The *fib* Carbon Reduction Roadmap to 2050

Background

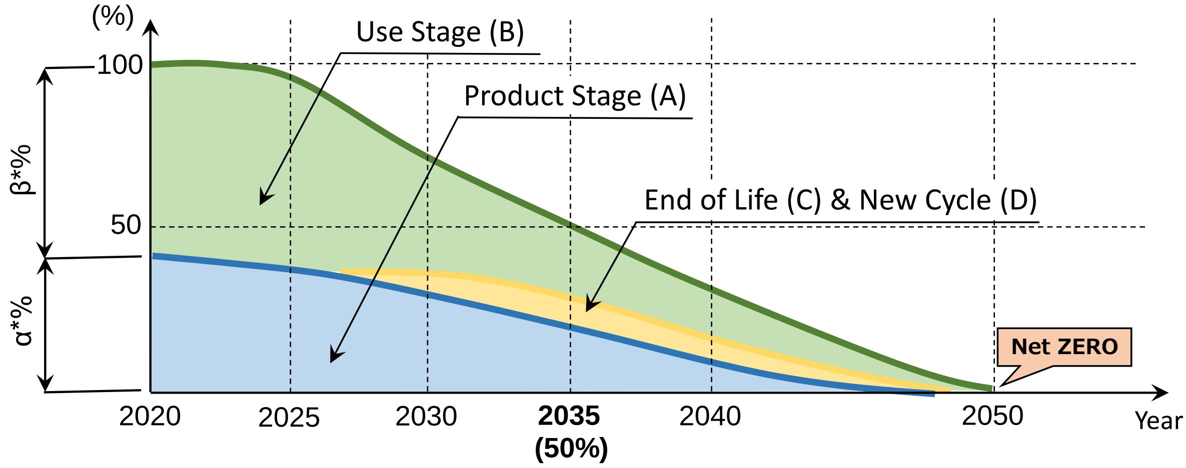
In 2021, the *fib* issued an official statement outlining its achievements to date and reaffirming its commitment to sustainability goals. Building on this foundation, and following further discussions in 2022, the Special Activity Group on Sustainability was formed to advance this agenda. The *fib*'s efforts to reduce CO_2 emissions throughout the lifecycle of concrete buildings and infrastructure are now making significant progress, supported by valuable contributions from member organisations. This roadmap is intended to strengthen these efforts, providing a central framework for the fib's sustainability initiatives.

The "*fib* Carbon Reduction Roadmap to 2050" is designed to guide the *fib*'s internal efforts and shape its external communications. We recognise that achieving carbon neutrality poses a considerable challenge, requiring technological innovation and close collaboration among suppliers, designers, builders, and owners. The *fib* is uniquely positioned on the international stage to encourage its members to meet this challenge boldly and to bridge the gap between research and practice.

This document considers four building lifecycle stages in line with EN 15978: A – Product and Construction Stage; B – Use Stage; C – End-of-Life Stage; and D – Beyond End-of-Life Stage, which includes reuse and recycling.

Roadmap to carbon neutrality and the role of fib members

The *fib* is committed to leveraging its expertise and resources to achieve the overarching goal of reducing CO_2 emissions from structural concrete by 50% by 2035 and reaching net zero by 2050 for both new and existing structures, as illustrated in Figure 1.



＊; α and β might vary depending on the type of structure and the country.

Figure 1. Timeframe for carbon neutrality by 2050.

We recognise that the proportion of CO_2 emissions reductions will vary across different types of concrete structures and regions. We also recognise that the challenges associated with achieving reductions in Stages A, B, C and D vary. For A and B technologies are becoming increasingly mature, whereas Stages C and D will require substantial changes to current practices, and such efforts must begin immediately.

Carbon considerations across the building lifecycle

As illustrated in Figure 2, various stakeholders have distinct opportunities to impact carbon reduction. Suppliers can concentrate on researching and developing low-carbon, ultra-durable materials for Stages A1 to A3. Designers play a critical role in decision-making, proposing low-carbon technologies that encompass material selection (Stage A) through to dismantling and recycling (Stages C and D) to achieve a minimised lifecycle assessment (LCA). Builders contribute to carbon reduction by adopting sustainable material procurement and construction methods in Stage A, which helps to lower the overall LCA. Additionally, by ensuring quality during construction, builders enhance durability across the structure's lifespan (Stage B).

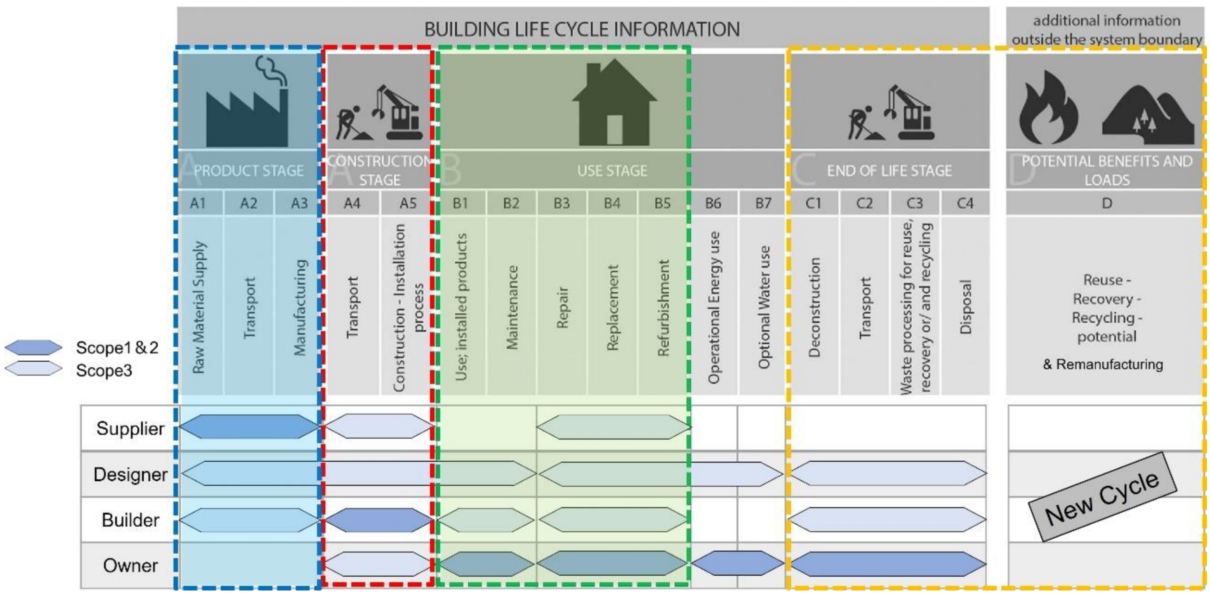


Figure 2. CO_2 emissions across the construction supply chain.

Owners are responsible for implementing conservation plans and gathering data during Stages B and C, and they can further improve resilience in existing structures. They also play a key role in evaluating options for reuse and recycling to extend a structure's lifecycle.

A conceptual diagram illustrating the longevity of a structure and associated CO_2 emissions with both current and low-carbon technologies is presented in Figure 3.

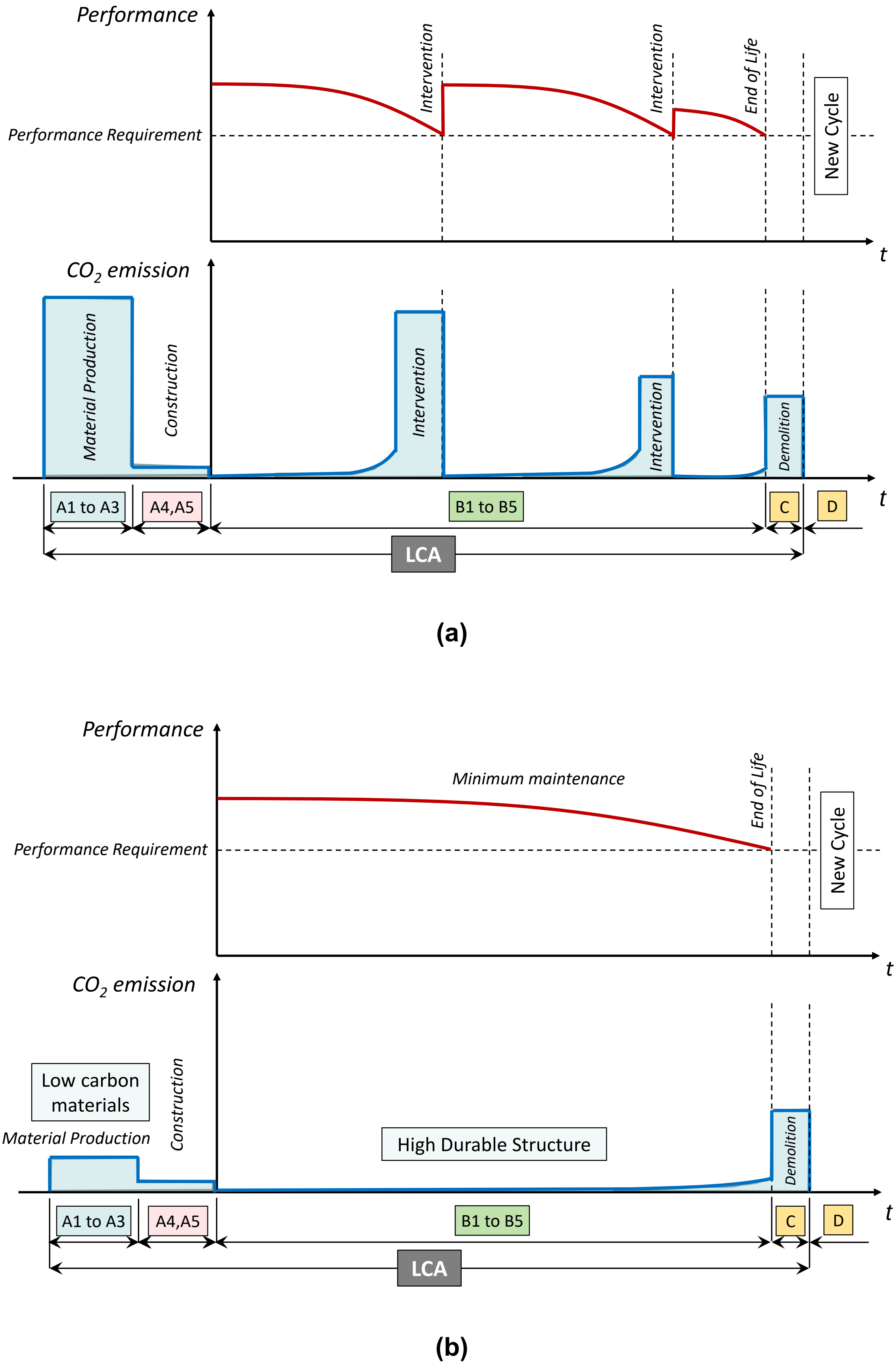


Figure 3. Longivity versus CO_2 emissions: (a) with current technologies and (b) with low carbon technologies.

Extending the life of existing structures

The lifespan of existing structures should be extended as much as possible, with demolition and reconstruction considered only as last resorts. Where feasible, it may be more beneficial to repurpose the structure for a new function without demolishing it.

For existing structures, calculating the lifecycle assessment (LCA) from the point of intervention through to the end of life is essential. Since interventions involve construction activities that emit CO_2, the optimal construction method should balance the duration of the intervention with the associated CO_2 emissions, considering its impact on social activities. Additionally, existing structures should be designed to be resilient, minimising damage and reducing CO_2 emissions related to repair and recovery.

Minimising lifecycle costs through carbon pricing can help identify the most effective solutions. Decisions regarding interventions should be based on the total CO_2 emissions cost, converted to monetary terms via carbon pricing.

How to achieve carbon neutrality

The solutions that are available now or need to be developed for each stage are shown in Table 1.

Table 1. Currently available and future solutions for each of the construction stages A-D.

	Solutions
Low carbon technologies currently available	
Stage A	Light weight structures
	Low carbon concrete
	FRP reinforcements and tendons
	Fiber reinforced concrete
	Precast construction
Stage B	FRP reinforcements and tendons
	Coated and non-ferrous rebars
	Resilient structures
	Accelerated execution
Stage C and D	Precast using unbonded tendons (easy dismantlement)
	Reuse and recycle
	Monitoring of members
Low carbon technologies need to be developed	
Stage A	Low carbon boilers for curing
	Lean construction
Stage B	CO_2 absorption by concrete
Stage C and D	Remanufacturing
	Standardization for remanufacturing and reuse
	Assessment of dismantled members

Progress review

The overall goal of the *fib* is to support and promote halving of CO_2 emissions by 2035, recognising that it is not the role of the *fib* to collect and aggregate carbon emission data.

Members can share their progress achieved towards the goal of *fib* at events, particularly at the *fib* 2030 Congress in Japan, where a dedicated session will be held to showcase advancements made towards this goal. Based on the progress observed in 2030, the roadmap may need to be redefined.

The *fib* will update the General Assembly and its membership annually the progress achieved against this roadmap.

Approved: *fib* Presidium 7 November 2024