INFRALCA AGENDA

Case study results

- Strategy overview
- Baseline calculations
- Geometrical optimization
- Material optimization
- Next steps and reflections

02

STRATEGY OVERVIEW

Baseline pre 2010

BASELINE PRE 2010 RESULTS

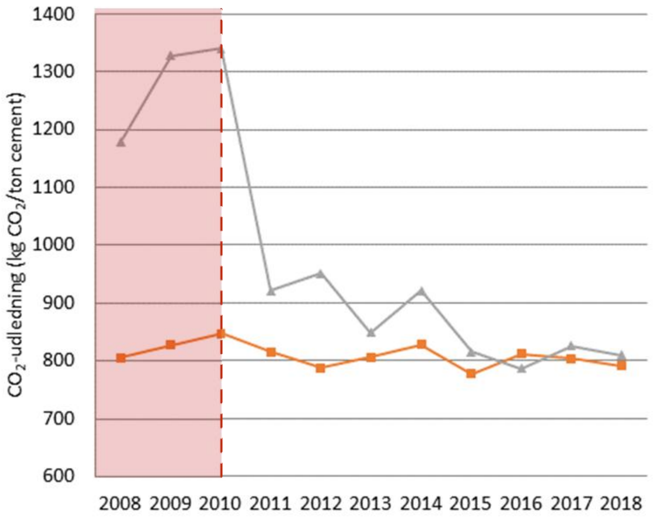
In-situ: Vindingevej

Material GWP [kg CO_2 / m^3]	Standard value (InfraLCA)	Pre 2010 (ref. CMP)
Concrete C35-A	392	550
Concrete C40-E	427	620

Element deck: Vesterled

Material GWP [kg CO_2 / m^3]	Standard value (InfraLCA)	Pre 2010 (ref. CMP)
Concrete C35-A	392	700
Concrete C40-E	427	800

Aalborg Portland, ref. CMP:



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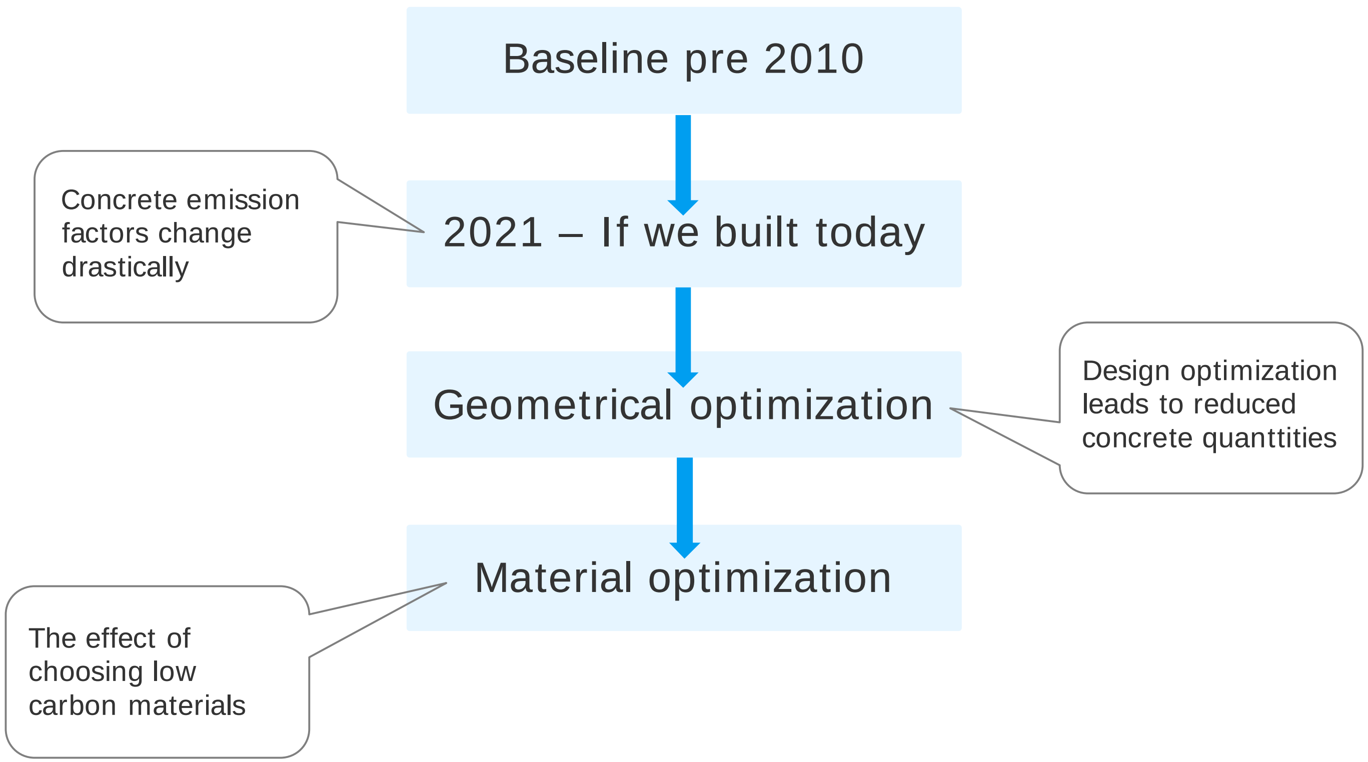
STRATEGY OVERVIEW

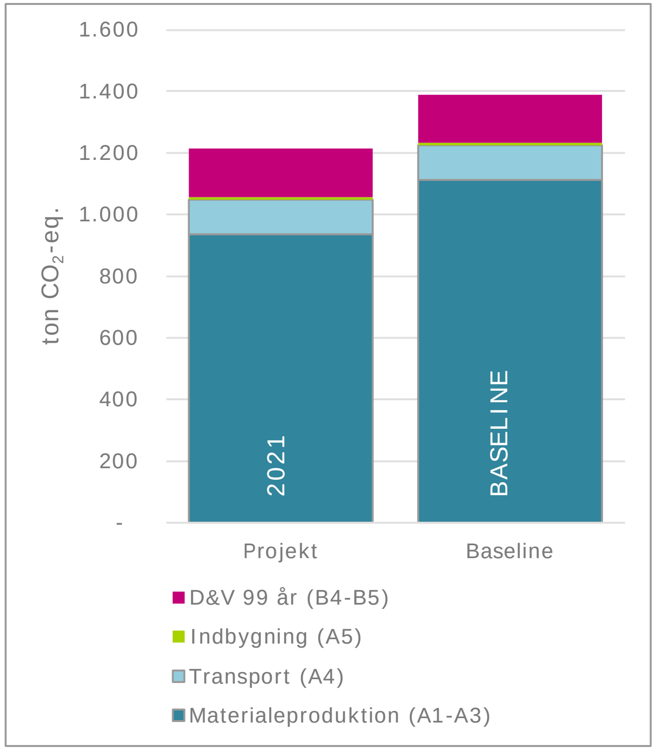


2021 – IF WE BUILT TODAY RESULTS

In-situ: Vindingevej

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	940	1.116	(176)
Transport (A4)	113	113	-
Indbygning (A5)	9	9	-
D&V 99 år (B4-B5)	156	156	-
Sum	1.217	1.394	(176)

Inkluderet direkte emissioner på byggeplads, ikke inkluderet arealbrugsændringer

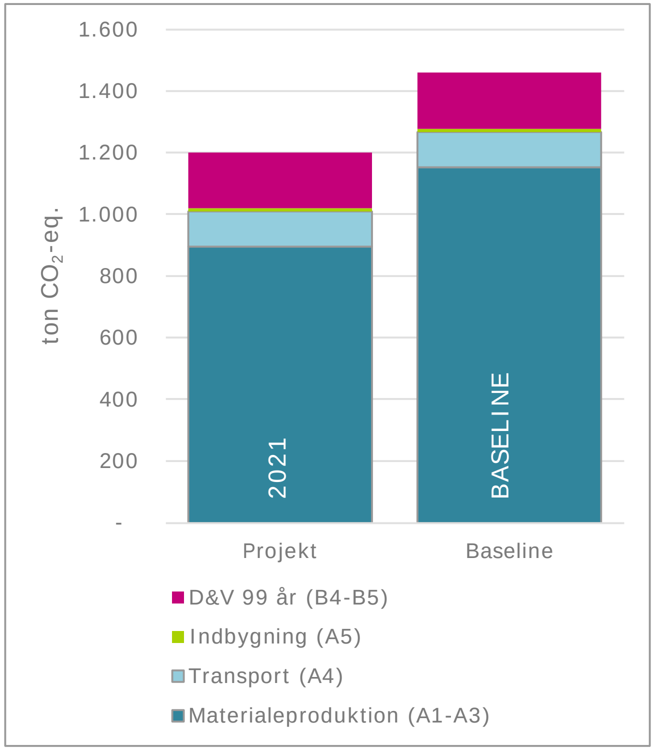


2021 – IF WE BUILT TODAY RESULTS

Element deck: Vesterled

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	895	1.153	(258)
Transport (A4)	114	114	-
Indbygning (A5)	10	10	-
D&V 99 år (B4-B5)	182	182	-
Sum	1.201	1.459	(258)

Inkluderet direkte emissioner på byggeplads, ikke inkluderet arealbrugsændringer



GEOMETRICAL OPTIMIZATION RESULTS

In-situ: Vindingevej

4 webs, monolithic solution (variant 7)

Material	Unit	Original	Variant 7
C35	m^3	40	146
C40	m^3	739	431
C50	m^3	24	19
Armering	ton	82	79
Spændtarmering	ton	18	9
Spuns	ton	78	0
Anker stål	ton	6	0
Anker beton	m^3	15	0

Embodied carbon (A1-A3) [ton CO_2e]	
Oprindelig	633
Variant 7	355

44%

Element deck: Vesterled

OT-beam, portal solution (variant 2)

Material	Unit	Original	Variant 2
C35	m^3	248	172
C40	m^3	472	331
C50 piles	m^3	201	171
C50 element	m^3	293	199
Armering	ton	142	108
Spændtarmering	ton	34	16

Embodied carbon (A1-A3) [ton CO_2e]	
Oprindelig	765
Variant 2	538

30%

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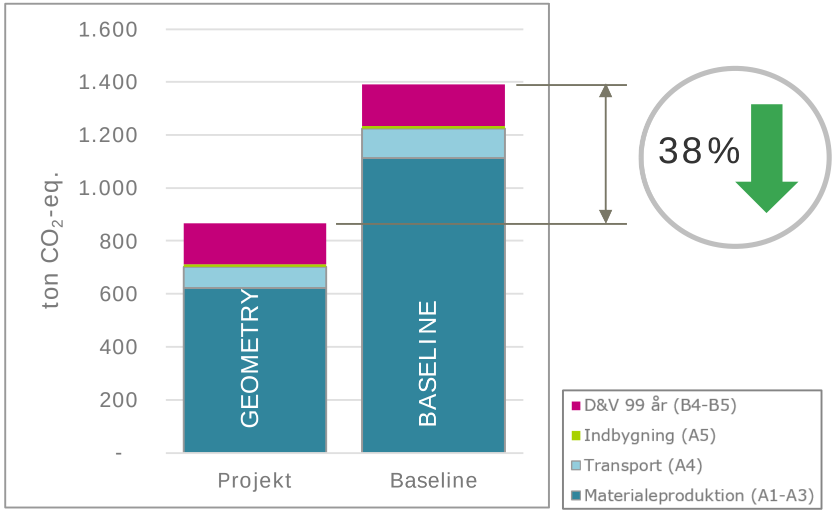
GEOMETRICAL OPTIMIZATION RESULTS

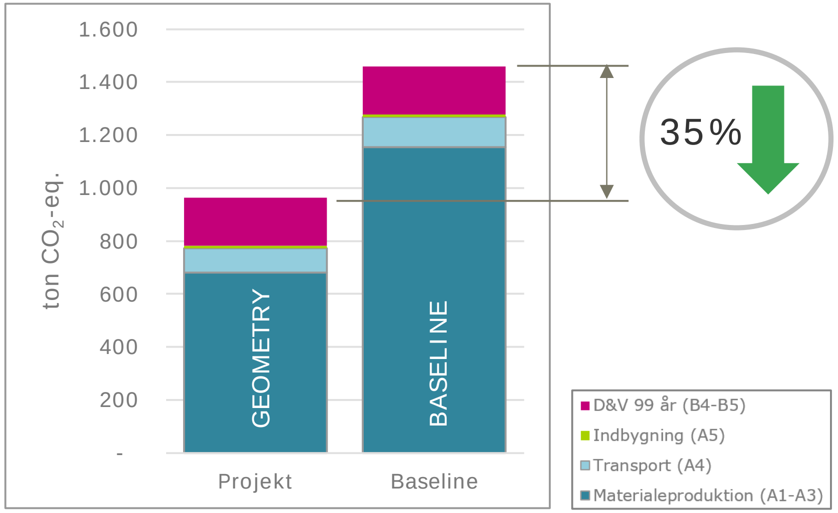
In-situ: Vindingevej

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	622	1.116	(494)
Transport (A4)	81	113	(32)
Indbygning (A5)	8	9	(1)
D&V 99 år (B4-B5)	156	156	-
Sum	867	1.394	(527)



Element deck: Vesterled

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	667	1.153	(486)
Transport (A4)	89	114	(25)
Indbygning (A5)	9	10	(1)
D&V 99 år (B4-B5)	182	182	-
Sum	946	1.459	(513)



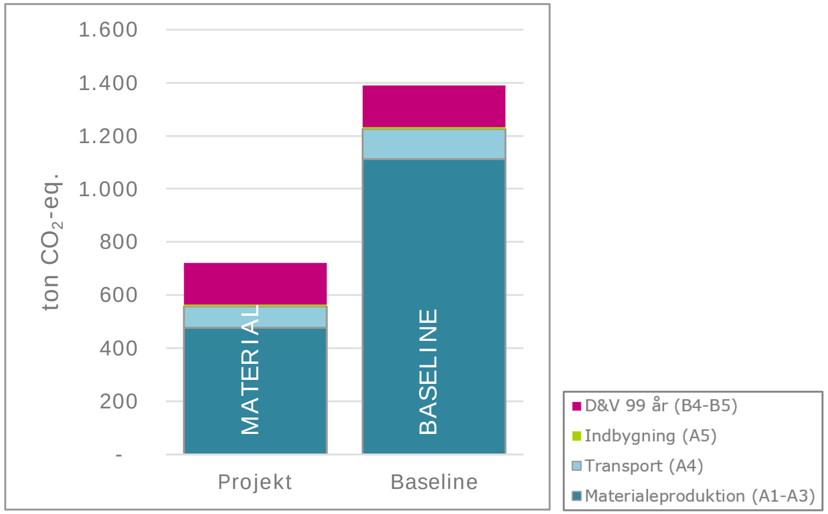
MATERIAL OPTIMIZATION RESULTS

Material GWP [kg CO_2 / unit]	Default factor	Applied factor	Source alternative material
Concrete 35-A	392	280	A-Beton (Optimeret): Notat "CMP materiale oplæg Version 11-08-2021.docx" Christian Munch Pedersen
Concrete 40-E	427	320	E-Beton (Optimeret): Notat "CMP materiale oplæg Version 11-08-2021.docx" Christian Munch Pedersen
Reinforcement	1060	488	Celsa stål (2021): Celsa Steel Service A/S, 2020; EPD registration number: S-P-00308
Sheet pile	2330	520	ArcelorMittal - EcoSheetPile Plus (2021): EPD-ARM-20210178-CBD1-EN
Prestressed steel	2180	584	Hjulsbro (2020) - PC-strand - Prestressed steel

MATERIAL OPTIMIZATION RESULTS

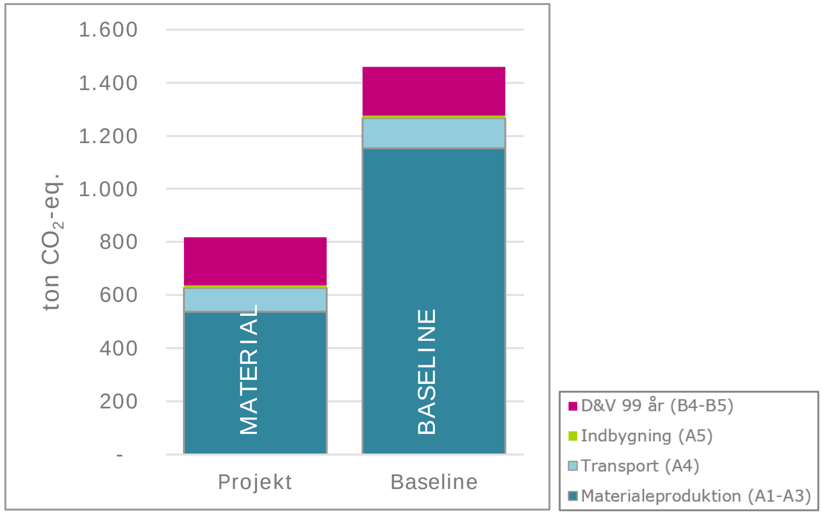
In-situ: Vindingevej

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	476	1.116	(640)
Transport (A4)	81	113	(32)
Indbygning (A5)	8	9	(0)
D&V 99 år (B4-B5)	156	156	-
Sum	721	1.394	(672)



Element deck: Vesterled

Global opvarmning fordelt på livscyklus og vejkomponent [ton CO_2-eq.]			
Beregnet			
Livscyklusfase	Projekt	Baseline	Forskel
Materialeproduktion (A1-A3)	524	1.153	(629)
Transport (A4)	89	114	(25)
Indbygning (A5)	9	10	(1)
D&V 99 år (B4-B5)	182	182	-
Sum	804	1.459	(655)



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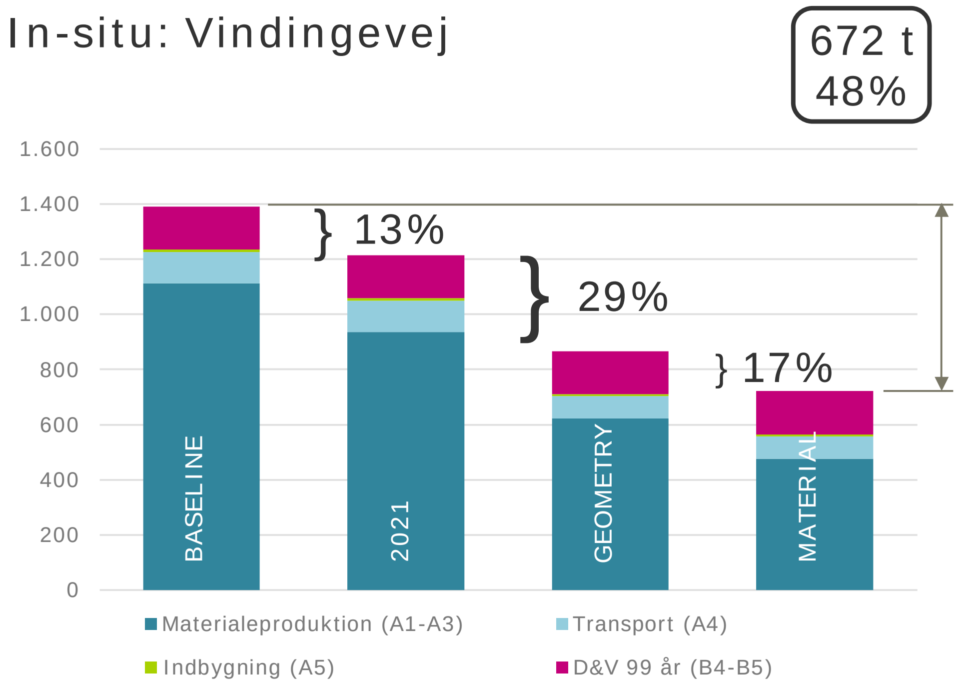
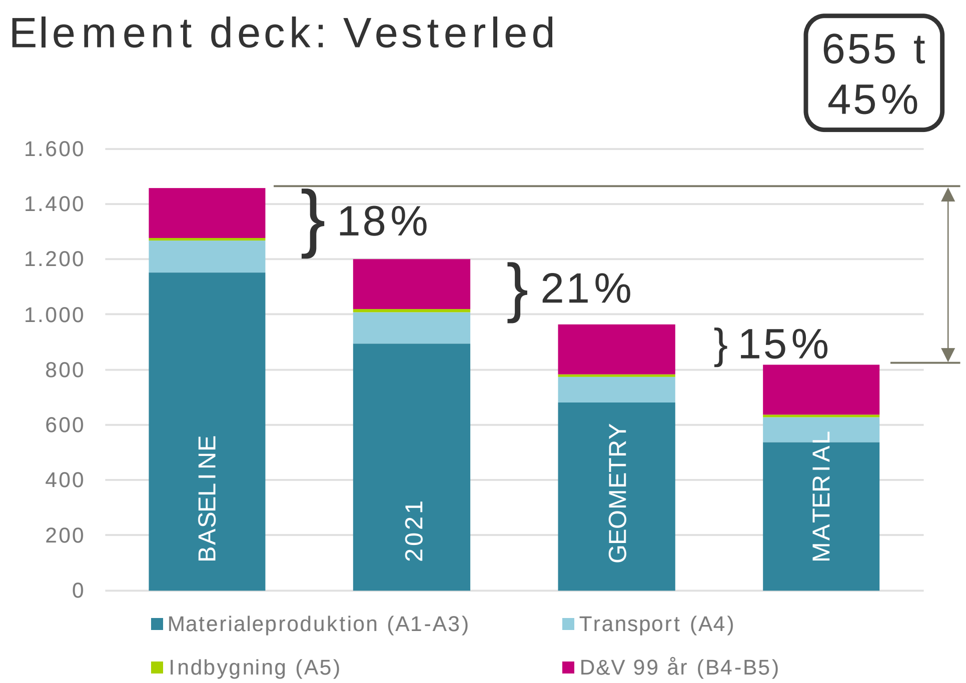
SUMMARY OF CASE-STUDY RESULTS





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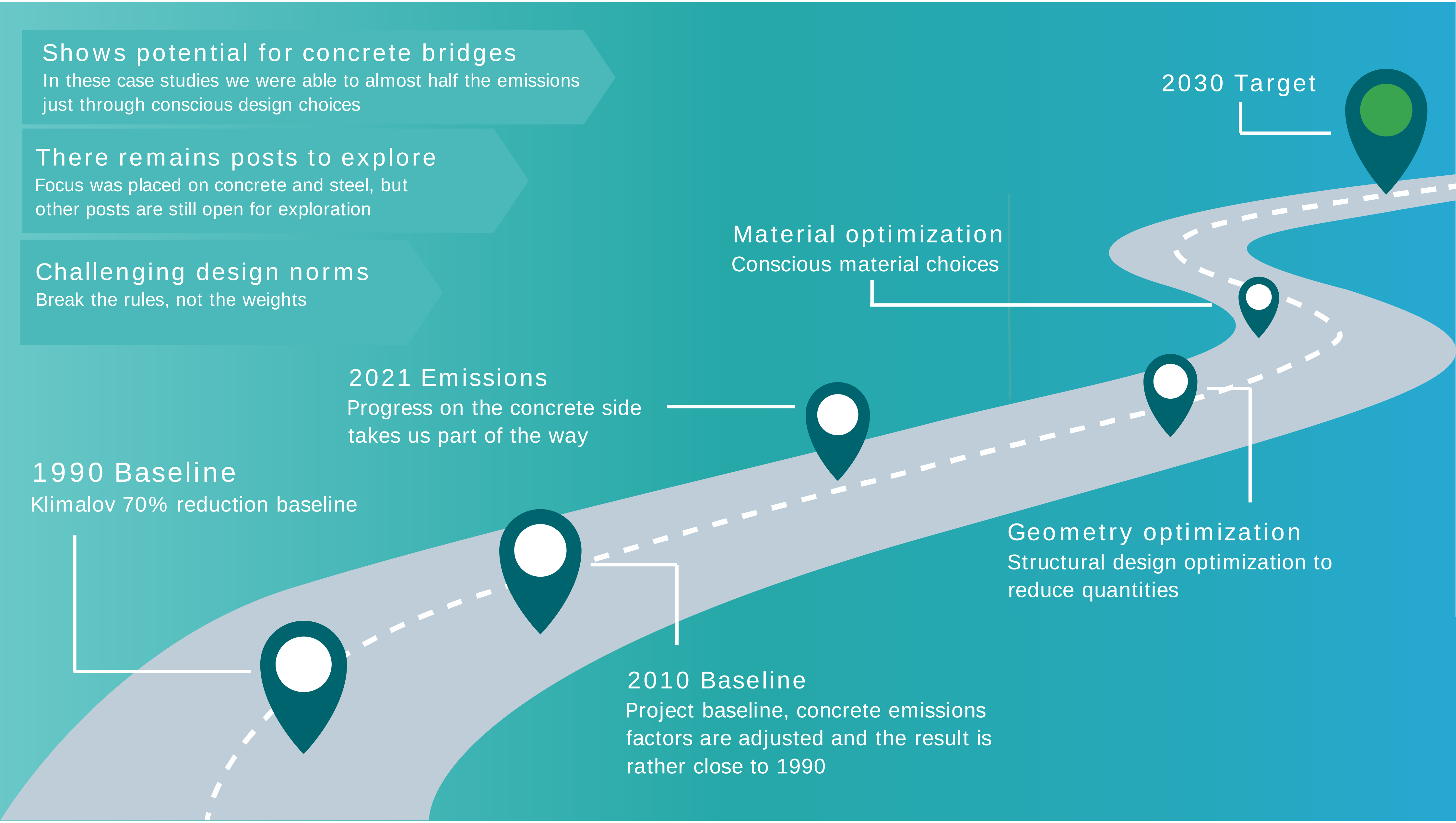
Shows potential for concrete bridges
In these case studies we were able to almost half the emissions just through conscious design choices
There remains posts to explore
Focus was placed on concrete and steel, but other posts are still open for exploration
Challenging design norms
Break the rules, not the weights
2030 Target
Material optimization
Conscious material choices
2021 Emissions
Progress on the concrete side takes us part of the way
1990 Baseline
Klimalov 70% reduction baseline
Geometry optimization
Structural design optimization to reduce quantities
2010 Baseline
Project baseline, concrete emissions factors are adjusted and the result is rather close to 1990

THOUGHTS ON WORKING WITH INFRALCA

- Fantastic to have a tool that allows us to *quantify* project emissions
- Strong tool for documentation, not designed as much for exploration
- Current version is adapted for roads, need a shortened input list specifically for bridges (see VegLCA, or how it's handled in Klimatkalkyl)
- Improved transparency as to what goes on in the background + user giude for different levels (how to add input items, adjust them, cannot change works connected to A5)
- Implementation of other types of fuels, such as biodiesel
- Tips & tricks:
    - Lifetime
    - Re-usable structures

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