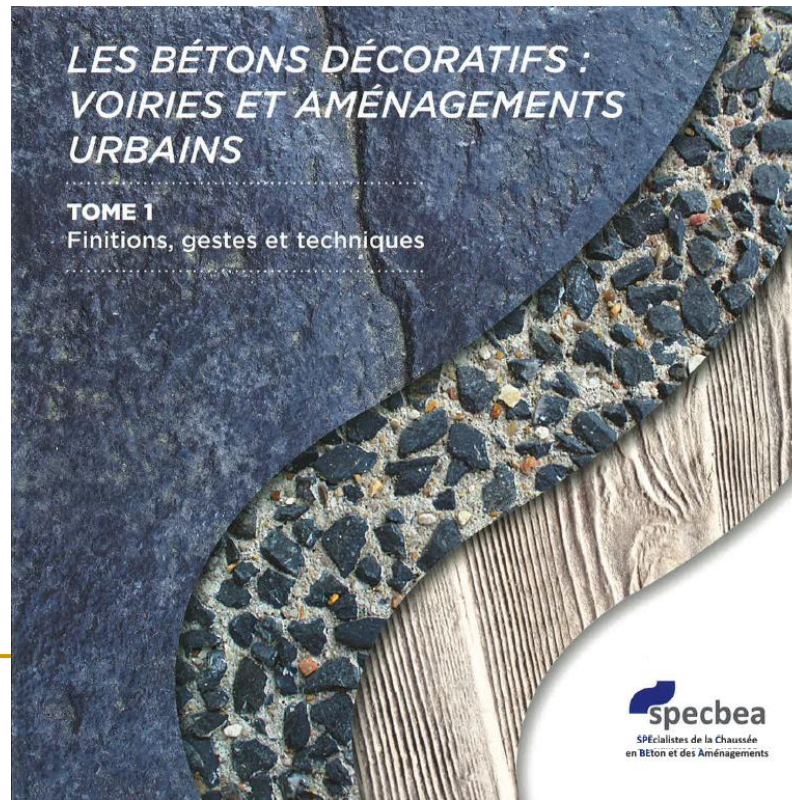
Refurbishment of public spaces

- Massive use of decorative exposed aggregate concrete in France



Refurbishment of public spaces

- Massive use of decorative exposed aggregate concrete in France
- 60 types of surface finishing



Refurbishment of public spaces

- Precast solutions



Climate Action Plan

To stop global warming, EU leaders decided in 2007 to:

- reduce greenhouse gas emissions by 20% by 2020 (30% if other developed countries do likewise)
- improve energy efficiency by 20% by 2020
- raise the share of renewable energy to 20% by 2020 (wind, solar, hydro power, biomass)



Are concrete pavements ready for a climate change ?

■ Construction issues

- ❑ See experiences in Mexico, Texas, Arizona,..
- ❑ Practices of “hot weather concreting”
- ❑ More attention to the T° of the fresh concrete
- ❑ Amplified curing measures



■ Behaviour of the pavement

- ❑ Increased risk for blow-ups
 - related to construction quality and maintenance
 - importance of monitoring
- ❑ Joint movements : maintenance



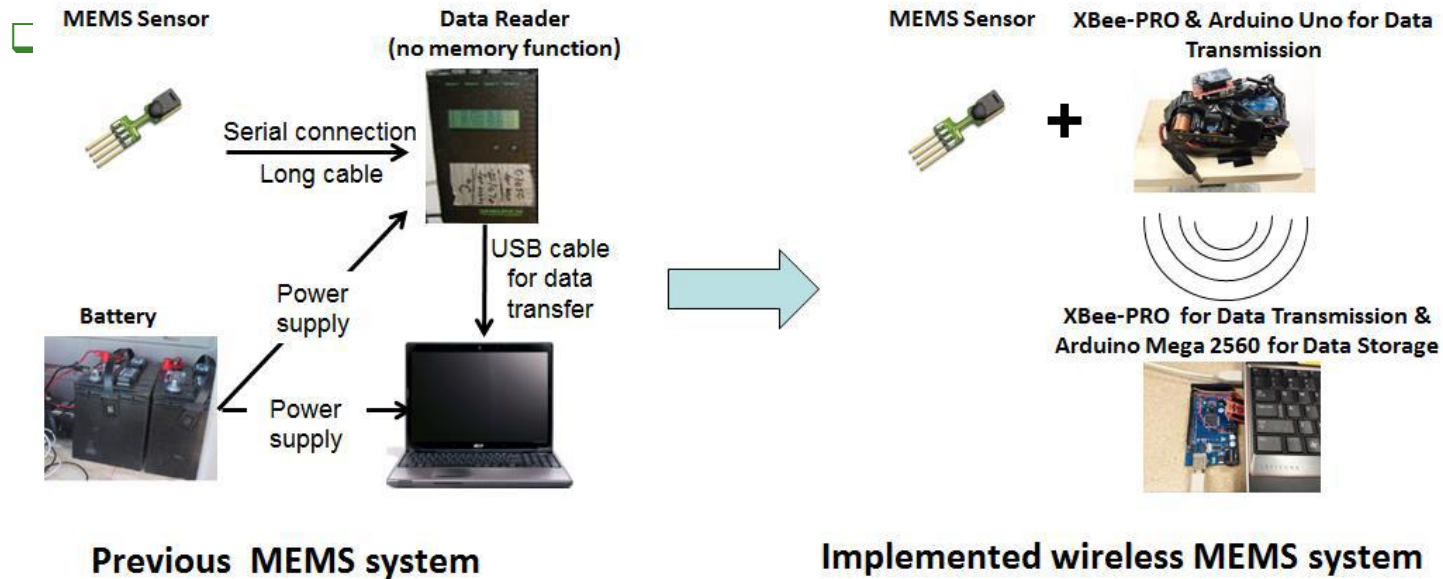
Are concrete pavements ready for a climate change ?

- Recife, 2007



Are concrete pavements ready for a climate change ?

■ Monitoring



EmbedSense® Wireless Sensor

Wireless sensor and data acquisition system.

Features and Benefits

- Small size is ideally suited for embedded applications
- No batteries to maintain, hence nodes can operate for the life of the structure or machine
- Wide operating temperature from -40 C to +125 C
- 30 Hz sample rate
- Configuration available for high inertial



DG Research and Innovation

■ Horizon 2020

- Research projects that contribute to cleaner, safer and smarter pan European transport system and to a more competitive Europe
 - Automotive sector
 - Infrastructure sector (Rail – Water – Air – Road)
-

Research – Electrification of cars

- « Continuous Electric Drive »
 - Inductive charging of electric buses
 - Charging system imbedded in concrete pavement



Conclusions

- Ambitious goals at EU level
- Trend is visible in national policies
- Governments are opting for sustainable mobility
- Appropriate infrastructures are needed

- CONCRETE
 - LCA +++
 - LCCA +++

**It is essential that the overall performance of a chosen solution is not compromised by prioritising short-term gains.
A sustainable approach requires thinking on the long term.**

Conclusions

International collaboration

- EUPAVE – ACPA – ISCP – FICEM – PIARC – ERF/IRF - ...
 - and **IBRACON**
 - Leverage strengths and avoid duplication of effort
 - Maximizing effectiveness of limited resources
 - Resulting in « best » solutions
 - Technically
 - In the sustainability context
-



***Thank you for your
kind attention***