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

Aquilino Alvarez-Castro
Project coordinator
ACCIONA INFRAESTRUCTURAS
aacastro@acciona.es

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Agenda

1. The LCE4ROADS Project
2. The EU-US Collaboration

The LCE4ROADS Project

Existing framework

1. *European Road Network*

Type of Road	Lenght [km]
Motorways	74.341
Main or National Roads	337.149
Secondary or Regional Roads	1.459.546

2. *Use of the road network*

	People (passenger/km)	Goods (tonnes/km)
EU-28	**4.766** *(72,3% modal share)*	**1800** *(49% modal share)*
US	**6.005,9** *(78,7% modal share)*	**3.810,5** (47,8% modal share)

3. *Increased interest in sustainability*

- Incorporate sustainability principles in road infrastructure life-cycle
- Europe 2020 Strategy → towards a cleaner, more efficient and more sustainable transport.
- Green Public Procurement Criteria for Design, Construction and Maintenance of Roads (EC JRC, 2016)

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Current sustainability evaluation systems

EUROPE	THE UNITED STATES
CO2 PERFORMANCE LADDER, route durable, SAMARIS, DUBO Calc, MRPI, EU Ecolabel, SUNRA, EPD, OFRIR, miraveC, Re-Road, Eurbanlab, MIRIAM, COST C35	Greenroads™, THE ENVISION™ RATING SYSTEM, INVEST ECONOMIC • SOCIAL • ENVIRONMENTAL

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Barriers to a full implementation

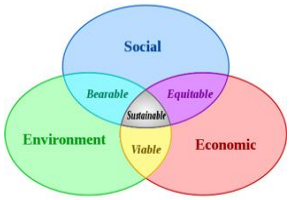
Not covering all phases

PLANNING → DESIGN & CONSTRUCTION → OPERATION (Use) → MAINTENANCE → END OF LIFE

Not covering regional peculiarities

Energy mix (key for LCA), different regulations and testing methods.

Not covering all sustainability pillars



No standard available

CEN ISO International Organization for Standardization

CEN/TC 350 work in progress. Framework for sustainability assessment under development

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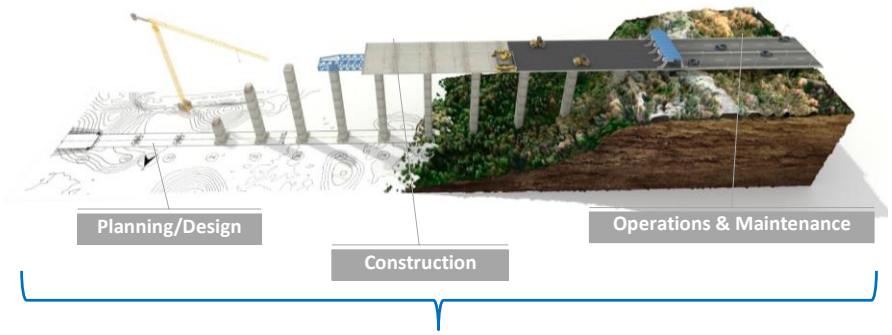
The project concept

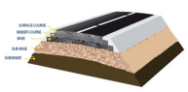


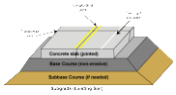
A new, holistic and EU-harmonised Sustainability Certification System for roads, integrating by a Life Cycle Engineering (LCE) approach all the sustainability pillars, plus a technical one, and road phases.

The LCE4ROADS Project

The project concept

- Useful for contractors, engineering companies.
- Useful for NRAs
- Useful to foster GPP and PPI
- Useful for users, society and the environment
- Useful for certification bodies
- Pavement Focused





- EU Harmonized

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The project consortium

- 1 Large Enterprise
- 4 Research Centers
- 3 Associations
- 1 NRA
- 2 SME's
- 1 Certification Body
- 1 University

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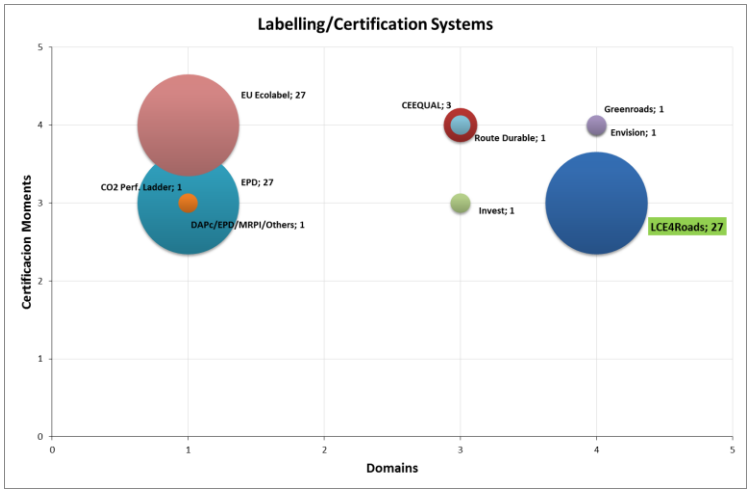
What differentiates LCE4ROADS



Domains - KPI's	
Environmental	1
Social	2
Economic	3
Technical	4

LC Stages/Moments	
Planning/Design	1
Construction	2
O&M	3
End of Life	4

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Methodology and indicators

- JRC Green Public Procurement criteria (EC) and indicators
- ISO Standards for LCA (14040-44) & for LCC (15686) indicators
- Aligned with CEN/TC 350 Sustainability in construction works and TC 227 Road materials.

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	Comfort Index	X	X
	Safety	Safety audits & safety inspections	X	X
	Noise	Amount of noise reduction realized by the pavement surface in dB.	voluntary	X
Technical	Structural	Resilient modulus values from FWD	voluntary	voluntary
		Roughness	X	X
		Skid resistance/Macrotexture	voluntary	voluntary
		Rut depth	X	X
		Resilience to climate change	voluntary	voluntary

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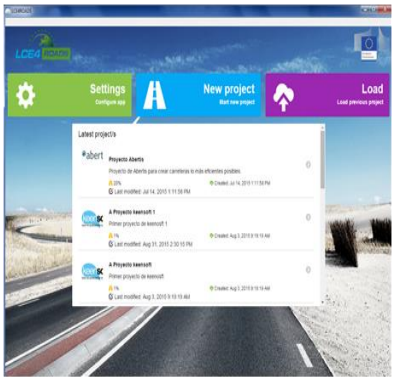
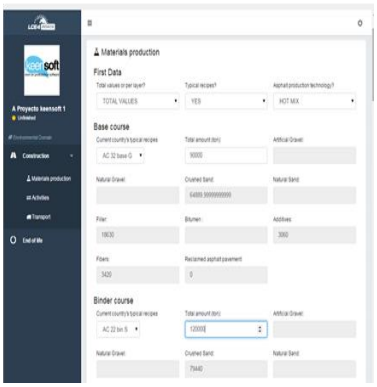
Software tool

a)



b)



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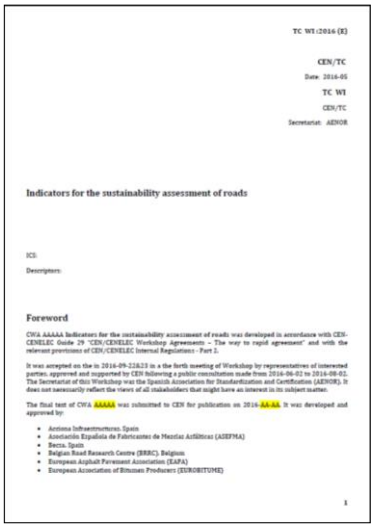
Guidelines

1. ***Suggestions for greener, safer and cost effective road products and infrastructure***
2. ***Handbook for the use of the tool***
3. ***Guide for the LCE4ROADS certificate for road infrastructure***

The LCE4ROADS Project

Standardization

- **CEN Consortium Workshop Agreement**
- **4 years validity, extendable to 4 additional years**
- **Basic document for developing full standards or codes on sustainability performance of road.**
- **In accordance with Pr15643-5 (*Sustainability in civil works*) and**
- **20 industry stakeholders, including NRAs, associations and public/private institutions.**



TC WI :2016 (E)

CEN/TC

Date: 2016-05

TC WI

CEN/TC

Secretariat: AENOR

Indicators for the sustainability assessment of roads

ICS:

Descriptors:

Foreword

CWA AAAAA Indicators for the sustainability assessment of roads was developed in accordance with CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – The way to rapid agreement" and with the relevant provisions of CEN/CENELEC Internal Regulations - Part 2.

It was accepted on the in 2016-09-22&23 in a the forth meeting of Workshop by representatives of interested parties, approved and supported by CEN following a public consultation made from 2016-06-02 to 2016-08-02. The Secretariat of this Workshop was the Spanish Association for Standardization and Certification (AENOR). It does not necessarily reflect the views of all stakeholders that might have an interest in its subject matter.

The final text of CWA AAAAA was submitted to CEN for publication on 2016-AA-AA. It was developed and approved by:

- Acciona Infraestructuras. Spain
- Asociación Española de Fabricantes de Mezclas Asfálticas (AEFPM)
- Becsa. Spain
- Belgian Road Research Centre (BRRC). Belgium
- European Asphalt Pavement Association (EAPA)
- European Association of Bitumen Producers (EUROBITUME)

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EU-US Collaboration

Scope of the twinning activities

Promoted by the EC and the FHWA, the aim of this collaboration is fostering the exchange of knowledge between both sides of the Atlantic, working on the synergies which improve the current trends in terms of enhancing sustainability in pavements.

- **National Sustainable Pavement Consortium**
  - Identification and evaluation of novel products, practices, and pavement systems
  - Best practices for sustainable pavement management;
  - Climatic changes adaptation.
- **Partners**
  - Virginia Tech
  - FHWA
  - Mississippi DOT
  - Pennsylvania DOT
  - Virginia DOT
  - Wisconsin DOT

Washington. March 2014

Madrid. September 2015

EU-US Collaboration

What has been achieved

1. Defining common boundaries for LCE/LCA
2. Agreement on different strategies for implementation based on regional dynamics
3. Benchmark US/EU methodologies against each other in terms of indicators and scope. Inputs from INVEST, ENVISION and GREENROADS for improving LCE4ROADS.
4. Sharing experience with data sources, tools and their use to pavements/infrastructures (GaBi, Palate and Coimbra/VTTI LCC).
5. LCCA in pavements and integration models with use phase. Review of the state of the art in The States. NSPC shared papers about LCCA in pavements.
6. Resilience climate change: agreement on including it on the sustainability assessment. Identified fields for future project development.

EU-US Collaboration

What has been achieved

8. "*Comparison of assessments´ tools and roads carried out*". Paper on critical review about different LCA tools (GaBI, Palate and Coimbra/VTTI LCC) submitted to 2017 TRB Annual Meeting.
9. Analysis of rolling resistance models to analyze vehicle fuel consumption-Use phase. A working document summarizing the models in the US and EU has been produced.
10. Development of a Topic Proposals for the next WP2018-2020 on LCA approaches and LCI structures and use.
11. Development of a Research Need Statement (TRB) on "Ground tire rubber for asphalt mixes". Still under development.
12. A Transport Research Circular on international approaches to EPDs. This document will include, inputs from the last Life Cycle Inventories held in Michigan Tech Research Institute are under discussion and potential contributors are under discussions: NAPA (US); IECA (ES); others.

THANKS!