AMCRETE UK
THE CONCRETE TECHNOLOGY SPECIALISTS

Andrew Mullholland

AMCRETE UK Ltd

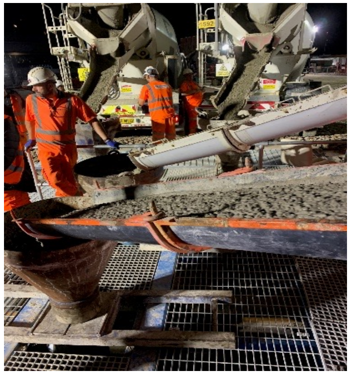
AMTEST UK
THE CONCRETE TECHNOLOGY SPECIALISTS

Decarbonisation – Webinar 25th February 2022

Introduction

What we Do

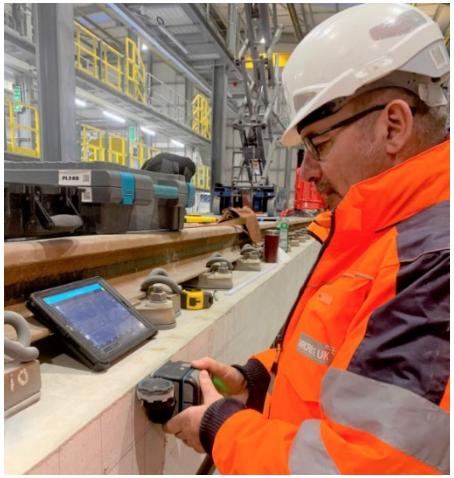
- Infrastructure and Civil Engineering

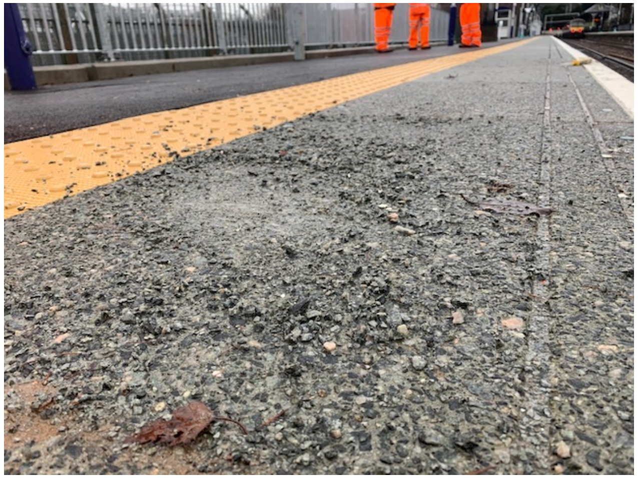


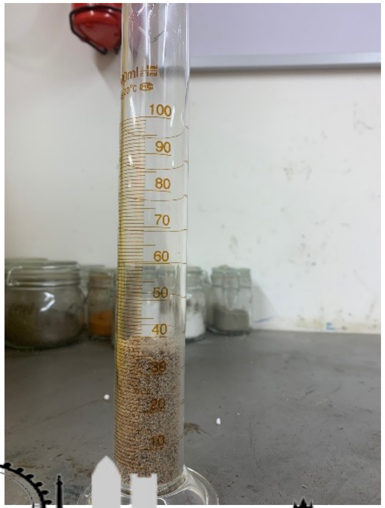
Introduction

What we Do

- Technical Support and Investigations



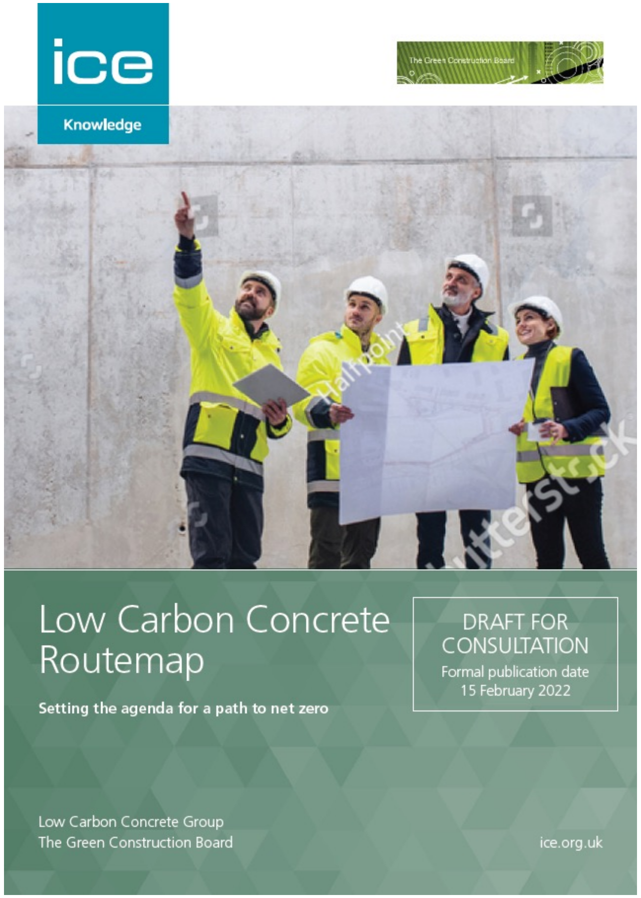




The Low Carbon Concrete Group

- Green Construction Board (part of IWG)
- Industry Consultants
- Contractors
- Clients
- Universities
- Structural Engineers
- Architects
- Research Organisations
- Utility Providers
- Main Contractors
- Cement Manufacturers
- Associations
- Concrete Producers

The LCCG Routemap


ice
Knowledge
The Green Construction Board

Low Carbon Concrete Routemap

Setting the agenda for a path to net zero

DRAFT FOR CONSULTATION
Formal publication date 15 February 2022

Low Carbon Concrete Group
The Green Construction Board

ice.org.uk


Executive summary

Using concrete

Strands 2, 3 and 4: Best practice in using concrete

There is huge variation in how concrete is used and specified. It is possible to reduce significantly the carbon intensity of concrete through better design, specification and construction practices – this requires a focus on carbon and the necessary guidance and support.

ACTION:
A coordinated approach between industry and government to optimise the use of concrete for carbon.

2 KNOWLEDGE TRANSFER
Knowledge transfer is crucial to addressing barriers and accelerating the use of lower-carbon concrete. There needs to be clear guidance on how to specify, design and use lower-carbon concretes within the existing standards, as well as a better understanding of performance and how and when to engage with stakeholders. Coordination between institutions and trade bodies is important to ensure guidance is effective.

3 DESIGN AND SPECIFICATION
The use of concrete must be optimised within the design process regardless of its carbon intensity. Guidance that demonstrates how material savings can be made through efficient design is required. The specification of concrete and concrete products must include carbon intensity, and specifiers need to understand how they can work to reduce it while meeting other performance requirements.

4 SUPPLY AND CONSTRUCTION
Consideration must be given to how a concrete will be produced and whether in-situ or precast concrete offers greater potential carbon savings. The performance requirements, installation method and project-specific logistical constraints should all be considered during early collaboration between the concrete producer and the project team. There must also be a clear plan for verification of the material to avoid waste or an excessive testing regime.

Left: Hollowcore precast panel environmental product declaration (EPD)
Above: Concrete placement using a concrete pump

Making concrete

Strands 5, 6 and 7: Best practice in making concrete

There is also huge variation in how concrete is produced and the constituents used. While the engineering performance of concrete is standardised, its carbon intensity is not and there are many opportunities using existing technologies as well as new approaches.

ACTION:
Concrete industry to coordinate modernisation to allow the standardisation of the carbon intensity of concrete production with support for new technologies. Government support will accelerate this process.

5 OPTIMISE EXISTING TECHNOLOGY
Within current standards and practice, it is possible to produce concretes that have lower embodied carbon. To achieve this, stakeholders need to work together to ensure that all options for cement types are considered. In addition, the project team must work to ensure that the cement content is optimised for a given cement type. Collectively this optimised approach will realise significant carbon savings over typical practice.

6 ADOPTING NEW TECHNOLOGY
Concretes that use cement blends or contents outside of current standards will be part of the overall solution to reducing the carbon intensity of the industry. Some of these concretes are an extension of existing technology, while others adopt wholly different chemistry. Wherever possible and appropriate, these new technologies should be supported by the industry to allow the development of standards and an increase in commercial readiness and application.

7 CARBON SEQUESTRATION, CAPTURE AND USE
Carbon sequestration within concrete can offer some benefit in performance and the potential reduction of atmospheric CO_2. Guidance on how to use novel carbon curing technology and a better understanding of how to maximise long-term carbonation is required. Carbon sequestration technology to reduce the intensity of cement production requires large-scale industry and government support and should be recognised as an end-of-pipe solution that should be considered only once other carbon-saving opportunities are maximised.

Above: Precast panels at the Global Change Institute made using Wagners EFC
Right: Waste clay at a quarry with potential for use as calcined clay

Decarbonisation – Logical Sequence

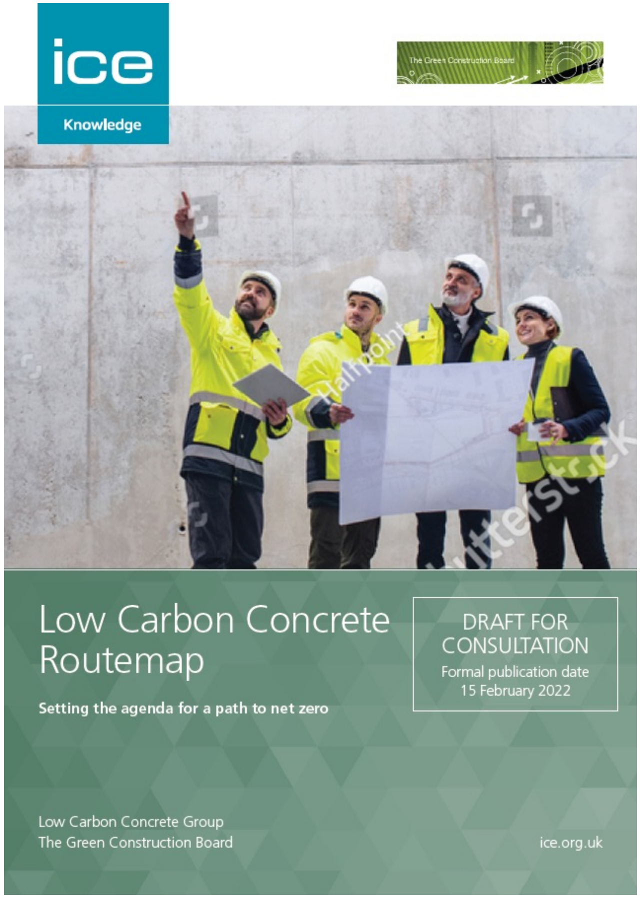
	Item	1. Benchmarking	2. Knowledge transfer	3. Design and specification	4. Construction and operation	5. Optimising existing technology	6. Adopting new technology	7. Carbon sequestration	Opportunity	Impact	Start date	Example products
Client signalling	A1	■							Clients define product requirements using the LCCG benchmark rating criteria and commit to buying concretes that meet the criteria	5	2022	
Task force	B1		■						Formation of a Concrete Decarbonisation Task Force to coordinate and communicate the development of low-carbon technologies and initiatives	4	2022	
Design and specification	C1			■					Include voids, coffers or profile sections to reduce concrete volume in thick or planar concrete sections (slabs, rafts, diaphragm walls)	4	2022	
	C2			■					Increase utilisation factors and assess design optimisation	3	2022	
	C3			■					Make use of EN 1992 provisions to reduce material partial factors based on quality control and reduced deviations	1	2022	
	C4			■	■				Take account in design of the real strength of concrete arising from the cement content that is required for workability and early strength gain	1	2022	
	C5			■					Specify reinforcement which will not corrode and define the real lifetime of RC elements	1	2022	
	C6			■					Include an upper bound on kg CO_2e/m^3 in the specification	3	2022	
	C7			■	■				Allow the concrete supplier the maximum possible flexibility to meet or beat the specified upper bound kg CO_2e/m^3	3	2022	
	C8		■	■			■		Identify elements suitable for the use of new and emerging low-carbon concrete. Encourage the use of these concretes for these elements	3	2022	
	C9			■	■				When identity testing, ensure quality control methods are communicated to batching plant so cement content is not increased for reduced results	2	2022	
	C10			■					Require reporting of the as batched kg CO_2e/m^3	3	2024	
Site works	D1				■				Adopt working methods that reduce the required slump/flow of concrete	2	2022	
	D2				■				Adopt working methods that reduce the requirement for early strength gain	3	2022	
	D3			■	■				Avoid use of sacrificial concrete in temporary works (e.g. ballast systems to be precast and re-usable, sand blinding instead of concrete blinding, etc)	3	2022	
	D4			■	■				Minimise waste, including through use of BIM to avoid over-ordering	3	2022	
	D5				■	■		■	Plan demolition works to maximise carbon take-up by concrete demolition arisings	2	2022	
	D6				■				Reclaim cementitious material and aggregates from demolition arisings	2	2026	SmartCrusher
Cement manufacture and concrete batching	E1					■			Continue to decarbonise the production of Portland cement (CEM I)	1	2022	
	E2	■			■	■			Calculation of as built CO_2e based on as batched ingredients and volumes mixed or dispatched to site	3	2022	
	E3				■	■	■		Modify batching plants to enable production of lower-carbon concretes. For example, add silos for alternative SCMs, add dispensers for AACM activators	4	2022	
	E4				■	■	■		Propose alternative lower-carbon concretes/mixes to clients, including as pilots	4	2022	
	E5			■		■			Increase and optimise use of GGBS and FA as an SCM in blended cements already in current standards (BS EN 197)	3	2022	CEM III/B, CEM III/C
	E6					■			Increase use of tertiary (three-part) and quaternary (four-part) blended cements already in current standards (BS EN 197)	1	2022	CEM VI(S-P), CEM VI(S-L), CEM II/C-M
	E7					■			Extending the use of limestone fines as a blended cement within the current standards (BS EN 197)	1	2022	CEM II/B-L, CEM II-B-LL
	E8					■	■		Use of current-generation AACMs and geopolymers that make use of GGBS and FA if they can be shown to meet necessary requirements	3	2022	Cemfree, EFC ECOPact, Virtua
	E9	■			■	■			CO_2e calculations to be based on kg CO_2e/kg of ingredients as used (i.e. based on actual processing, not industry database values)	2	2026	

	Item	1. Benchmarking	2. Knowledge transfer	3. Design and specification	4. Construction and operation	5. Optimising existing technology	6. Adopting new technology	7. Carbon sequestration	Opportunity	Impact	Start date	Example products
Reporting	F1	■	■		■	■			Public reporting of kg CO_2e/m^3 based on material batched and dispatched to site, improving on EN 15804. Include assessment against LCCG benchmark	4	From 2022	
	F2	■	■						Periodic updating of LCCG benchmark and guidance	3	From 2022	
	F3			■					Designers to report on optimisation and utilisation for all concrete elements as standard practice	3	From 2024	
Piloting	G1				■			■	Central database of pilots required and reporting of findings	4	From 2022	
	G2			■	■		■		Expectation that large projects will include pilots of ways to reduce concrete CO_2e (design, specification, types of concrete, batching, site works, demolition)	3	From 2024	
	G3				■			■	Establish pilots of CO_2 capture at cement works	5	From 2026	
Developing technologies and preparing/ publicising guidance	H1						■		Tertiary and quaternary mixes beyond the guidance already provided in BS EN 197 and BS 8500, reducing the clinker proportion	1	From 2025	CEM II/C-M
	H2						■		Limestone fines as a SCM at higher % replacement than currently permitted by BS EN 197	1	From 2022	
	H3						■		Identification of clays in the UK with mineralogy suitable for calcining to use as cementitious materials (SCM or AACM)	5	From 2022	
	H4		■	■					Develop performance-related standards for concrete works	3	From 2022	
	H5					■	■		Convert PAS 8820-2016 to a British Standard – AACM/Geopolymer Activator Standard	2	From 2022	
	H6			■					When non-corrosive reinforcement should be used	1	From 2022	
	H7		■				■		Assessment of risk and consequence levels and conditions where the use of different concretes should be accepted/expected	4	From 2022	
	H8		■	■	■				Working methods to maximise carbon take-up by concrete demolition arisings	2	From 2022	
	H9		■	■			■		Availability and remuneration of competent persons to develop the guidance	3	From 2022	
	H10			■		■			Reduce minimum cement contents listed in BS 8500-2	4	From 2024	
	H11						■	■	Concretes that contain sequestered CO_2	4	From 2024	CarbonCure
	H12					■			Fly ash reclaimed from stockpiles as a SCM	3	From 2024	
	H13						■	■	Synthetic aggregates that sequester CO_2 during manufacture	2	From 2024	Carbon8
	H14						■		Use of graphene in concrete	3	From 2024	
	H15						■	■	Concretes that cure by carbonation	2	From 2024	Solidia Concrete
	H16		■		■	■			Construction methods/formwork that make economic use of efficient/ voided forms	4	From 2024	
	H17				■			■	Identify optimal locations for factories that will make use of captured CO_2	3	From 2024	
	H18						■		Calcined clay as a SCM at higher percentage replacement than currently permitted by BS EN 197	4	From 2026	
	H19						■		AACMs based on calcined clay (including metakaolin)	4	From 2026	BanahCEM (no longer trading)
	H20						■		Use of cementitious materials reclaimed from demolition arisings as a SCM	3	From 2026	
	H21						■	■	Synthetic SCMs that sequester CO_2 during manufacture	5	From 2030	Solidia SCM, Seratech
	H22						■	■	Synthetic AACMs that sequester CO_2 during manufacture	[illegible]	From 2030	Seratech

The LCCG Routemap

Remaining tasks to Publication

- Final edits
- Selection of case studies
- Sign off February 2022
- Formal Publication April 2022



Decarbonisation – Easy wins

What we needed to do:

Develop a strategy – *Avoid fragmentation!*

Identify the challenges – *Different groups have different motivations and areas of expertise and influence!*

Engage with everyone – *Collaboration*

Present Opportunities – *To build a repository of experiences*

Other Groups

Collaboration is key

The Edge

Concrete Decarbonisation Taskforce

ConcreteZero

Decarbonisation – Immediate mitigation measures

Technical

Direct reductions through existing technology. Direct reductions through new and emerging technology

Survey

Engagement with the industry to determine what is seen as a barrier to decarbonising of concrete and associated materials.

Compliance

How to navigate the existing suite of codes and Standards to utilise those cements that are suitable but outside of EN 197. What changes are required and how the “change process” needs to be more dynamic

Operational

To support the wider implementation of all low carbon concrete technologies – Including AACM’s and where CEM I is used as an activator combined with secondary cementitious materials (SCM’s), including new materials and capital expenditure

Complimentary Design

Good design places material only where it is used most efficiently and makes full use of code provisions for efficient design. Good design also enables the adoption of construction methods which permit high quality workmanship reducing the risk of error and also enabling lean design while maintaining durability and fitness for purpose.

Decarbonisation – Engineer, Contractor and Concrete Producer

Fig 2.4: Step 1 – Application feasibility assessment

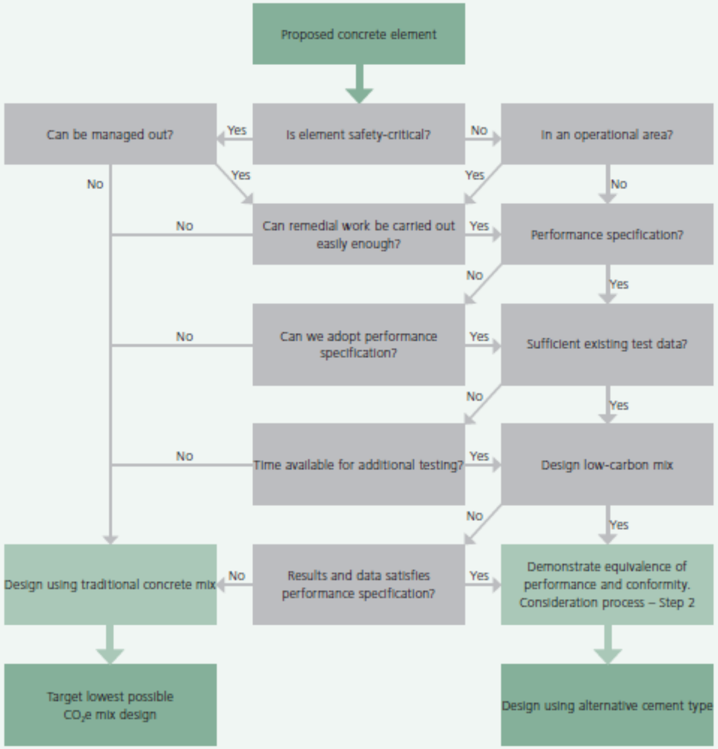
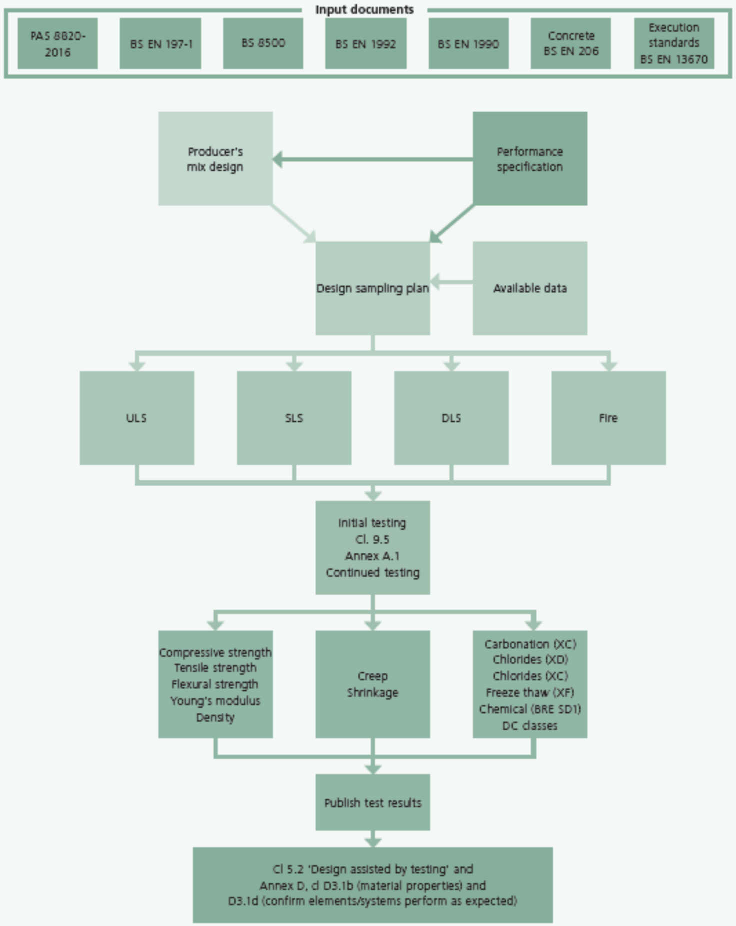


Fig 2.5: Step 2 – Demonstrating technical equivalence



Decarbonisation – Engineer, Contractor and Concrete Producer

CHALLENGES:

Local Availability of materials

Improvements for existing infrastructure

Knowledge sharing

Support from existing standards – although not always necessary…….

Historic and relevant test data

Minimum cement content criteria – Temporary Works especially

Application suitability

A move towards performance specifications rather than prescriptive standards and specifications

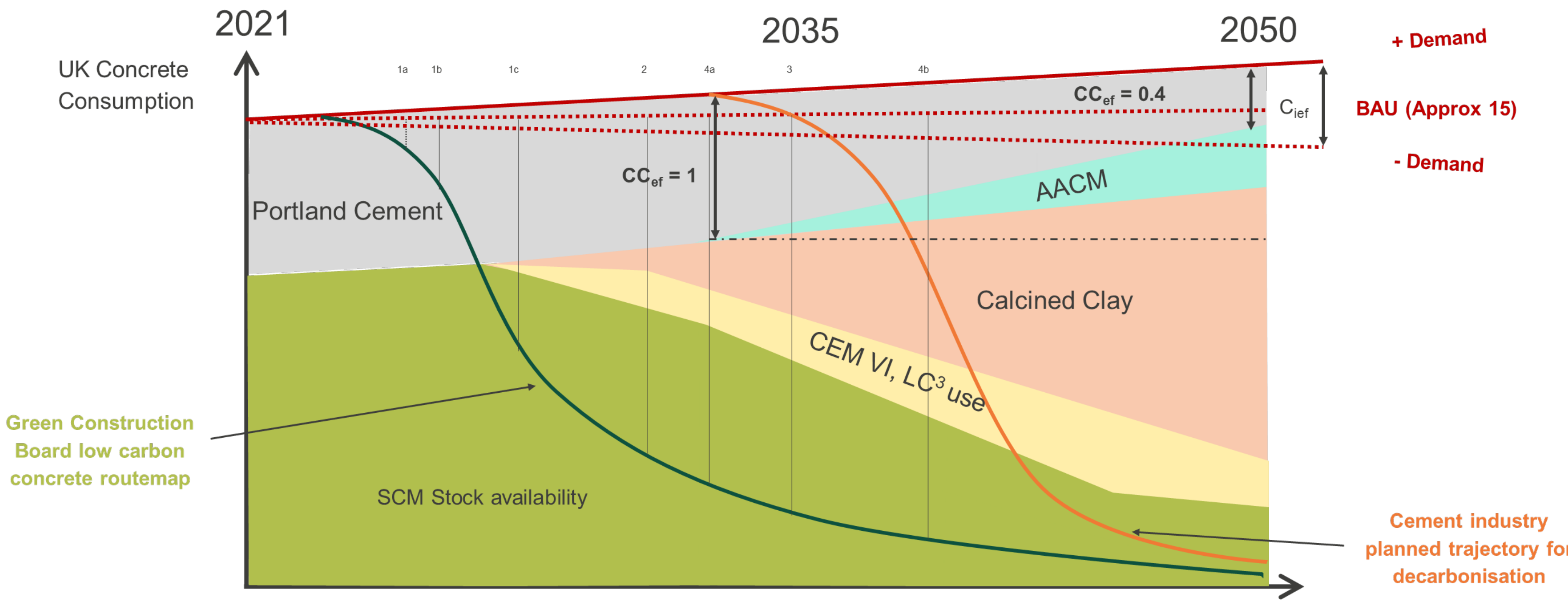
Admixtures technology

Construction Programs

The will to do it!

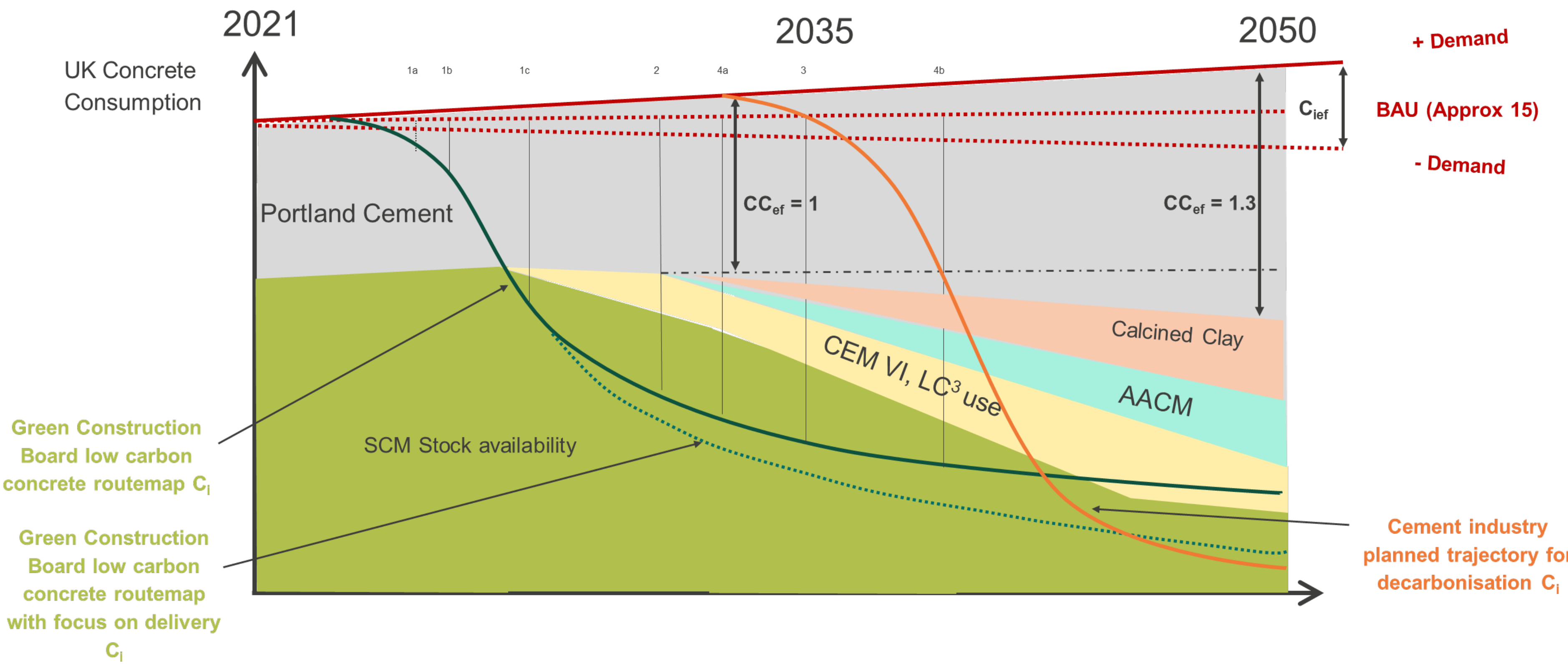
Decarbonisation – Innovation v Consumption v Material availability

What could happen



Decarbonisation – Innovation v Consumption v Material availability

What could happen



Thank you for your time:

Questions?