Precast concrete…

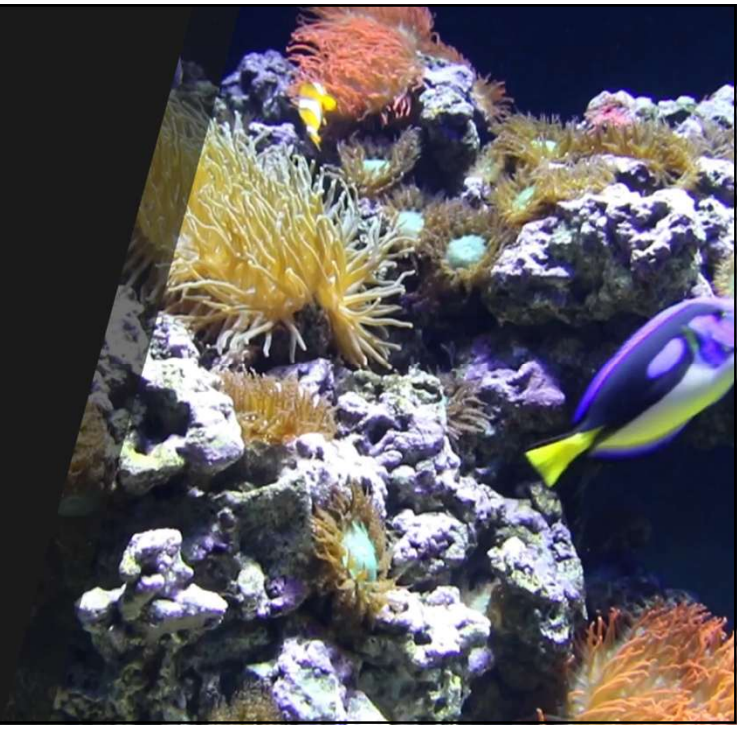
…and contemporary societal challenges

FEBE

Stef MAAS
17/12/2025

Societal challenges

BIODIVERSITY



Societal challenges

Biodiversity

The variety of life on Earth…

… in all its forms

Photo by Egor Kamelev

Societal challenges

Biodiversity

'Healthy ecosystems provide us with many essentials we take for granted'

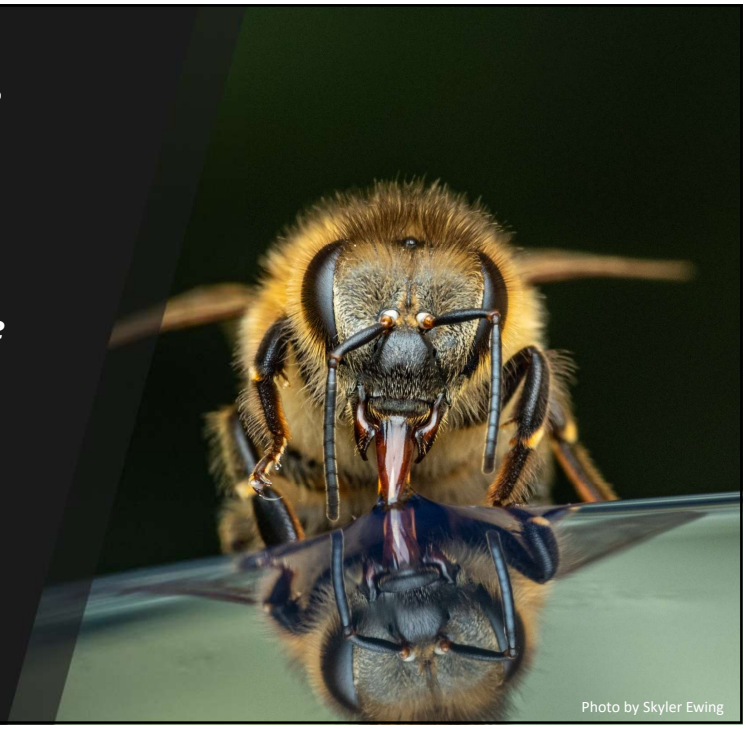


Photo by Skyler Ewing

Societal challenges

Biodiversity

Reasons for biodiversity loss

- Changes in land use
- Direct exploitation
- Climate change
- Pollution
- Invasive alien species

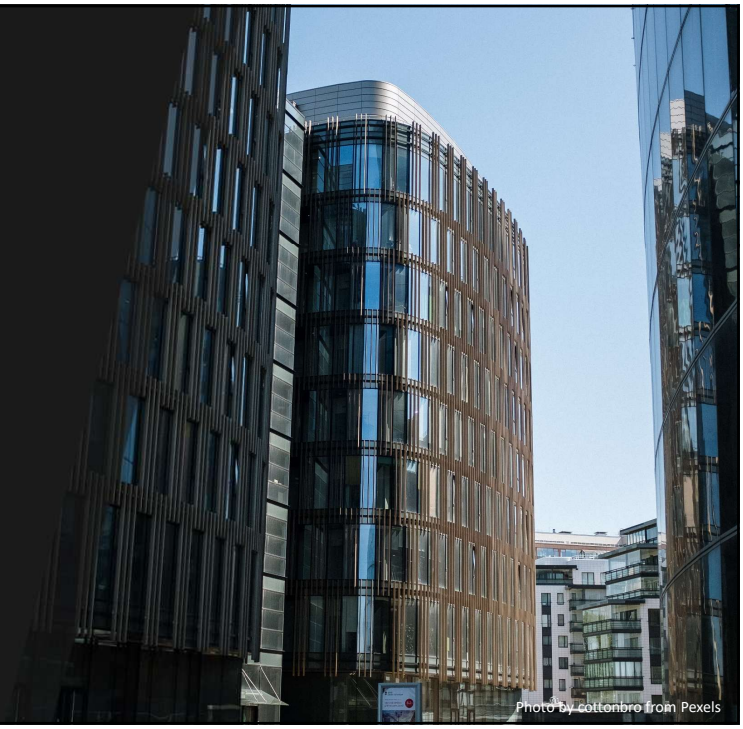


Photo by cottonbro from Pexels

Societal challenges

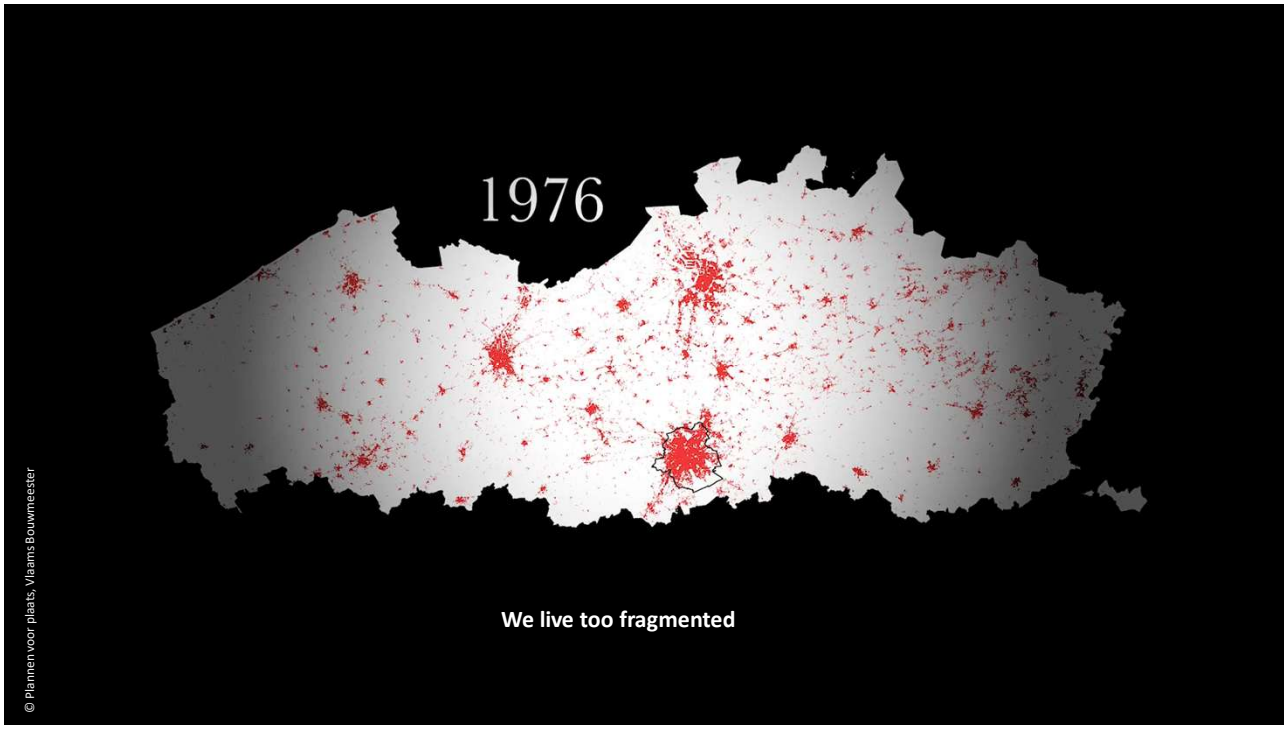
Biodiversity

We are using too much space!

Flanders:

- 16% covered
- 33% settlement area

Photo by Het Nieuwsblad

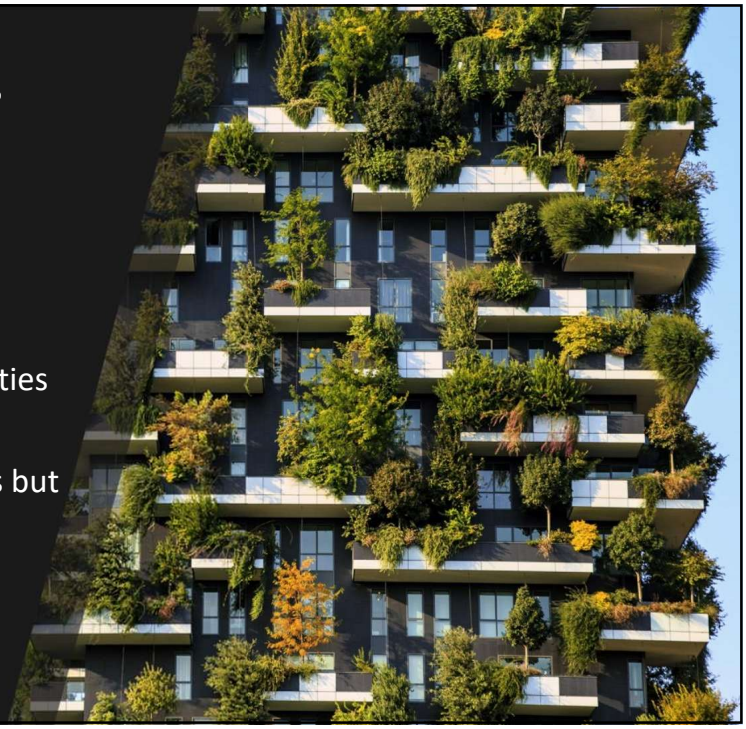


Societal challenges

Biodiversity

The future is in the city!

- Vertical and horizontal
- Compacted villages and big cities
- High- and low-rise buildings
- No mono-functional buildings but multifunctional buildings
- High-quality public space
- No cars in the city



Societal challenges

Biodiversity

Does not rot

Slender columns

High strength

Earthquake resistant

Structural behaviour

High and low-rise buildings

(no pigeonholes)

CO_2 uptake

Flexible

'Precast concrete is particularly suitable for realising buildings of the future'

Long life span

Adaptable

Robust

Large spans

Resistant to effects of climate change

Slender floors (prestressed HC)

Thermal inertia

Architectural concrete

High fire resistance

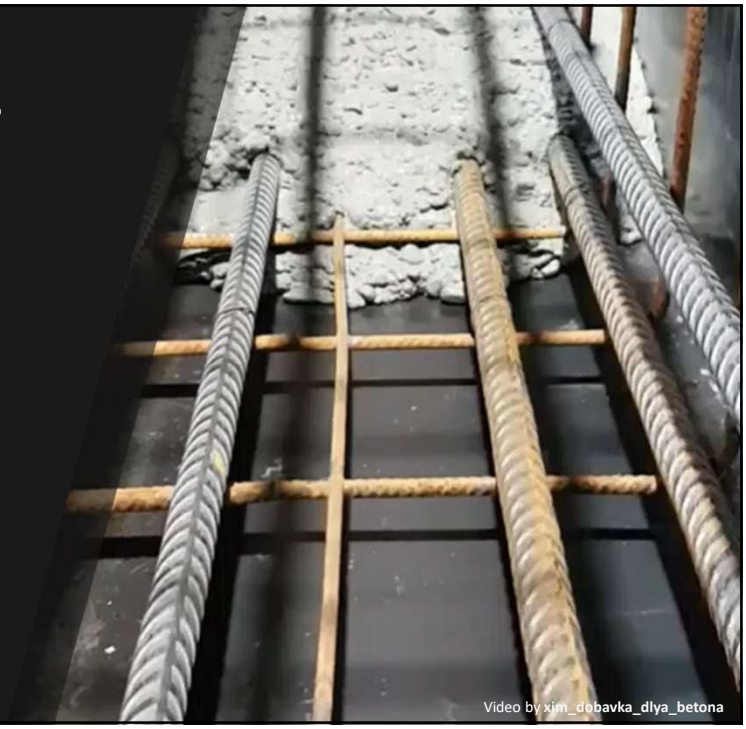
Green roof gardens

Good acoustic properties (important with mix of activities)

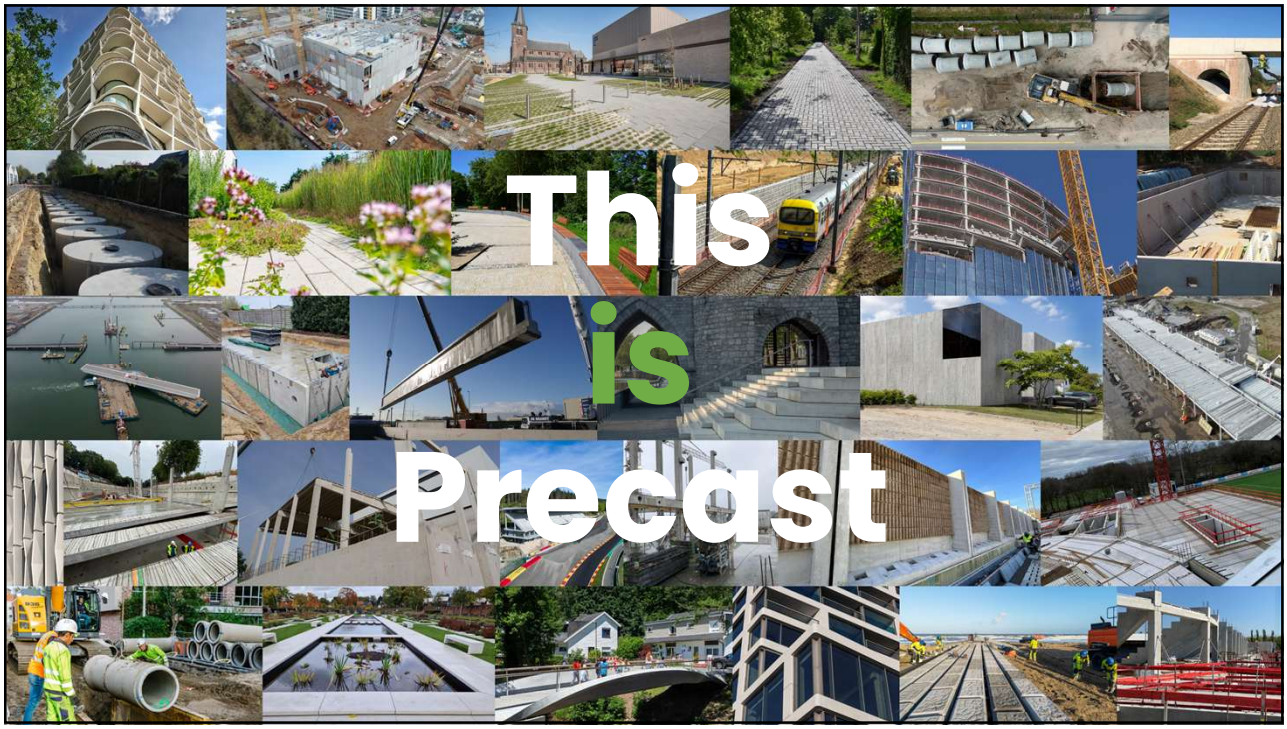
Replaceable

Societal challenges

CONCRETE




KitchenAid
KitchenAid


This
is
Precast

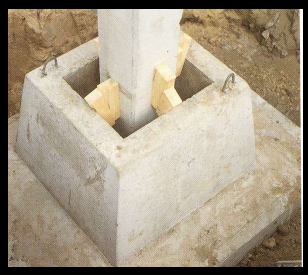
This is Precast

Elements for buildings

- Foundations
  - Foundation piles
  - Foundation-beams
  - Pocket foundations
- Floors
  - Floor plates for floor systems
  - Beam and block
  - Hollow core
    - Reinforced
    - Prestressed
  - Ribbed floors
  - Solid labs (& balconies)
- Roofs
  - Roof Elements
  - Tiles
- Walls
  - Masonry blocks
  - Solid walls
  - Sandwich panels
  - Double walls
  - Cladding
- Stairs
  - Flights
  - Landings
- Linear elements
  - Columns
  - Beams
    - Half beams
- Cells

This is Precast

Elements for buildings



This is Precast

Elements for buildings

Floor and roof types	Max. span in m	Floor thickness mm	Unit width m	Unit weight kN/m²
	7	120 - 200	300 - 600	2,1 – 3,2
	20	120 - 500	600 – 1200 - 2400	2.2 – 5.2
	12	175 – 355	2400	1.2 – 1.8
	24 -30	200 – 800	2400 – 3000	2.0 – 5.0
	6	100 - 200	300 - 600	0,7 – 3,0
	7 - 10	100 – 400	600 – 2400	2.4 – 4.8
	6	200 - 220	515 - 635	1,7 - 2,3

This is Precast

Elements for buildings



This is Precast

Elements for landscaping & infrastructure

- Sewers and drains
  - Pipes
  - Jacking pipes
  - Manholes
  - Ditch elements
  - Drainage channels
  - …
- Tanks
  - Water tanks
  - Grease and oil separators
- Paving stones and tiles
- Kerbs
- Lego blocks
- Retaining walls
- Benches
- …
- Bridge elements

This is Precast

Elements for landscaping & infrastructure



ADVANTAGES

Reliable

Smart

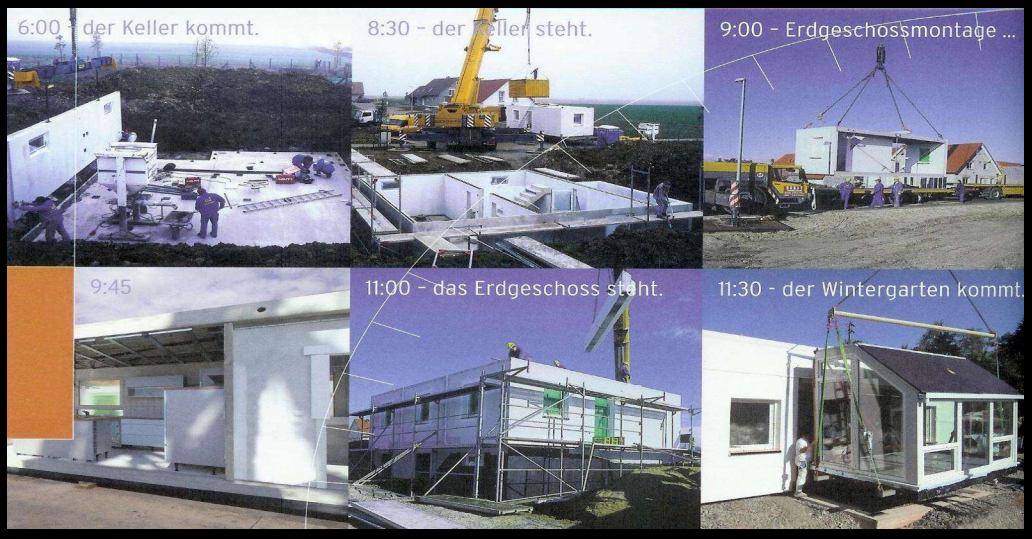
Uncomplicated

Safe

Fast

This is Precast

Fast construction



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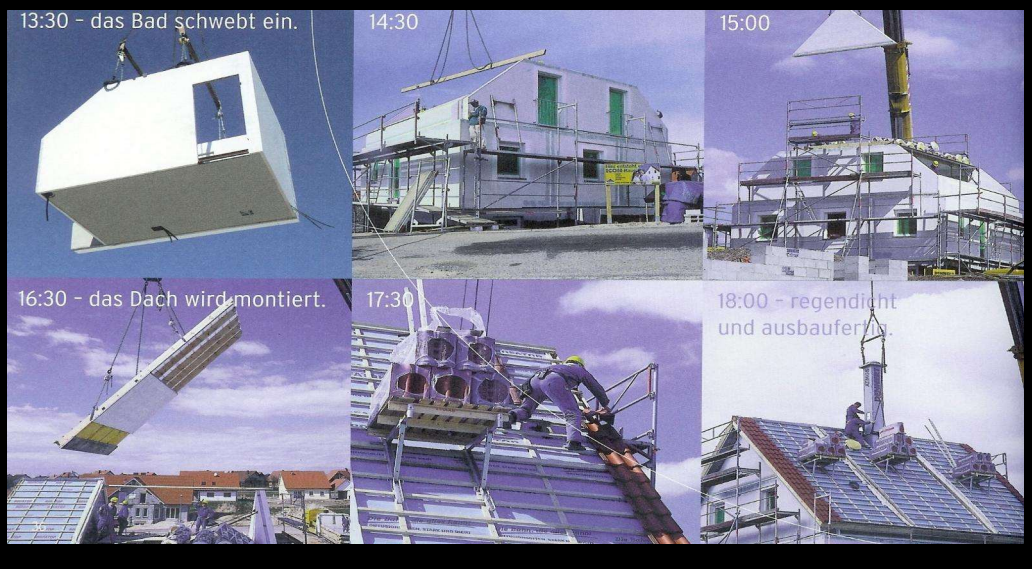
Fast construction



Video

This is Precast

Advantages

- Factory-based production
  - Protected and controlled environment
  - Efficient production methods
  - Trained staff
  - Early adaptor of new technology (SCC, UHPC, FRC,…)
- Environmentally friendly construction method
  - Closed loop
  - No waste (no spillage)
  - Long service-life
    - Robust
    - Does not rot
  - Low environmental footprint

This is Precast

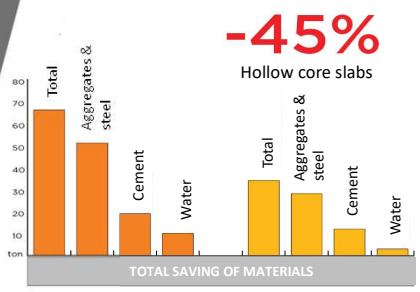
Advantages

- Site Safety (Staff)
  - Clean and well-organised site to **minimise risks**
  - Precast stairs serve as **permanent access**—no temporary site stairs required
  - Load-bearing floors delivered **fully compliant and ready for use**
  - Secure installation of **guardrails to prevent falls**
  - Maximised factory work hours—less on-site labour, **increased safety and better working conditions**

This is Precast

Advantages

- Quality
  - FPC
  - Better preparation, pouring, **compacting**, curing
- Construction time
  - Less dependent of weather conditions
- Optimal use of raw materials
  - No spillage
  - Use of voids



This is Precast

Advantages

- Size of the construction site
  - No place needed for reinforcement or formwork
- Structural efficiency
  - Long spans, slender columns
  - Prestress
  - High concrete grades
- Flexibility
- Adaptability
- Fire resistance

This is Precast

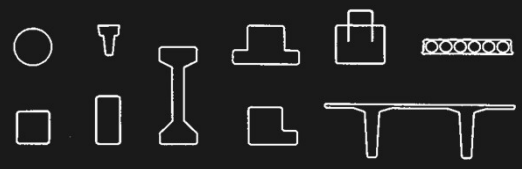
Advantages

- Prefabrication is flexible
  - Almost any building can be prefabricated
  - Almost everywere

This is Precast

Disadvantages

- More expensive construction products
- Limitations in dimensions (transport)
- Fixed unit sizes (subjective)
- Equipment



Prefabrication is not just a construction method—it's a risk management strategy.

Risk Area	Traditional Site Construction	Prefab Construction Advantage
Quality	Variable workmanship, weather dependency	Certified, factory-controlled production (CE, BENOR,…)
Safety	Many workers on site, formwork, reinforcement, working at height	Fewer workers, safer tasks, repetitive factory processes No formwork or reinforcement on site Integrated collective safety features
Structural Risk	On-site temporary phases may lack stability	Immediate stability with full/semi precast elements
Weather Delays	Frequent interruptions	Fast assembly, nearly weather-proof
Theft	Loose materials, tools easy to steal	Heavy, hard-to-resell components; easier to secure site
Fire & Water	Long term effects when exposed to rain, fire	Concrete doesn't burn or rot; moisture-resistant during works

Societal challenges

CO_2

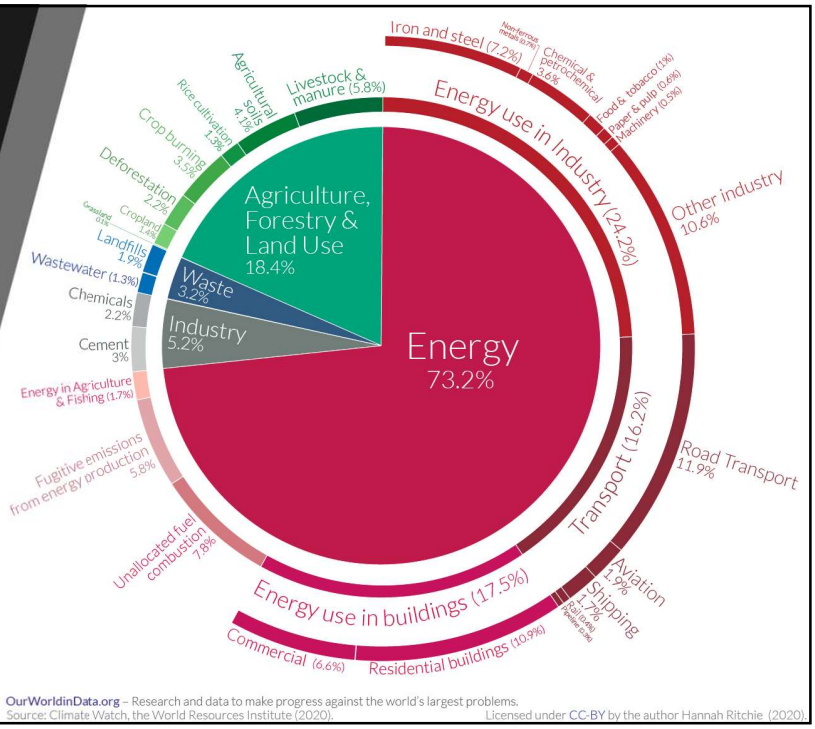
Societal challenges
CO_2

8%

Societal challenges
CO_2

Societal challenges

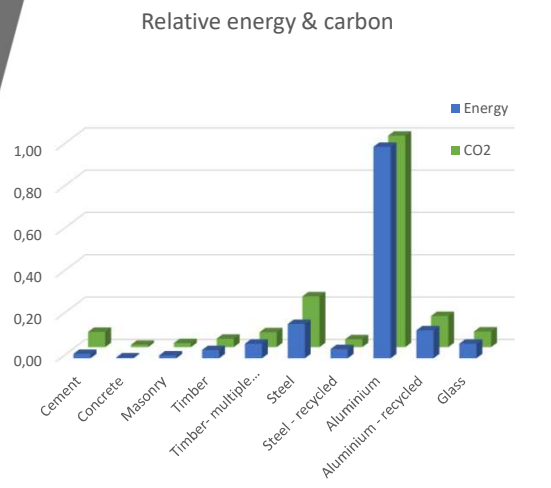
CO_2



Societal challenges

CO_2

- No alternative to concrete
- Not in terms of
  - CO_2
  - Performance
  - Life span
  - Availability



Source: Inventory of Carbon & Energy, Version 1.6a

Societal challenges

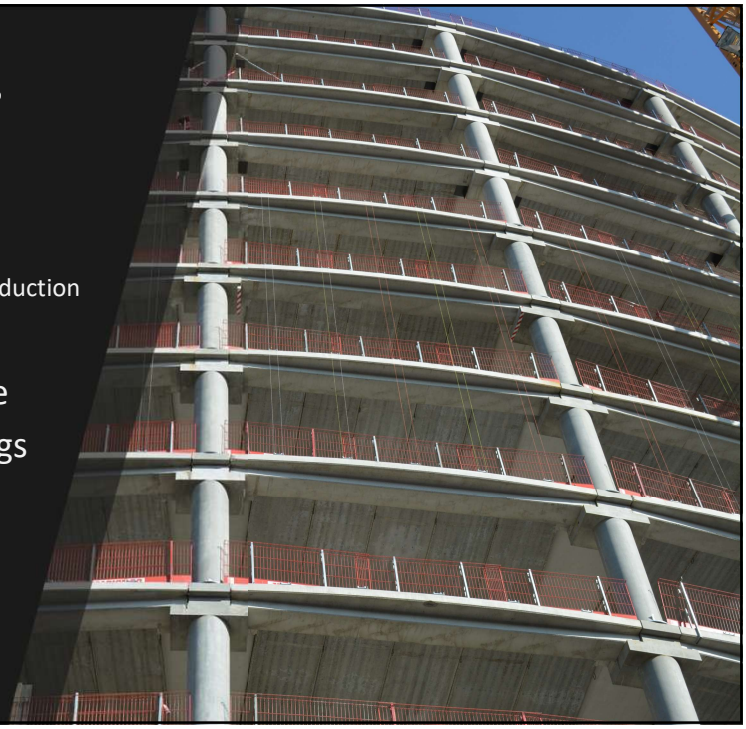
CO_2

Societal challenges

Strategies to reduce CO_2

Reduce

- CO_2 emissions during clinker production
- Clinker content of cement
- Cement content of concrete
- Concrete content in buildings
- Number of buildings



Societal challenges

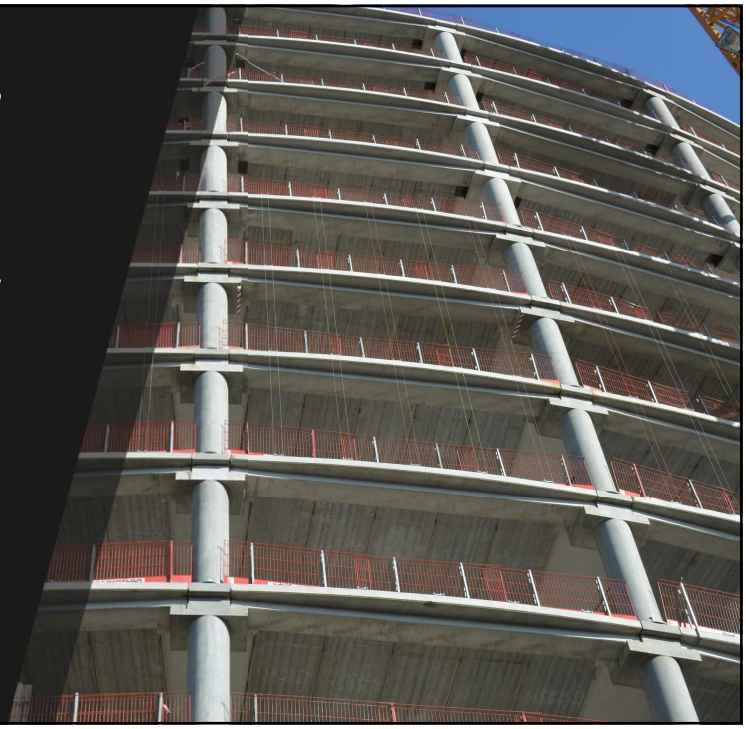
Strategies to reduce CO_2

(Re)use

- (Re)use buildings efficiently
- Reuse components
- Reuse raw materials

↓

Circularity



Societal challenges

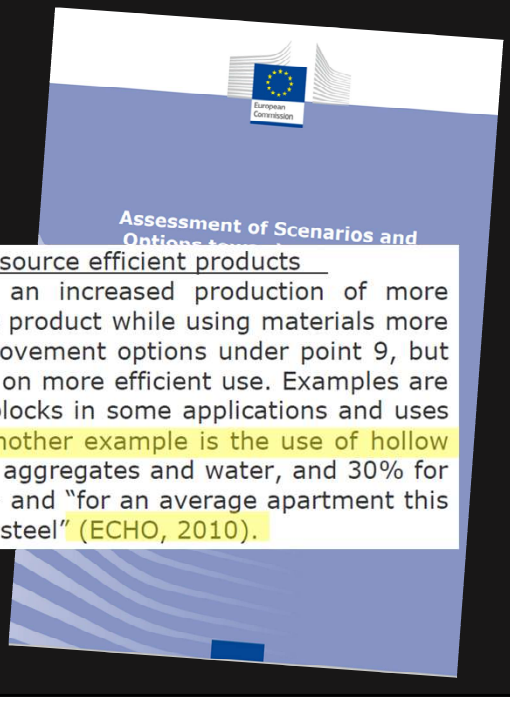
Strategies to reduce CO_2

Search for alternatives

- Geopolymer-hype
  - Availability
  - Environmental impact activators
  - Impact on a global scale?
- Promising alternatives
  - LC^3
  - FUTURECEM
  - …
- Up to 40% reduction

Societal challenges

Strategies to reduce CO_2



10. Use materials more efficiently: produce more resource efficient products

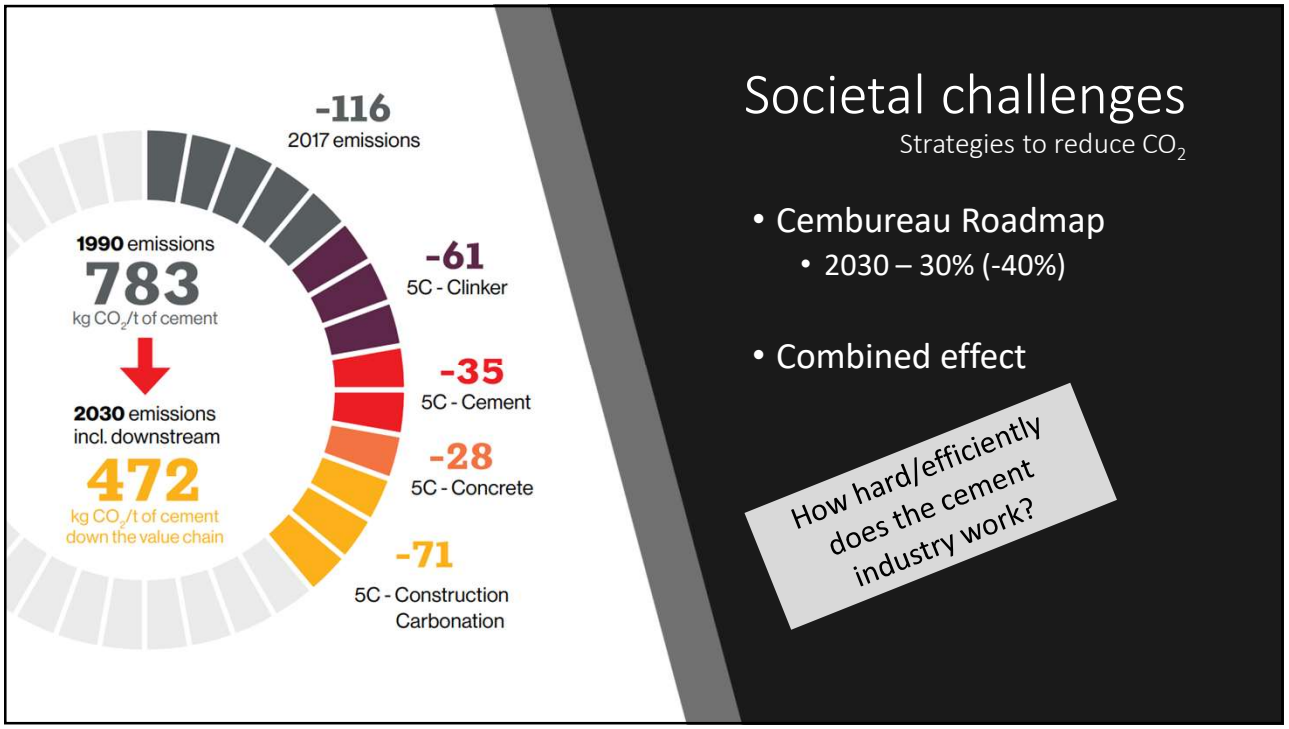
This technical improvement option is based on an increased production of more resource-efficient products, i.e. providing the same product while using materials more efficiently[10]. It relates closely to the technical improvement options under point 9, but focuses more on resource-efficient production than on more efficient use. Examples are hollow concrete block work that can replace solid blocks in some applications and uses around 25% less material because of the voids. Another example is the use of hollow core flooring that shows a saving of about 45% for aggregates and water, and 30% for cement compared to in-situ concrete construction – and "for an average apartment this means savings of 14.4 tons of concrete and 275 kg steel" (ECHO, 2010).

Societal challenges

Strategies to reduce CO_2

-45%

material use



Societal challenges

Strategies to reduce CO_2

- Cembureau Roadmap
  - 2030 – 30% (-40%)
- Combined effect

How hard/efficiently does the cement industry work?

Societal challenges

Strategies to reduce CO_2

- Cembureau Roadmap
  - 2030 – 30% (-40%)
- Combined effect
- Carbonation

Societal challenges

Strategies to reduce CO_2

Carbstones®

- No cement
- Binder = 100% recycled Carbinox®
  - steel slag powder
    - Binds aggregates by reaction with CO_2
    - Total CO_2 footprint* before CO_2 capture:
      - 0,55 kg CO_2 eq/ton
    - CO_2 sequestration:
      - +/- 90 kg CO_2 /ton
- 100 % recycled aggregates
- Total CO_2 footprint *:
  - - 9,71 kg CO_2 eq / m^2

* Life cycle analyses, FOB

Societal challenges

Strategies to reduce CO_2

Carbstones®

- Mix design (example)
  - +/- 700 kg/m^3 Carbinox
  - +/- 1500 kg/m^3 fine and coarse aggregates
  - +/- 180 l water
  - +/- 80 kg CO_2

Societal challenges

Strategies to reduce CO_2

- Curing
  - In CO_2 curing chambers:
    - Recycled CO_2 (purity > 20 %)
    - 80 % relative humidity
    - Atmospheric pressure
  - 24 hours
  - Exothermal process (40 °C - 80 °C)
  - No energy consumption
  - CO_2 sequestration

Societal challenges

Strategies to reduce CO_2

Carbstones®

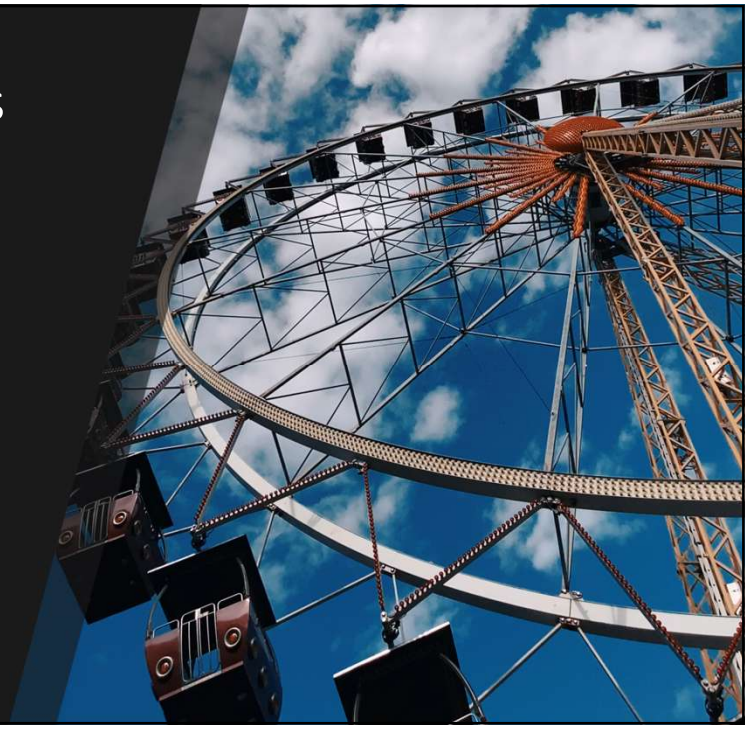
- Example

• Dimension	390 x 140 x 190	mm
• Gross dry density *	1400 – 1600	kg/m³
• Mean normalised compressive strength *	11,8	N/mm²
• Water absorption by capillarity *	< 8	g/(m².s)
• Shear bound strength **	0,15	N/mm²
• Size change due to moisture *	< 0,45	mm/m
• Thermal conductivity λ***	0,51	W/(m.K)

* EN 772 ** EN 1052 *** EN 12667

Societal challenges

CIRCULARITY



Societal challenges

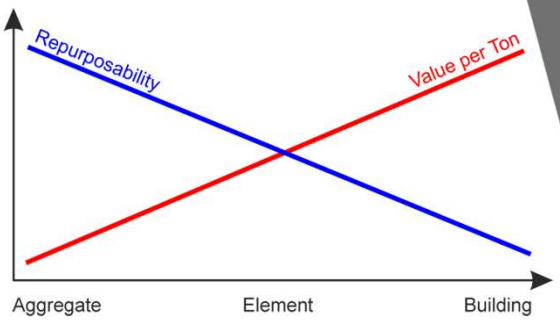
Circularity

What?

- Reduce waste to a minimum
- Keep materials in the loop

Why?

- Demand vs resources
- Environmental impact



Societal challenges

Circularity

What?

- Reduce waste to a minimum
- Keep materials in the loop

Why?

- Demand vs resources
- Environmental impact

Societal challenges

Circularity

Strategy for precast

1. Design for a long lifespan
2. Design for re-use
3. Design for de/re-mountability
4. Make elements crushable

Societal challenges

Circularity

Points of attention and opportunities

- Preventive and curative maintenance
- Standardisation of elements
- Architectural freedom
- Technical assessment of elements
- Allocation of responsibilities
- Role of the demolition contractor
  - DoP
- Record-keeping of technical information
  - Electronic Product Passport
  - BIM
- PaaS

Arch. Borel,Photo by Decomo

INNOVATION

R&D

INNOVATION

R&D

- The construction sector
  - Conservative market
  - Building is a cultural act
  - Change is incentive driven
- IDF
- Geopolymers

INNOVATION

R&D

- Technology
  - Connections
  - Layer approach
- Materials
  - New binders
  - Recycled binders
  - CO_2 as resource
    - Binder
    - Aggregate
  - Urban mining
- Commercial models
  - Maintaining ownership over high quality raw materials

fib bulletins

www.fib-international.org

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