CONCRETE INDUSTRY SOLUTIONS

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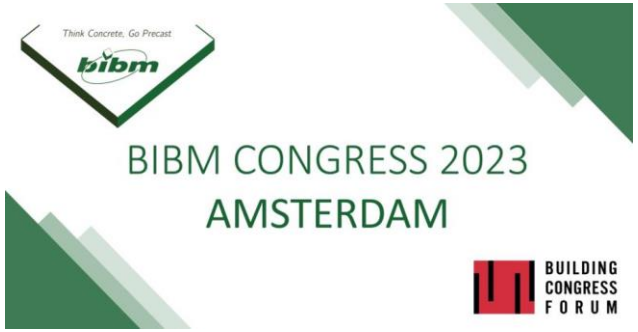
A pathway for the reduction of carbon footprint in precast reinforced concrete structures



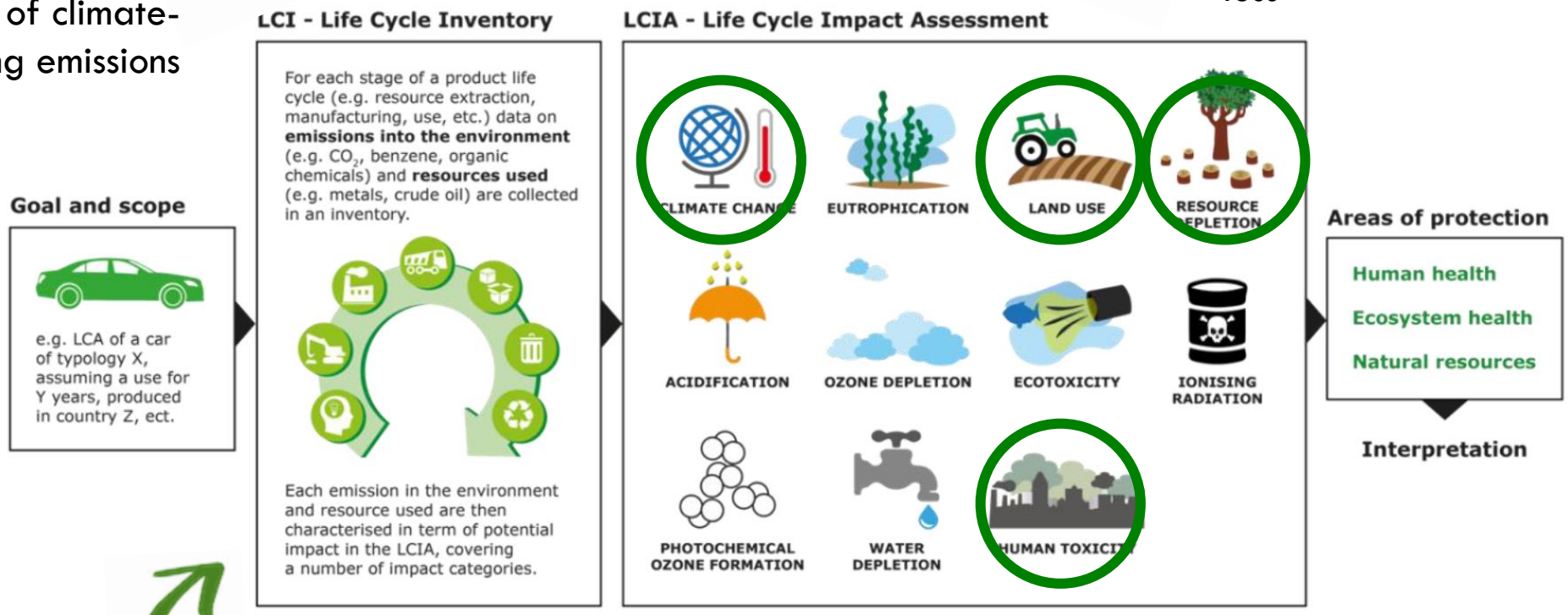
Amsterdam, 28/9/2023

Sustainable and durable concrete structures

The request for climate neutrality: the European Green Deal

Reduction of climate-altering emissions

Reduction of land consumption and reduction of biodiversity loss



Reduction in the consumption of fossil fuels and natural resources

Reduction of environmental impact of concrete

Reinforced concrete with low environmental impact

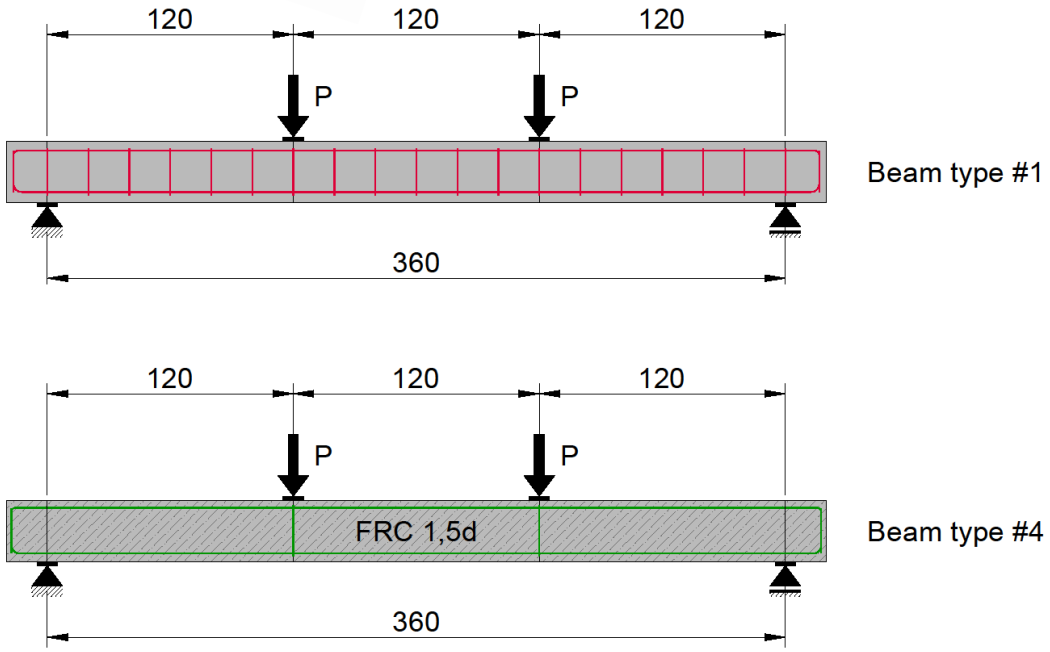
FRP + FRC

Concretes with reduced carbon footprint and recycled materials

Optimization of the use of reinforcements

New structural solutions for reducing environmental impacts: industrial test

Traditional solution:
STEEL REBARS



Innovative solution:
FRC + GFRP

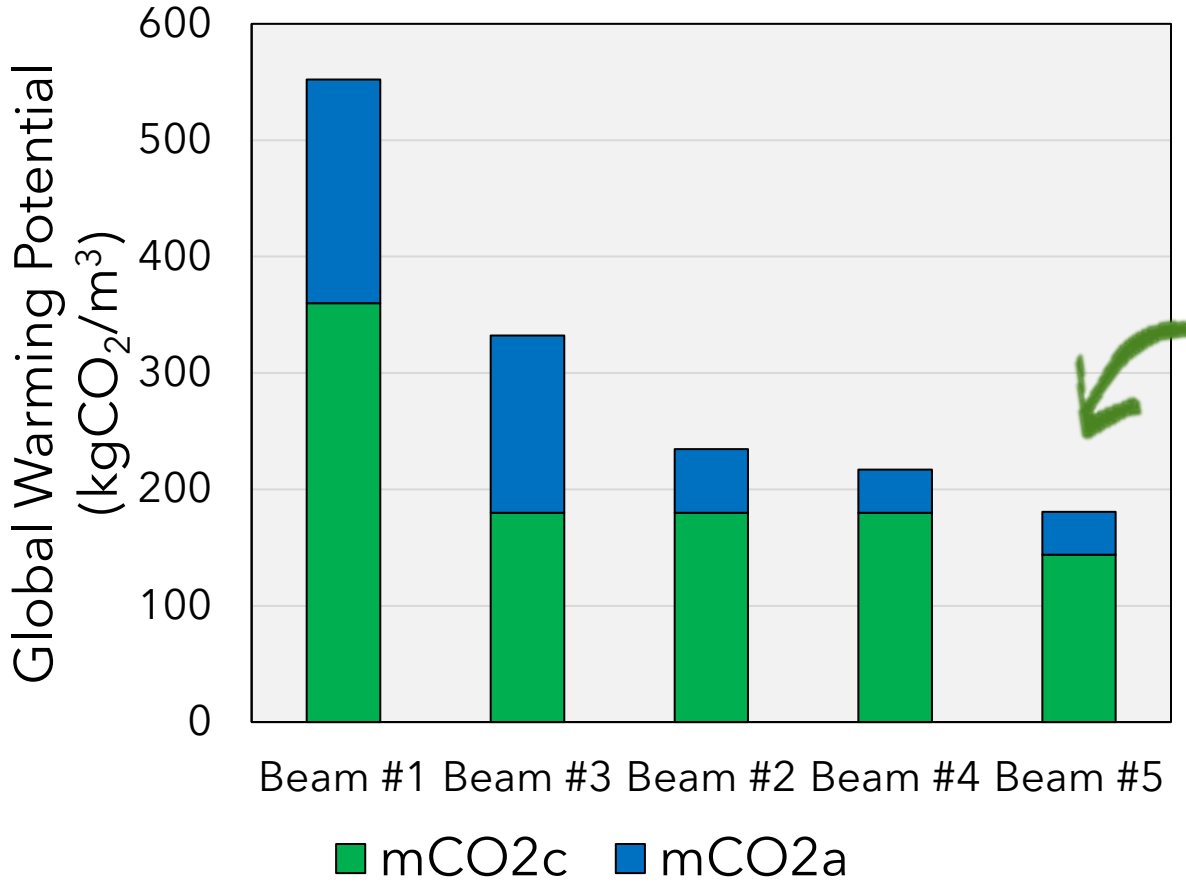
New structural solutions for reducing environmental impacts: experimental campaign

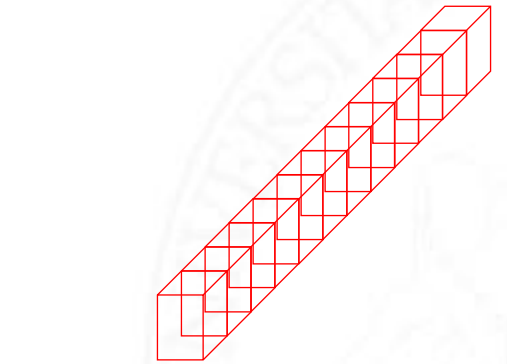
	CONCRETE	REBARS REINFORCEMENT	STIRRUPS AND SECONDARY REINFORCEMENT
BEAM 1	REF	STEEL	STEEL
BEAM 2	ECO 1	GFRP	GFRP
BEAM 3	ECO 1	STEEL	POLYMER FIBERS
BEAM 4	ECO 1	GFRP	POLYMER FIBERS
BEAM 5	ECO 2	GFRP	POLYMER FIBERS

Assessment of environmental impacts: Global Warming Potential

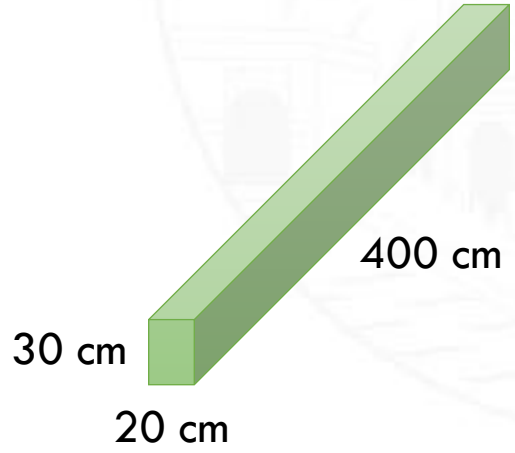
Emissions related to the production of reinforcements

Emissions related to concrete production



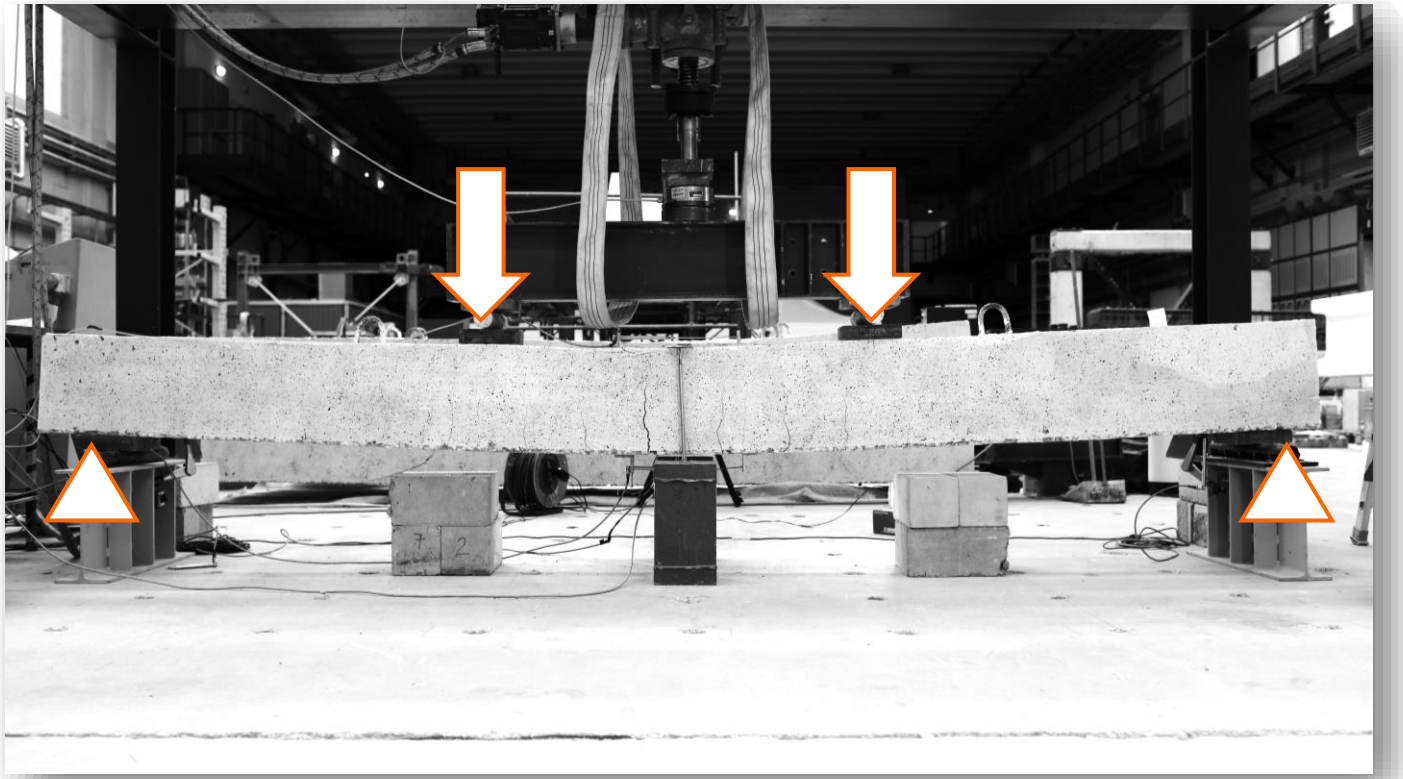


Reduction up to 70%



Flexural tests on beams: set-up

4 point flexural tests



Test under deformation control

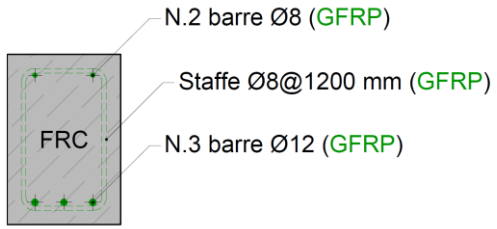
Digital Image Correlation (DIC)

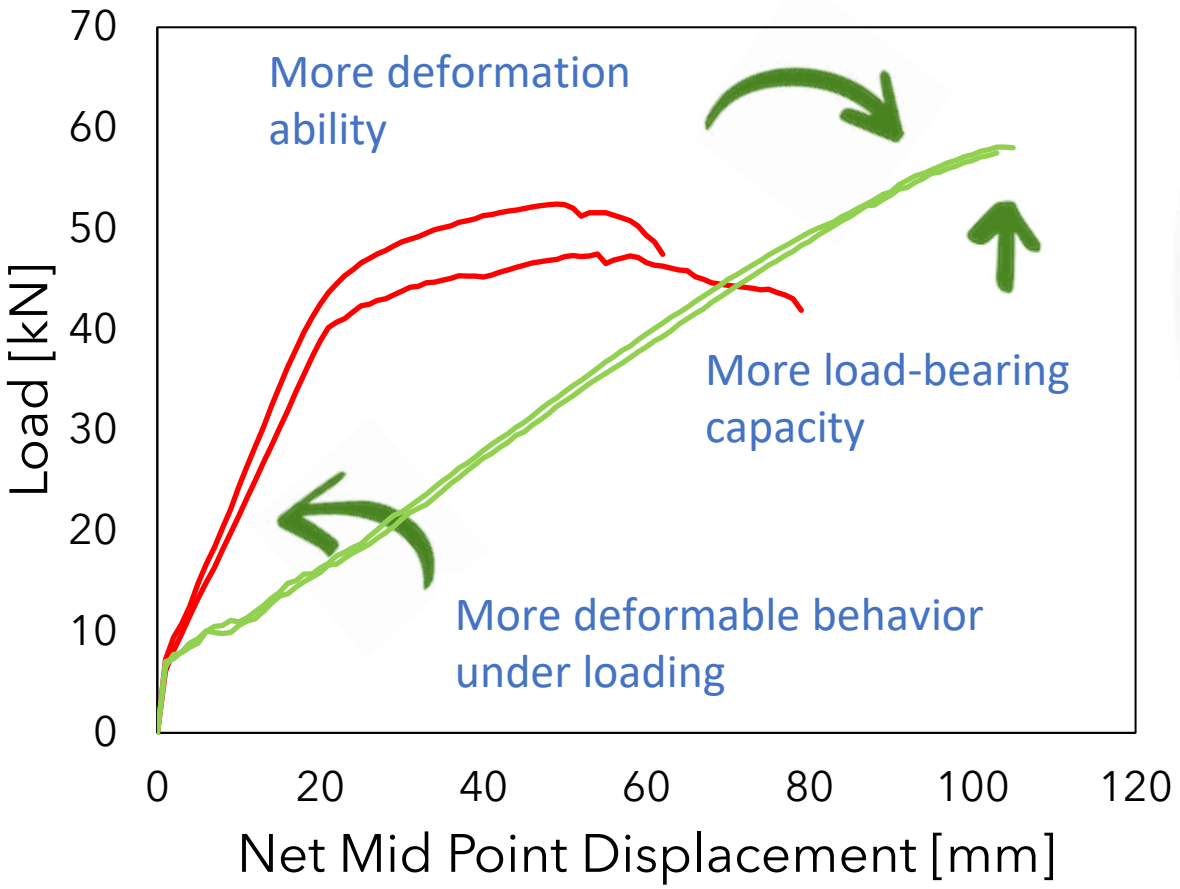
Linear Voltage Displacement Transducers (LVDTs)

New structural solutions for reducing environmental impacts: Beams #1 vs. Beams #4.

BEAMS #1

BEAMS #4





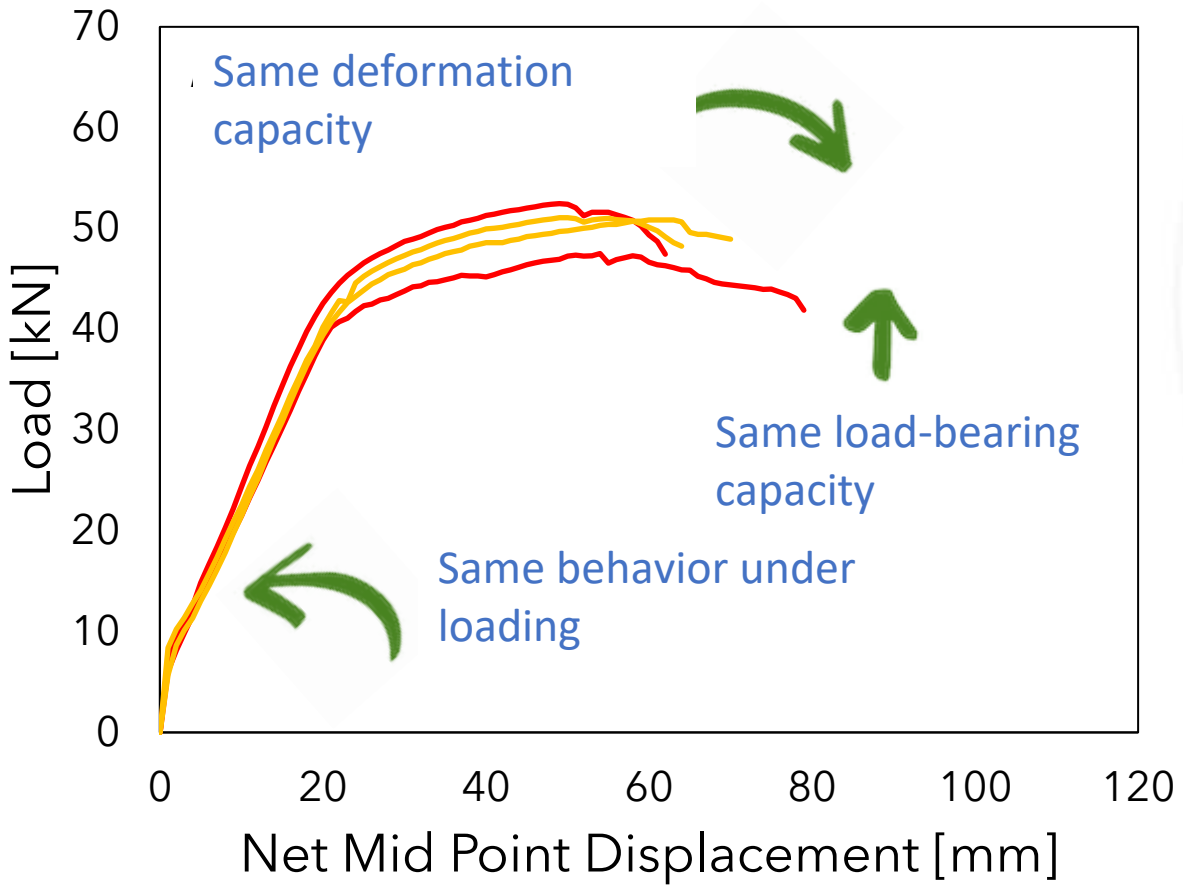
BEAMS #1
Traditional solution with STEEL REBARS+ STEEL STIRRUPS

BEAMS #4
Innovative solution with FRC + GFRP REBARS+ GFRP STIRRUPS

New structural solutions for reducing environmental impacts: Beams #1 vs. Beams #3.

BEAMS #1

BEAMS #3

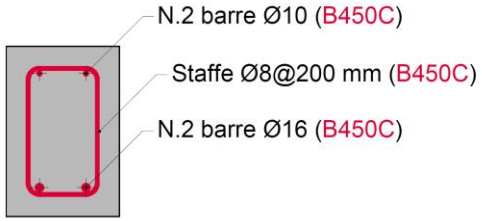


BEAMS #1
Traditional solution with STEEL REBARS+ STEEL STIRRUPS

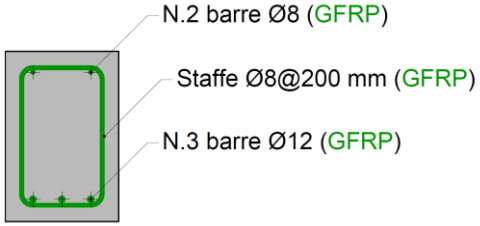
BEAMS #3
Innovative solution with FRC+STEEL REBARS + STEEL STIRRUPS

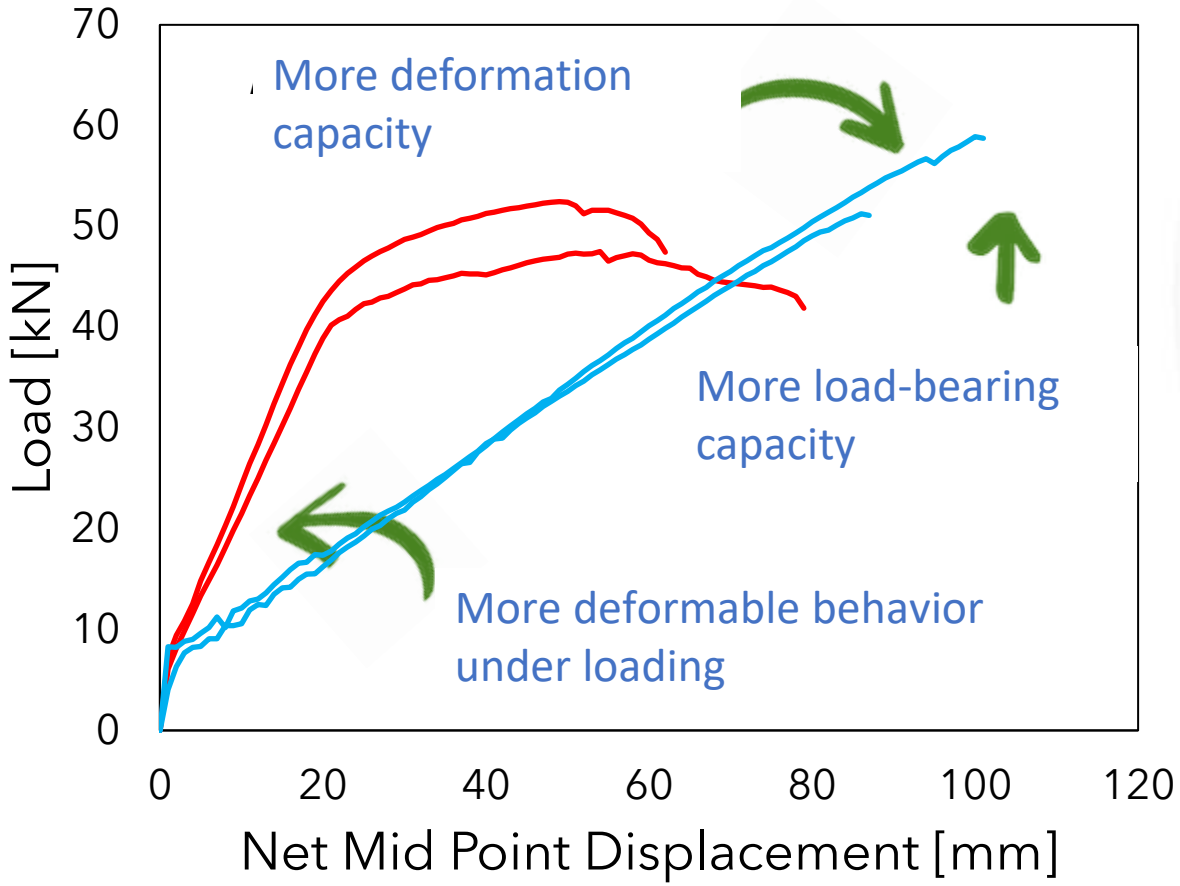
New structural solutions for reducing environmental impacts: Beams #1 vs. Beams #2.

BEAMS #1



BEAMS #2



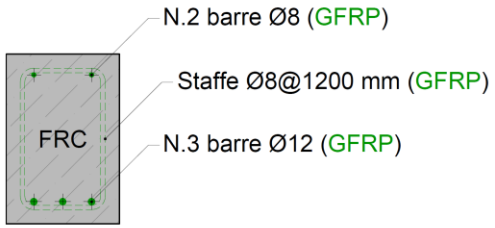


BEAMS #1
Traditional solution
STEEL REBARS+ STEEL STIRRUPS

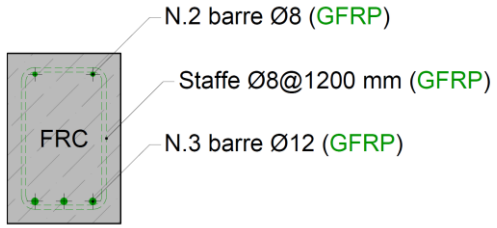
BEAMS #2
Innovative solution
GFRP REBARS + GFRP STIRRUPS

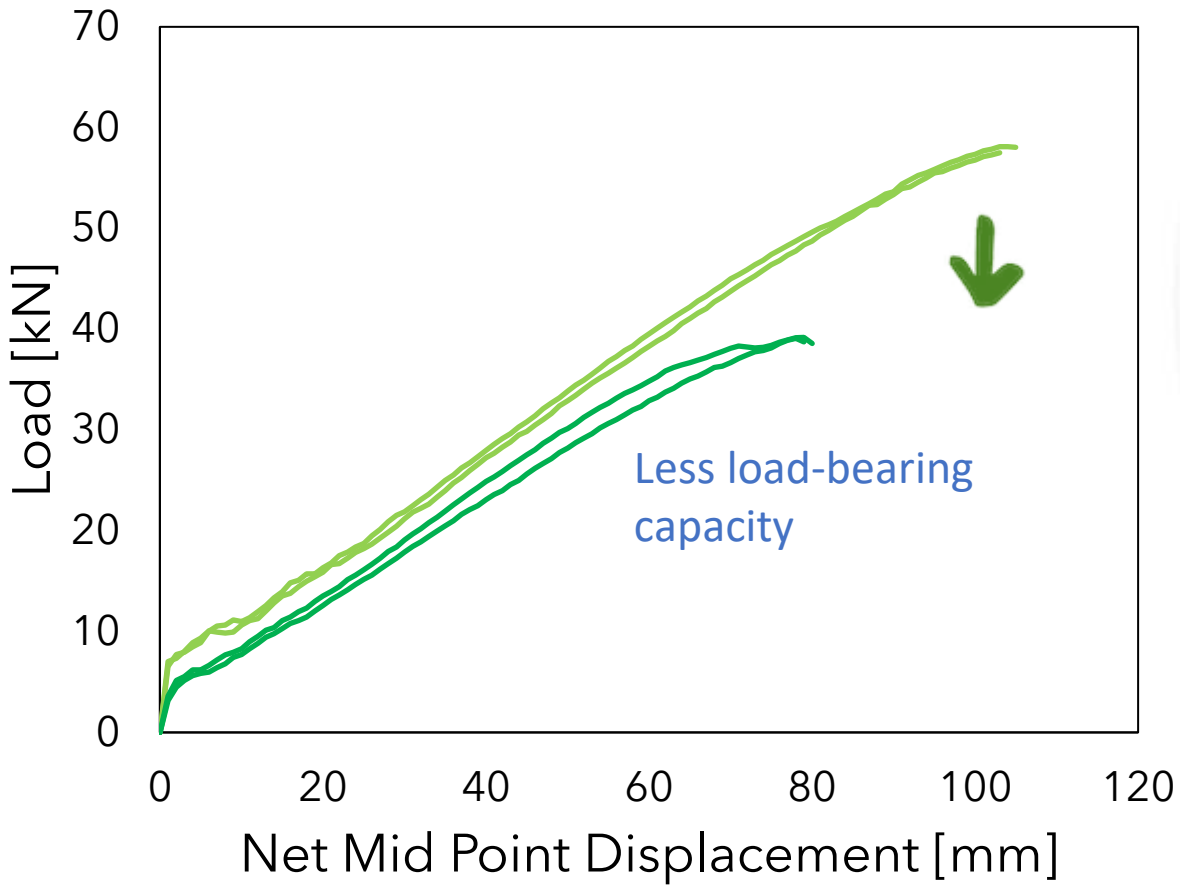
New structural solutions for reducing environmental impacts: Beams #4 vs. Beams #5.

BEAMS #4



BEAMS #5





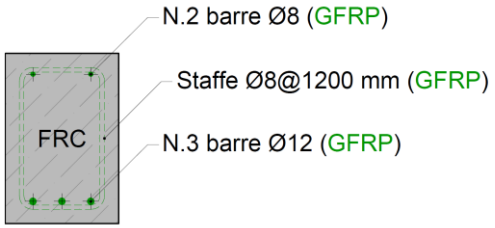
BEAMS #4
Innovative solution
FRC + GFRP Rebars + GFRP STIRRUPS

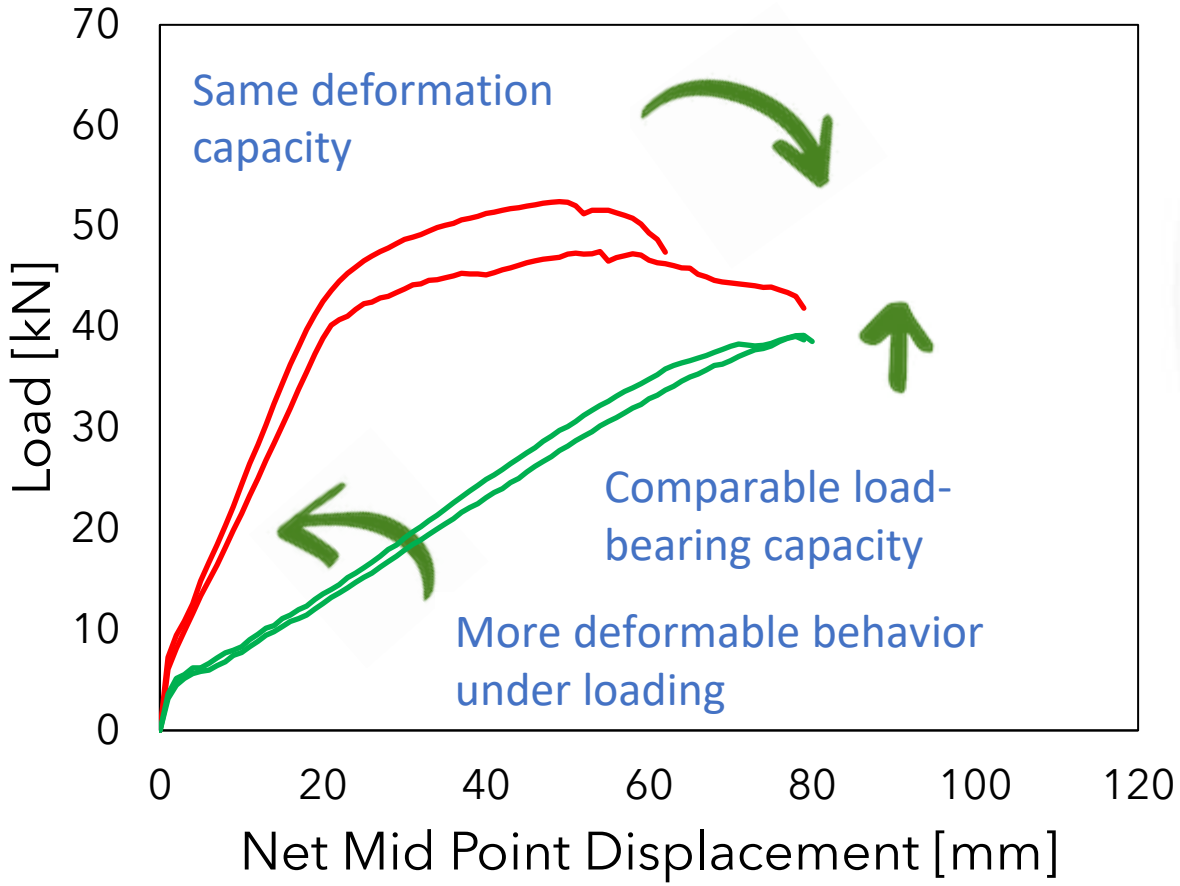
BEAMS #5
Innovative solution
FRC + GFRP

New structural solutions for reducing environmental impacts: Beams #1 vs. Beams #4.

BEAMS #1

BEAMS #5

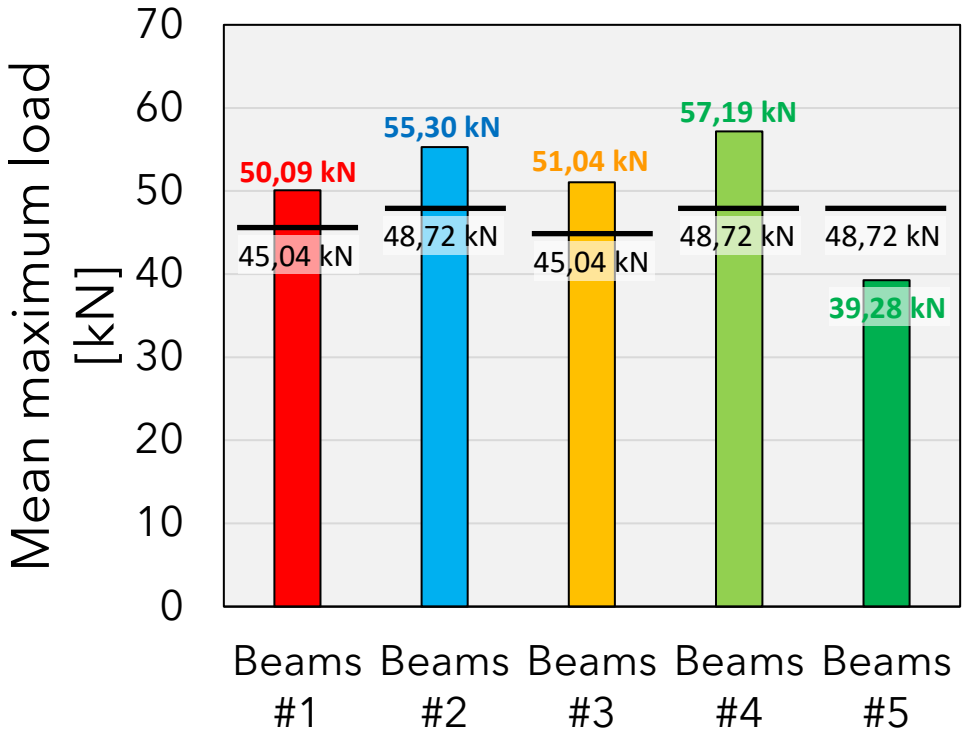




BEAMS #1
Traditional solution with STEEL REBARS+ STEEL STIRRUPS

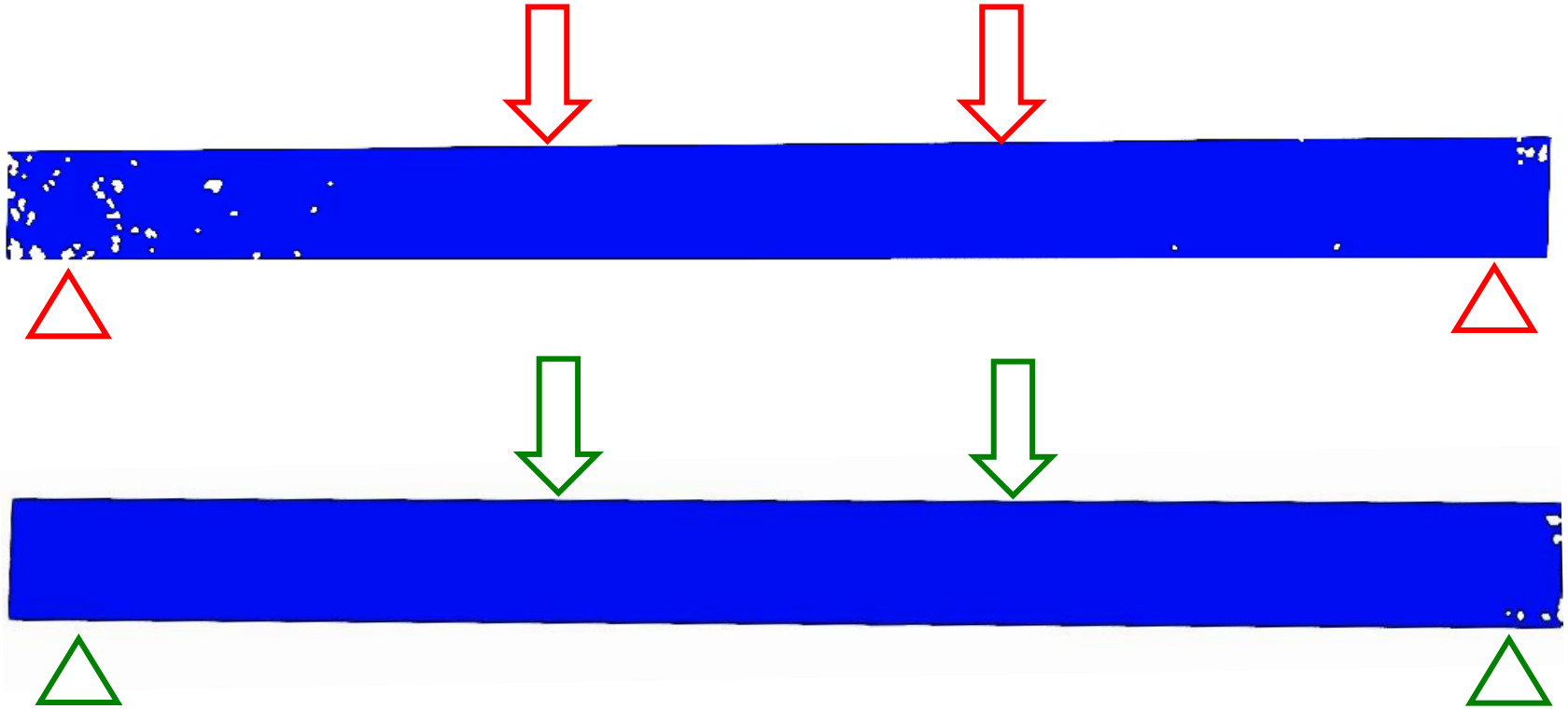
BEAMS #5
Innovative solution FRC + GFRP REBARS and STIRRUPS

New structural solutions for reducing environmental impacts: load-bearing capacity



	M_{Rd} (kNM)	P_{max} (kN)	Failure (-)
Beams #1	54,05	**45,04**	Concrete compression
Beams #2	58,46	**48,72**	Concrete compression
Beams#3	54,05	**45,04**	Concrete compression
Beams #4	58,46	**48,72**	Concrete compression
Beams #5	58,46	**48,72**	Concrete compression

New structural solutions for reducing environmental impacts: cracking pattern



BEAMS #1
Traditional solution with STEEL

BEAMS #4
Innovative solution with FRC + GFRP

Concluding remarks

- **The carbon footprint of concrete can be reduced through the diffusion of type III, IV and V cements instead of cement type I, combined with the addition of SCMs during the concrete production phase.**
- **The carbon footprint of structural precast elements can be reduced through a greater diffusion of innovative technologies for concrete (such as Plastic Fiber Reinforced Concrete combined with Glass fiber reinforcements) which allow optimizing the use of traditional steel reinforcements and the geometry of the cross sections.**