AMANAC CLUSTER

AMANAC WORKSHOP

WHAT KIND OF BUILT ENVIRONMENT FOR FUTURE GENERATIONS?

BRUSSELS, BELGIUM | 03.07.2019

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BUSINESS AS UNUSUAL

The perspective of a construction company

Jose Vera-Agullo, PhD
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DACOMAT

RESHEALIENCE
Ultra High Durability Concrete

The projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760639 (EnDurCrete), 760824 (ReSHEALience) and 761072 (DACOMAT)

Drivers for a sustainable construction sector

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CODES, LAWS AND REGULATIONS

How do EUROCODES address service life of concrete: EN 1990: Eurocode – Basis of structural design

2.3 Design working life

Table 2.1 - Indicative design working life

Design working life category	Indicative design working life (years)	Examples
1	10	Temporary structures (1)
2	10 to 25	Replaceable structural parts, e.g. gantry girders, bearings
3	15 to 30	Agricultural and similar structures
4	50	Building structures and other common structures
5	100	Monumental building structures, bridges, and other civil engineering structures

(1) Structures or parts of structures that can be dismantled with a view to being re-used should not be considered as temporary.

UK National Annex to **BS and DS EN 1990:2002** modified indicative design working lives :

Category 2 – 10 to 30 years

Category 3 – 15 to 25 years

Category 5 – 120 years

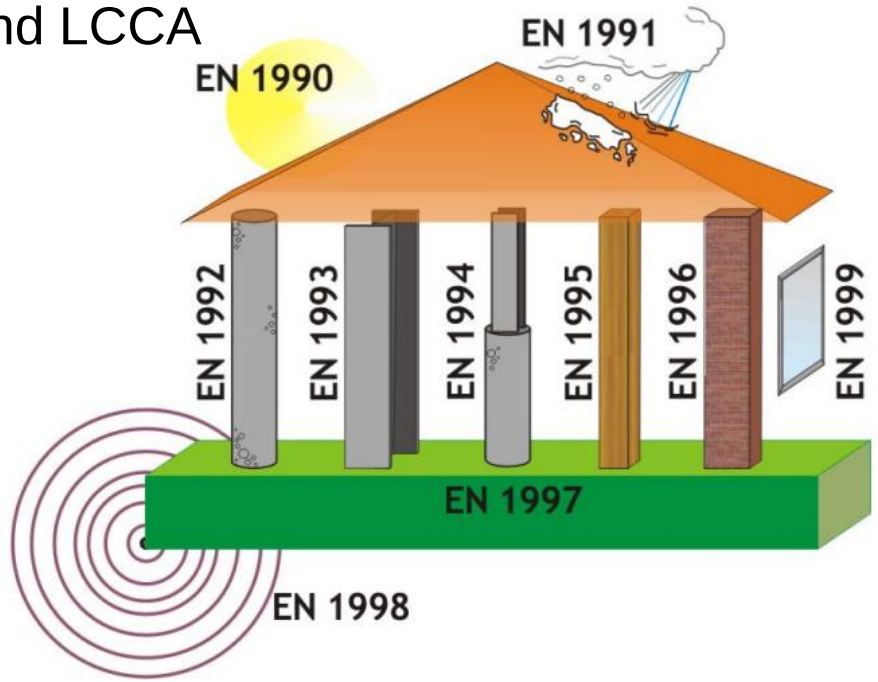
+ **Service life** (key point in civil engineering)

+ Sustainability

- Usage of natural resources

- CO_2 emisions

- Better LCA and LCCA



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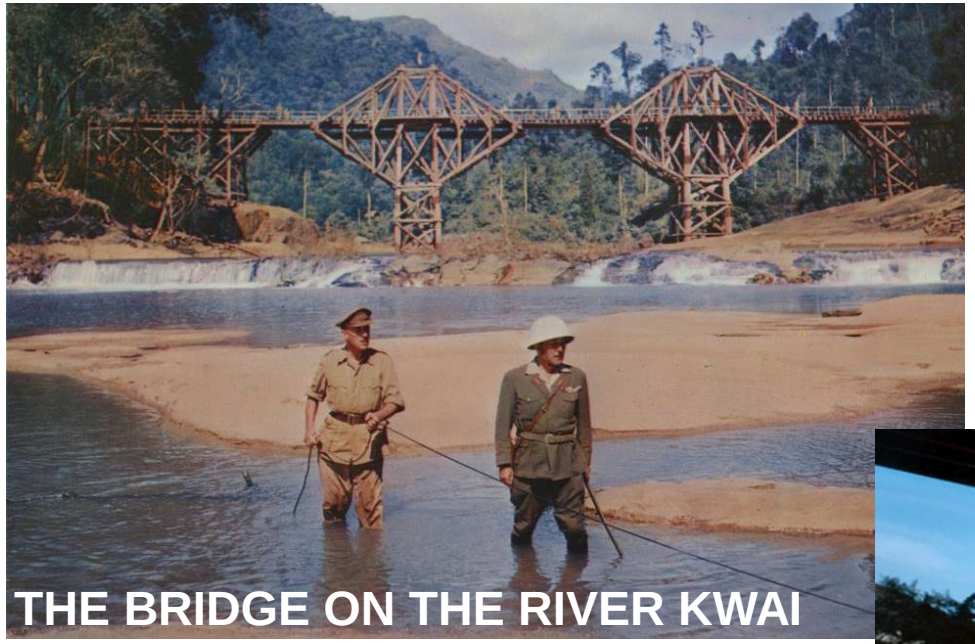
CODES, LAWS AND REGULATIONS

Category 1: 10 years



THE BRIDGE ON THE RIVER KWAI

Category 5: 100 years

TING KAU BRIDGE, HONG KONG (1998)

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CLIENT REQUIREMENTS. HIGHWAY ACROSS ROSKILDE FJORD IN DENMARK

ACCIONA Infrastructure, in a consortium with the Italian company Rizzani de Eccher and the Belgian firm BESIX, has been awarded the contract for the Frederikssund Link highway that will cross Denmark's Roskilde Fjord, worth 989.5 million Danish Krone (approximately €133 million).

The project includes the design and construction of an 8 km dual lane highway, a 1.3 km bridge that is 19.7 m wide and 1 km of local road between the dual carriageway and Lyngerupvej. The new link highway will reduce traffic congestion in the town of Frederikssund and provide an alternative route to the only bridge that currently crosses the fjord.

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CLIENT REQUIREMENTS. HIGHWAY ACROSS ROSKILDE FJORD IN DENMARK

4.2.1. Design life

A bridge working design life of 120 years (design working life category 5 to Eurocode 0 (DS/EN 1990)) shall be assumed in the design for all structures.

As a minimum, the following elements of the works shall be considered as non-replaceable components which shall meet the 120 year design life defined above:

- Foundations, including piles, pile caps and footings,
- Substructure, including piers, pier caps, abutments and retaining walls,
- Superstructure, including primary and secondary structural members and decks.

The design life of a replaceable component shall be defined as the period of time the component is required to remain in service, with planned maintenance, before it needs replacement. The design life of non-replaceable and replaceable components shall meet or exceed the minimum requirements specified in Table 4-1.

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CLIENT REQUIREMENTS. HIGHWAY ACROSS ROSKILDE FJORD IN DENMARK

Minimum required design life for structural components

Structural component	Minimum required design life (years)
Non-replaceable structural components	
All non-replaceable components	120 - design life of relevant structure as specified in this section (see above)
Replaceable structural components	
External post-tensioning cables	50
Bridge bearings	50
Expansion joints	whole system - 30 sliding elements - 30 steel elements (fatigue) - 120
Elastic joints	Hot applied joint sealants - 30 Cold applied joint sealants - 30
Concrete barriers	50
Steel barriers and guide rails	50
Waterproofing, bitumen sheets	40
Bridge deck wearing surface - asphalt	15
Drainage system	50
Access ladders and platforms	50
Etc…	…

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CLIENT REQUIREMENTS. CEBU BRIDGE PROJECT IN PHILIPPINES

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Key Enabling Technologies

European Commission

Key Enabling Technologies (KETs) provide the basis for innovation in a range of products across all industrial sectors. They underpin **the shift to a greener economy**, are instrumental in modernising Europe's industrial base, and drive the development of entirely new industries. Their importance makes them a key element of European industrial policy.

1. Micro and nanoelectronics
2. **Nanotechnology**
3. Industrial biotechnology
4. **Advanced materials**
5. Photonics
6. Advanced manufacturing technologies

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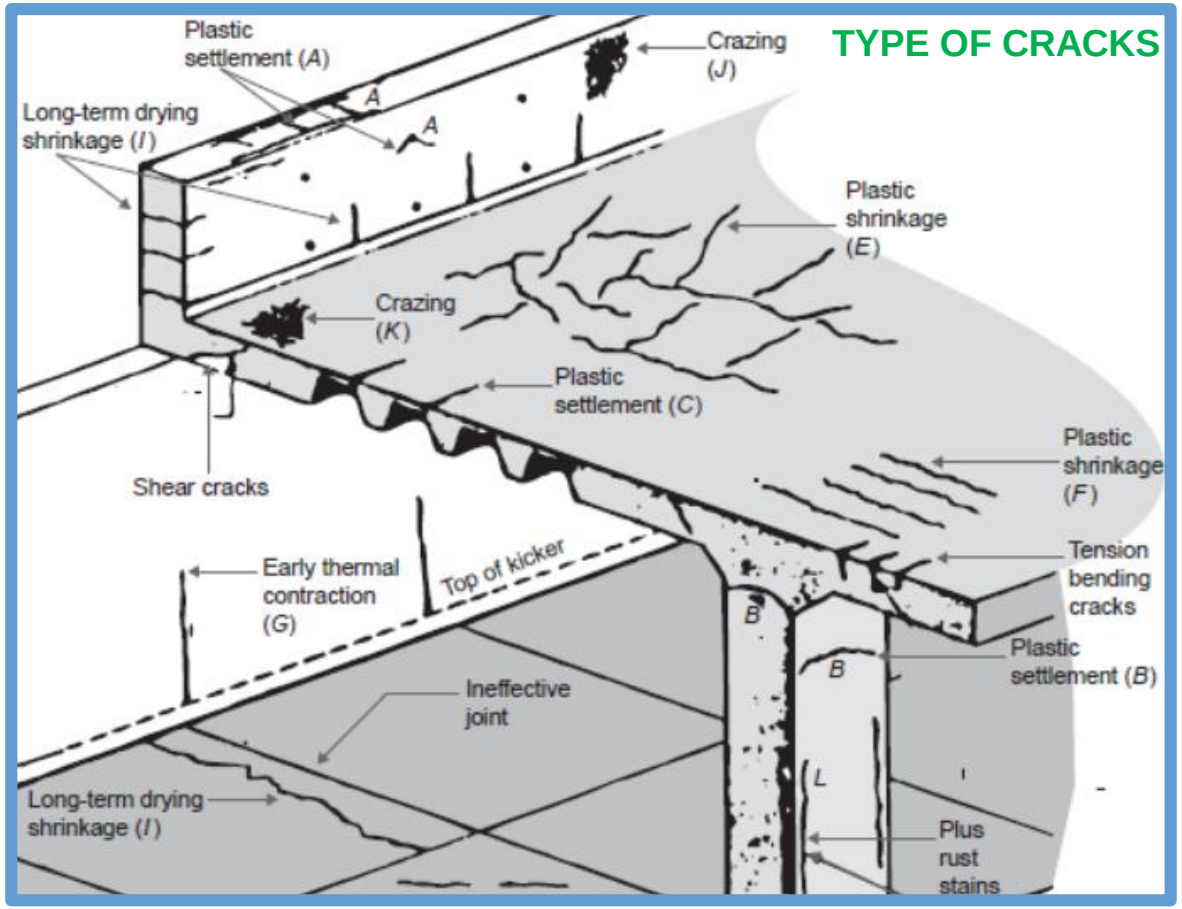
Key Enabling Technologies



- Cracks
+ Water tightness
+ **Service life** (key point in civil engineering)
+ Sustainability
- Usage of natural resources
- CO_2 emisions
- Better LCA and LCCA

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Self-curing
Self-protection
Self-diagnosis
Self-healing
Coatings
Low heat of hydration cements

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Key Enabling Technologies

Tipos	Denominación	Designación	Composición (proporción en masa [1) 5)])										
			Componentes principales										Componentes. minoritarios
			Clínker K	Escoria de horno alto S	Humo de sílice D [2)]	Puzolana		Cenizas volantes		Esquistos calcinados T	Caliza[4)]		
						Natural P	Natural calcinada Q	Silíceas V	calcáreas W		L	LL	
CEM I	Cemento pórtland	CEM I	95-100	–	–	–	–	–	–	–	–	–	0-5
CEM II	Cemento pórtland con escoria	CEM II/A-S	80-94	6-20	–	–	–	–	–	–	–	–	0-5
		CEM II/B-S	65-79	21-35	–	–	–	–	–	–	–	–	0-5
	Cemento pórtland con humo de sílice	CEM II/A-D	90-94	–	6-10	–	–	–	–	–	–	–	0-5
	Cemento pórtland con puzolana	CEM II/A-P	80-94	–	–	6-20	–	–	–	–	–	–	0-5
		CEM II/B-P	65-79	–	–	21-35	–	–	–	–	–	–	0-5
		CEM II/A-Q	80-94	–	–	–	6-20	–	–	–	–	–	0-5
		CEM II/B-Q	65-79	–	–	–	21-35	–	–	–	–	–	0-5
	Cemento pórtland con ceniza volante	CEM II/A-V	80-94	–	–	–	–	6-20	–	–	–	–	0-5
		CEM II/B-V	65-79	–	–	–	–	21-35	–	–	–	–	0-5
		CEM II/A-W	80-94	–	–	–	–	–	6-20	–	–	–	0-5
		CEM II/B-W	65-79	–	–	–	–	–	21-35	–	–	–	0-5
	Cemento pórtland con esquistos calcinados	CEM II/A-T	80-94	–	–	–	–	–	–	6-20	–	–	0-5
		CEM II/B-T	65-79	–	–	–	–	–	–	21-35	–	–	0-5
	Cemento pórtland con caliza	CEM II/A-L	80-94	–	–	–	–	–	–	–	6-20	–	0-5
		CEM II/B-L	65-79	–	–	–	–	–	–	–	21-35	–	0-5
		CEM II/A-LL	80-94	–	–	–	–	–	–	–	–	6-20	0-5
		CEM II/B-LL	65-79	–	–	–	–	–	–	–	–	21-35	0-5
	Cemento pórtland compuesto[3)]	CEM II/A-M	80-88	12-20									0-5
		CEM II/B-M	65-79	<---------- 21-35 ---------->									0-5
		CEM II/C-M	64 - 50	36 - 50									0-5
CEM III	Cemento de horno alto	CEM III/A	35-64	36-65	–	–	–	–	–	–	–	–	0-5
		CEM III/B	20-34	66-80	–	–	–	–	–	–	–	–	0-5
		CEM III/C	5-19	81-95	–	–	–	–	–	–	–	–	0-5
CEM IV	Cemento puzolánico[3)]	CEM IV/A	65-89	–	<---------- 11-35 ---------->					–	–	–	0-5
		CEM IV/B	45-64	–	<---------- 36-55 ---------->					–	–	–	0-5
CEM V	Cemento compuesto[3)]	CEM V/A	40-64	18-30	–	<---- 18-30 ---->			–	–	–	–	0-5
		CEM V/B	20-38	31-49	–	<------- 31-49 -------->			–	–	–	–	0-5
CEM VI	Cemento compuesto	CEM VI	49 - 35	35 - 49									0-5

- Clinker
+ Sustainability
- Usage of natural resources
- CO_2 emisions
- Better LCA and LCCA

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CEM II/C-M (S-V)
CEM II/C-M (S-LL)

CEM VI/S-V

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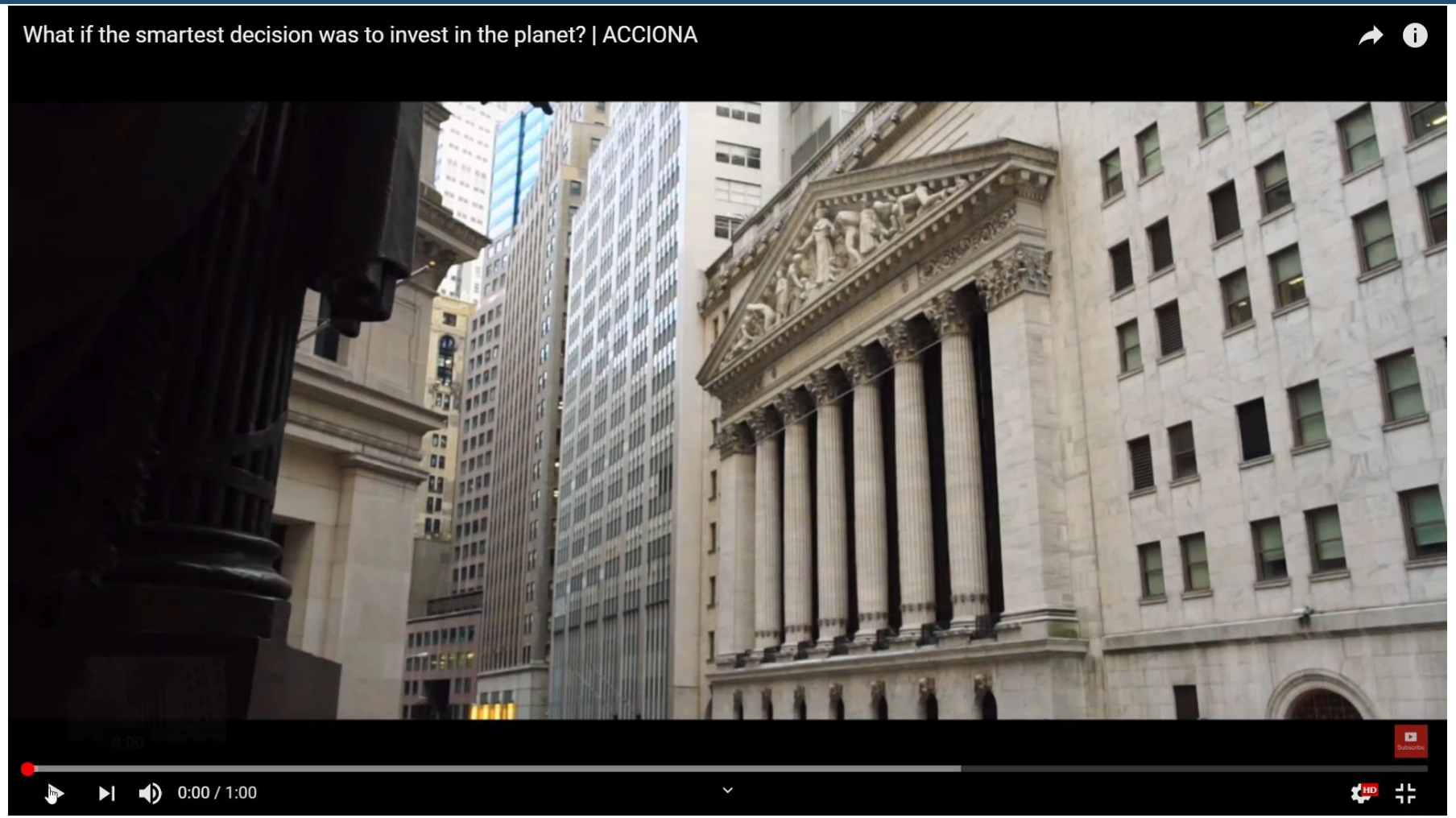
https://www.youtube.com/watch?v=h2KigmRHlvg

Society. Future Generations



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VALUES & MISSION

https://www.acciona.com/about-acciona/mission-and-values/

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BUSINESS AS UNUSUAL

We aim to meet the needs of today without compromising the ability of future generations to meet theirs.

Our **mission** is to be a leader in the creation, development and management of infrastructure, energy, water and services; **contributing actively to social wellbeing, sustainable development** and the creation of value for our stakeholder groups.

Our **vision** is to meet the challenge of achieving **sustainable development in all our business areas, so that the generations of today and the future will have a better life.**

Our fundamental **values** include: Honesty. Leadership. Excellence. **Environmental concern**. **Social responsibility**. **Long term view**. Financial strength. Customer focus. Innovation. **Care for people**

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