ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA E CONSULTORIA ESTRUTURAL

ABECE

RESPONSABILIDADE, CONHECIMENTO E EXPERIÊNCIA: VALORES DO PROJETO ESTRUTURAL



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Encontro Nacional de Engenharia e Consultoria Estrutural

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Presente e Futuro das Estruturas de Concreto sob a perspectiva da ***fib*** (The International Federation for Structural Concrete)

Íria Lícia Oliva Doniak
Presidente ***fib (2025-2026)***
Presidente Executiva ABCIC

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Mission and Objectives of the *fib*

"To develop at an international level the study of scientific and practical matters capable of advancing the technical, economic, aesthetic and environmental performance of concrete construction." *Statutes of the fib*



25th anniversary of the *fib*

Proceedings of the 25th anniversary of the *fib*,
held in Chania, Greece,
September 28-29, 2023.

The *fib*, Fédération internationale du béton, is a not-for-profit association formed by 42 national member groups and approximately 1'000 corporate and individual members. The *fib*'s mission is to develop at an international level the study of scientific and practical matters capable of advancing the technical, economic, aesthetic and environmental performance of concrete construction.

The *fib* was formed in 1998 by the merger of the Euro-International Committee for Concrete (the CEB) and the International Federation for Pre-stressing (the FIP). These predecessor organizations existed independently since 1953 and 1952, respectively.

International Federation for Structural Concrete
Fédération Internationale du Béton
https://www.fib-international.org/

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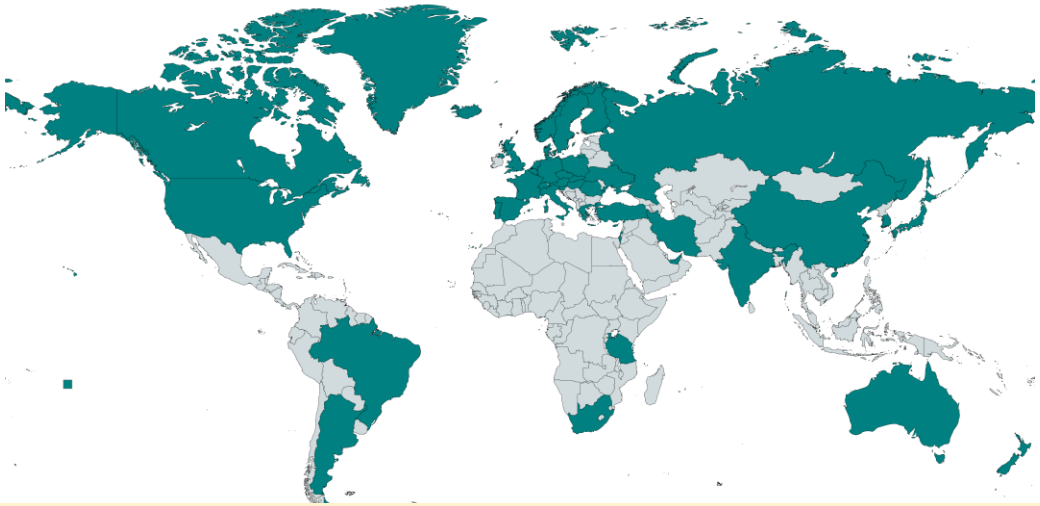
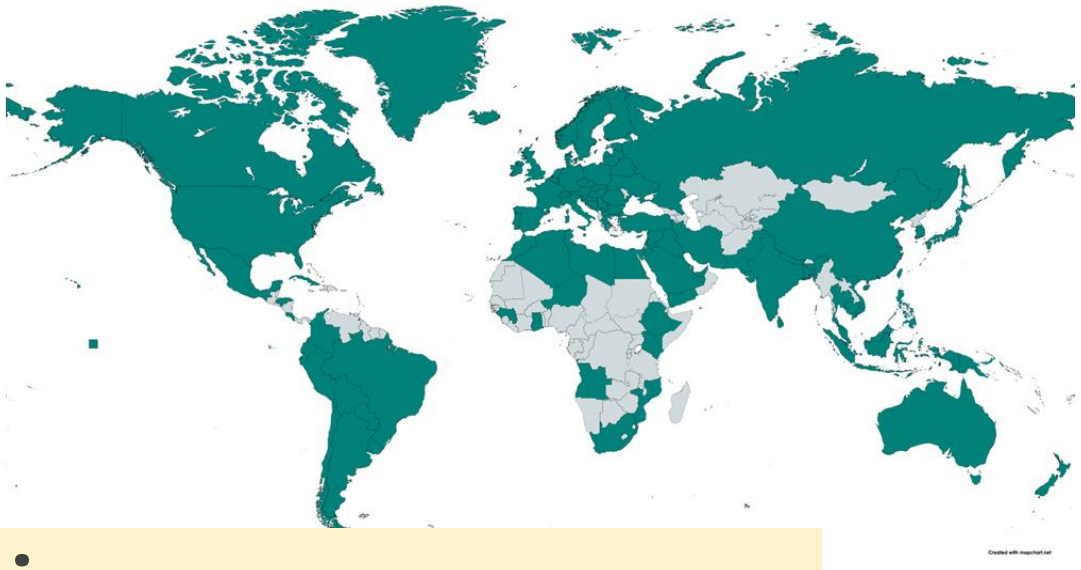
Creation of the *fib*

CEB 1953 + FIP 1952 → 1998 → *fib* CEB-FIP

42 *fib* statutory members



fib members in 104 countries



42 *fib* Statutory Member Countries

Argentina – Australia – Austria – Belgium – **Brazil** – Canada – China – Cyprus – Czech Republic– Denmark – Finland – France – Germany – Greece – Hungary – Iceland - India – Iran – Israel – Italy – Japan – Luxembourg – Netherlands – New Zealand – Norway – Poland – Portugal – Romania – Russia – Slovakia – Slovenia – South Africa – South Korea – Spain – Sweden – Switzerland – Tanzania - Turkey – UAE – Ukraine – United Kingdom – United States

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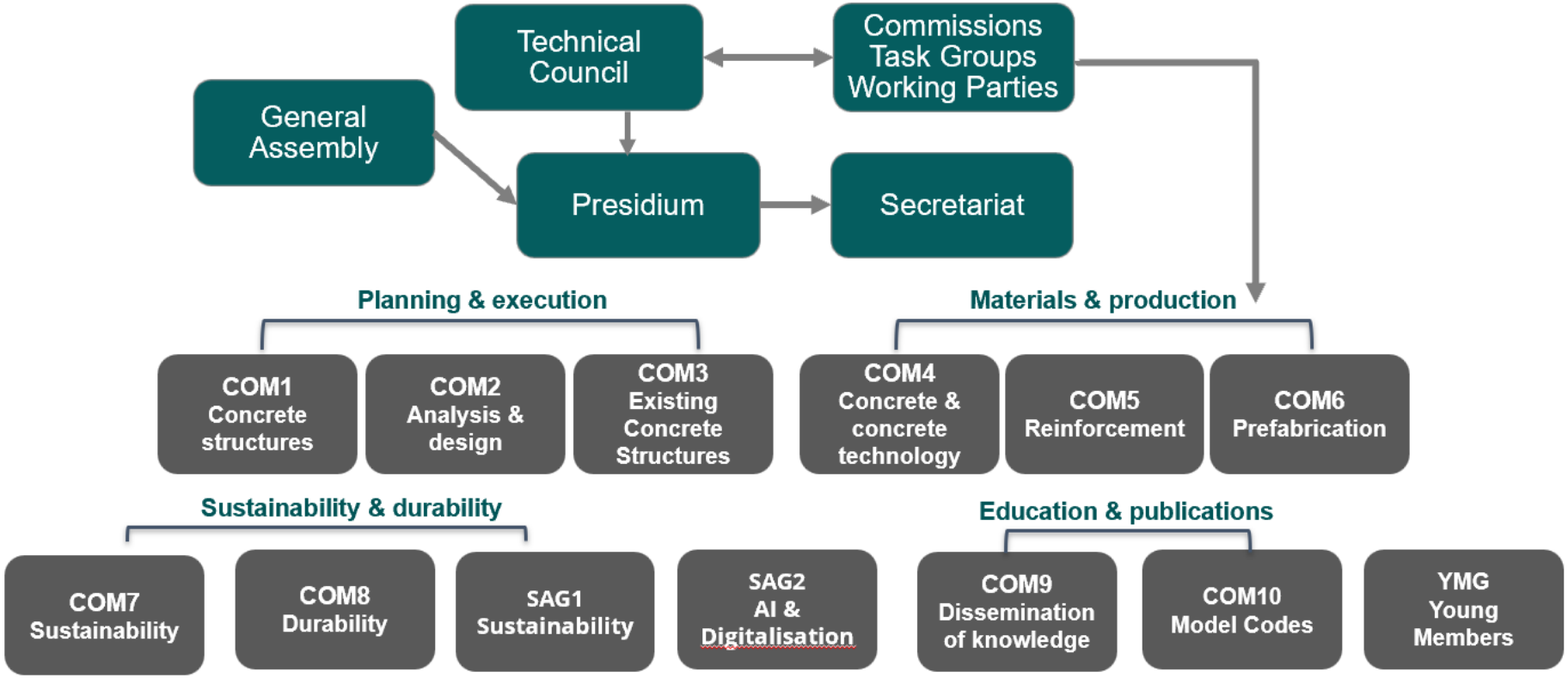
A brief history of the relationship Brazil *fib* (CEB - fip at the beginning)

- First Luso-Brazilian Civil Engineering Journey, Lisbon 1965: Fernando L. Lobo Carneiro and Yves Saillard agreed to have ABNT Brazilian Association for Technical Standardisation) as the Brazilian representative in CEB.
- Although Brazilian practice has always been influenced by Europe, with CEB, that influence has become more robust.
- Telemaco van Langendonk and Fernando L. Lobo B. Carneiro were Brazil's first representatives in CEB. Both collaborated on the first Brazilian Standard, which, in 1940, already allowed the ultimate limit state for flexure.
- Profs attended the course about the 1970 CEB Model Code in Lisbon in 1973. Pericles B. Fusco and Antonio R. Laranjeiras were essential for the review of our Standard
- NB1, now called NBR 6118, introduced Brazil's ultimate limit state method.
- Between the late 80s and early 90s, Augusto Carlos de Vasconcelos and Lidia Shehata also participated in the Model **Code.** This participation led to the COLLOQUIUM ON THE CEB-FIP MC90 in Rio de Janeiro in 1991.
- In 2006, Prof. Paulo Helene participated as deputy chair of Bulletin 34 – Model Code for Service Life Design
- In 2008, after a difficult period, Brazil recovered its participation with the support of ABECE and ABCIC. Fernando Stucchi was the Brazilian representative at MC 2010 and 2020.
- The organisation of the Workshop on fib MC2020 in São Paulo – 2018 was a significant milestone, as it allowed for the recovery of IBRACON's participation in our fib Brazilian Group.
- Brazil's culture of structural engineering is strongly focused on concrete, which enables it to contribute to and benefit community development through international technical community development. Joining an organisation such as fib effectively means being in a globalised context.
- 2022 – Íria Doniak – Deputy President (GA OSLO); Marcelo Melo (Chair of YMG and TG 10.3 Model Code Examples)
- 2025 – Íria Doniak – President (GA New Zealand)

Written by Prof. Fernando Stucchi and Prof. Augusto Carlos Vasconcelos to present at fib Congress – Mumbai 2014

The *fib's* structure



Members from Brazil in the *fib*

- + 100 members or participants in TGs
- 44 Students and Young Members



Persons in working groups

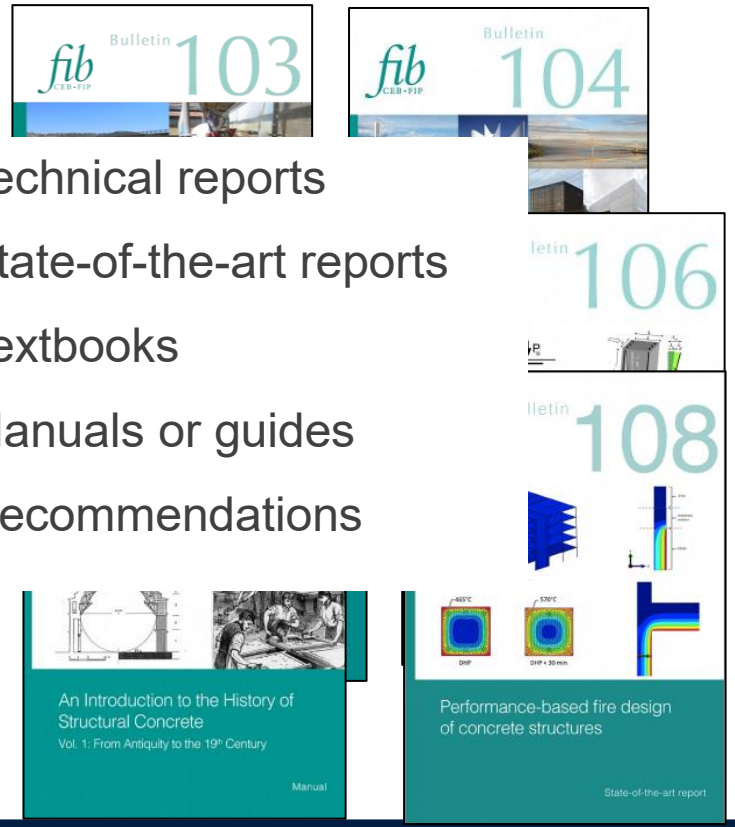
- President and Chair of the Technical Council: Íria Doniak

- YMG Deputy Chair:	Marcelo Melo
- TG 1.5 Structural Sustainability	Lígia Doniak
- TG6.3 Sustainability:	Lígia Doniak
- TG6.5 Precast bridges Convener:	Marcelo Waimberg
- COM 5 Reinforcements	Pedro Almeida
- COM 6 Prefabrication	Mounir El Debs, Marcelo Ferreira, Marcelo Cuadrado Ligia Doniak Íria Doniak

- COM 9 Dissemination of Technology: Fernando Stucchi, Marcelo Melo, Íria Doniak
- COM 10 Model Code: Fernando Stucchi
- TG 10.3 Examples of Model Code: Marcelo Melo, Daniel Miranda, Ligia Doniak, Alio Kimura

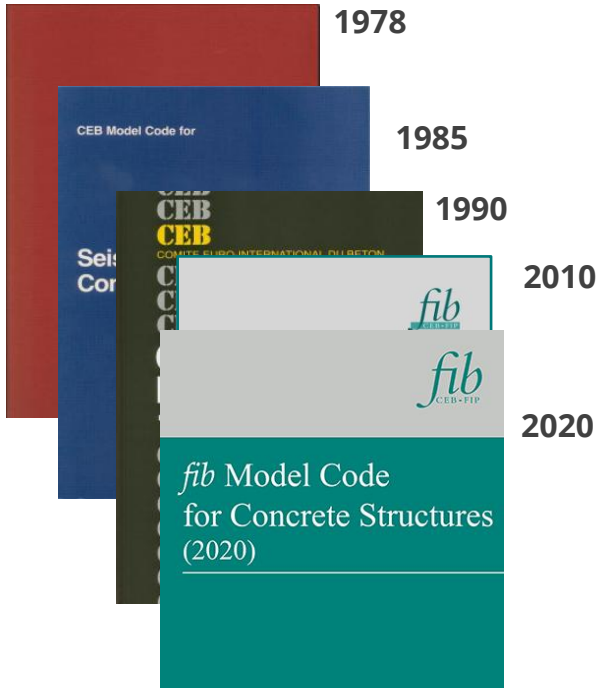
A *B*ridge between *R*esearch and *P*ractice
International Federation for Structural Concrete

fib Bulletins



- Technical reports
- State-of-the-art reports
- Textbooks
- Manuals or guides
- Recommendations

Model Codes



- Moving to a model of more a regular update cycle (5~6 years)

The *fib*'s journal *Structural Concrete*

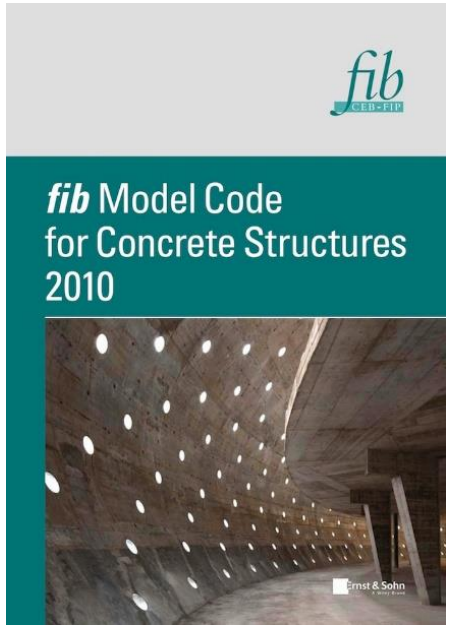


- Current impact factor: 3.3
- 6 issues per year

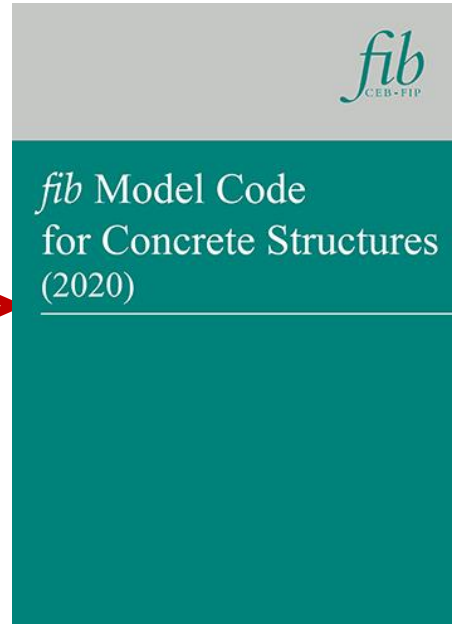


fib Model Code 2010

fib Model Code 2020







- Extensão de Escopo
- Alinhamento de conceitos

MC2010

5 Parts

10 Chapters

MC2020

10 Parts

39 Chapters

Por quê?

MODEL CODE 2020

- MC2020 is a structural code for new and existing structures
- Takes an integrated life cycle perspective
- Provides a holistic treatment of structural safety, serviceability, durability, and sustainability
- Defines fundamental principles and a safety philosophy based on reliability concepts and sustainability
- Uses a performance-based concept to remove specific constraints for novel types of concrete and reinforcing materials
- **Conceptual Design**
- Includes worldwide knowledge with respect to materials and structural behaviour
- Recognises the needs of engineering communities worldwide

Aspiration and challenge of fib Model Code 2020

- All ‘Engineering works’ are **undertaken to meet established societal needs and SDGs**
- The vision for MC2020 is for it to be future-oriented and capable of accommodating and not hindering **technological progress**, facilitating the ongoing evolution of concrete and reinforcement materials, associated technologies and structural forms which might be created using them.
- MC2020 consistently deals with **new and existing concrete structures**, incl. structures after interventions, applying fundamental principles of a **performance-based approach to design and assessment**, **safety philosophy based on risk and reliability concepts**, and **consistent treatment of safety, serviceability and durability verification**



The MC2020 Core Group, Madrid, December 2016



fib General Assembly voting on Model Code 2020,Istanbul, June 2023

Challenges Driving Present and Future Innovation:

- **Sustainability**: Decarbonising the construction sector.
- **Urbanisation**: High-density cities need adaptable, space-efficient solutions.
- **Ageing Infrastructure**: Repair and retrofit will dominate many regions.
- **Climate Resilience**: Structures must be able to withstand floods, fires, earthquakes, hurricanes, tornadoes, and storms.
- **Labour Shortages (costs and productivity)**: Demand for automation and prefabrication is rising.



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CONCRETO
SOLUÇÕES DE HOJE PARA UM AMANHÃ MELHOR

A engenharia do concreto contribui diretamente para os **Objetivos de Desenvolvimento Sustentável** (ODS), conectando pessoas, cidades e o planeta por meio de soluções seguras, duráveis, inclusivas e de baixo impacto ambiental.

AMBIENTAL
Construindo um planeta mais equilibrado

- **Água potável e saneamento** garantem saúde e qualidade de vida.
- **Energia limpa e acessível** impulsiona um futuro de baixo carbono.
- **Cidades e comunidades sustentáveis** com uso eficiente de recursos e menor impacto ambiental.
- **Consumo e produção responsáveis** com redução de resíduos e maior circularidade.
- **Ação contra a mudança do clima** com construções mais **resilientes** e de baixa emissão.
- **Vida terrestre** com preservação dos ecossistemas e da biodiversidade.



OBJETIVOS DE DESENVOLVIMENTO SUSTENTÁVEL

17 OBJETIVOS.
169 METAS.
UM SÓ FUTURO.

SOCIAL
Mais inclusão, bem-estar e oportunidades

- **Erradicação da pobreza** com moradias dignas e infraestrutura básica.
- **Saúde e bem-estar** com ambientes seguros e saudáveis.
- **Educação de qualidade** com espaços seguros e funcionais.
- **Igualdade de gênero** com acesso e oportunidades na construção e na engenharia.
- **Redução das desigualdades** com cidades e edificações mais acessíveis e inclusivas.

ECONÔMICO
Desenvolvimento com valor de longo prazo

- **Trabalho decente e crescimento econômico** com geração de empregos e inovação no setor da construção.
- **Indústria, inovação e infreestrutura** com soluções mais eficientes, industrializadas e digitais.
- **Cidades e comunidades sustentáveis** com edificações duráveis e planejamento urbano.
- **Consumo e produção** com materiais de materiais e empregade de carbono.
- **Parcerias e meios de implementação** com colaboração entre governo, empresas, academia e sociedade.

O CONCRETO É PARTE DA SOLUÇÃO.

ENGENHARIA DO CONCRETO
CONSTRUINDO OS ODS



Estruturas resilientes e sustentáveis não se baseiam na maximização de um único objetivo, mas na otimização do desempenho ao longo de todo o ciclo de vida.

Resilience x Performance:

Evolutionary resilience in the housing sector: requirements proposal

Morgane Bigolin, Camilla Zanon Bussular, Luiz Carlos Pinto Silva Filho

This paper aims to discuss how to apply the evolutionary resilience theory in the housing sector, aiming to develop an alternative resilience framework for planning social...



Mariana Bigolin 2018

FEDERAL UNIVERSITY OF RIO GRANDE DO SUL
Engineering School
Postgraduate Program in Civil Engineering: Construction and Infrastructure

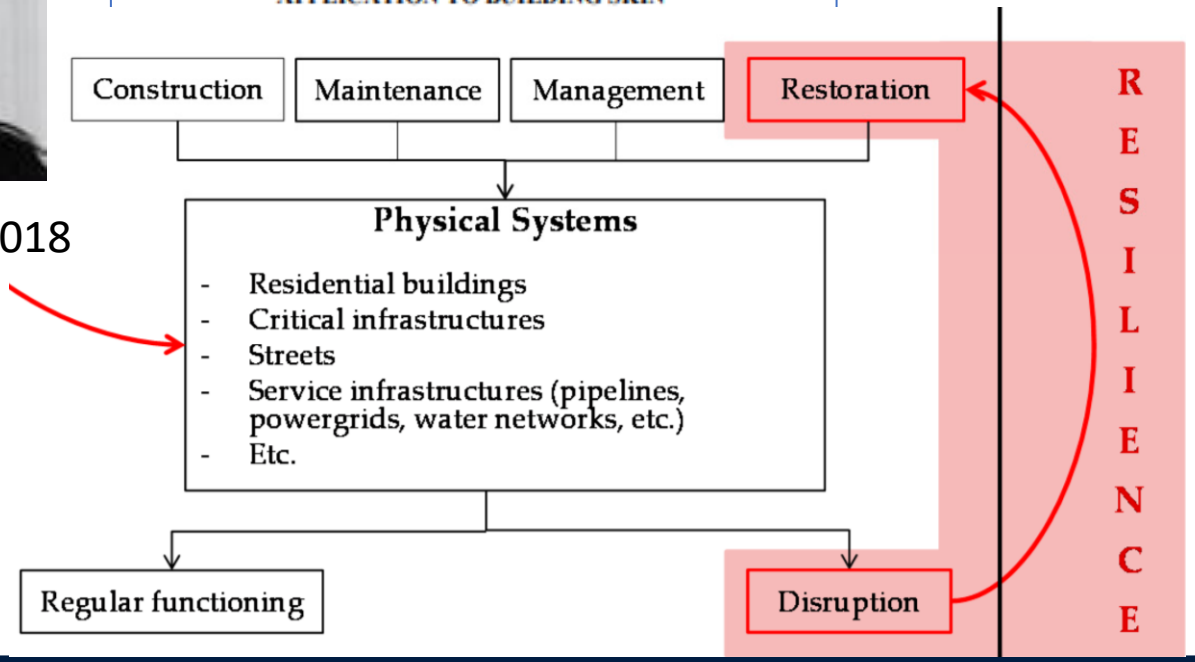
TOWARDS EVOLUTIONARY RESILIENCE IN THE HOUSE-BUILDING SECTOR: A FRAMEWORK PROPOSAL AND AN APPLICATION TO BUILDING SKIN

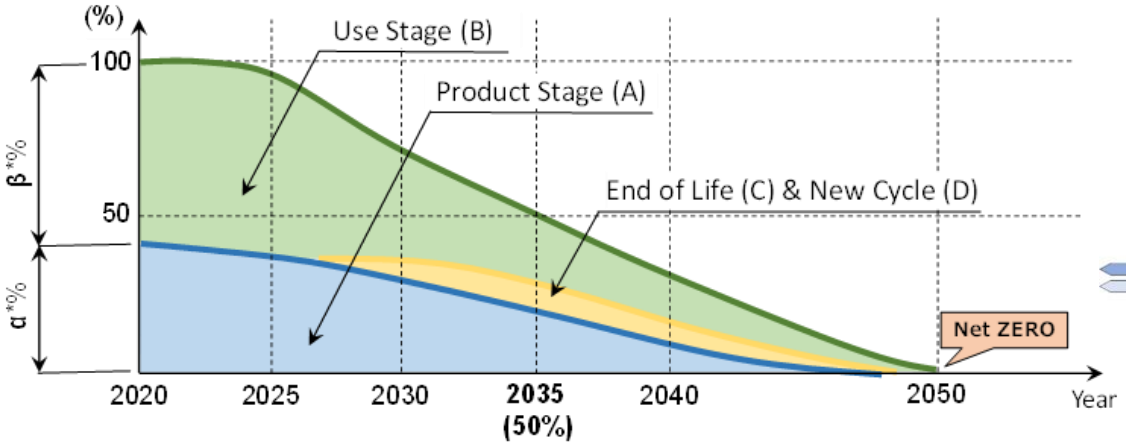
ice

What is civil engineering? News & Insight Events Engineering resources

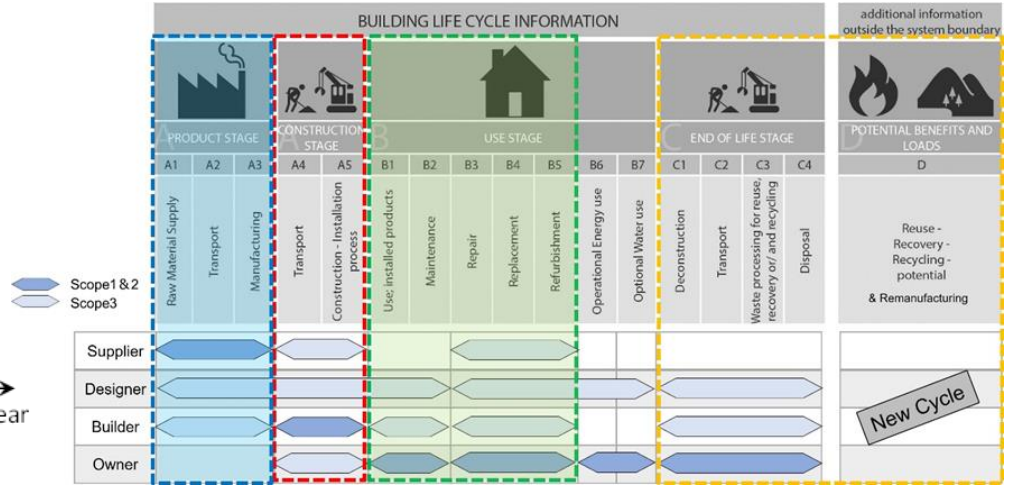
Home > News and insight > News and blogs > ICE Blogs > 6 principles to help engineers create resilient infrastructure

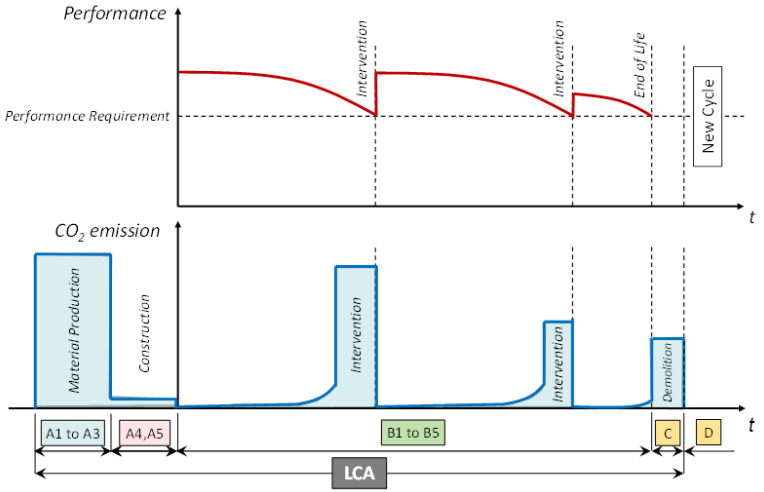


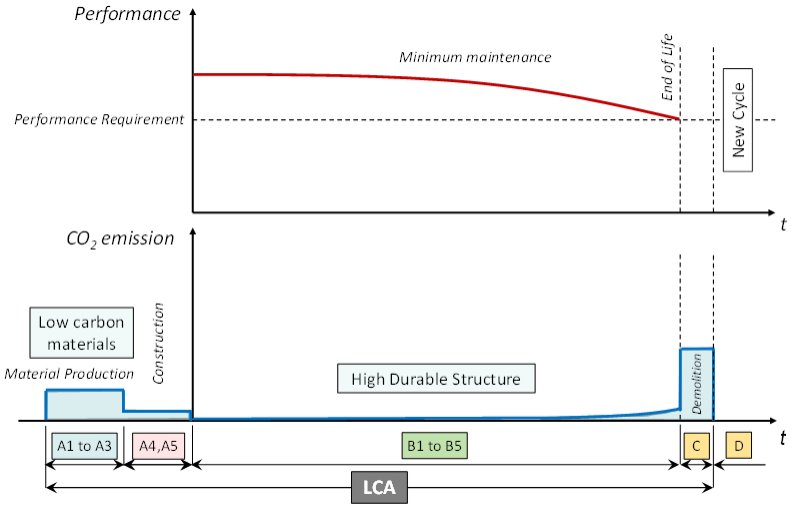




*; α and β might vary depending on the type of structure and the country.







fib Roadmap to 2050

Longevity versus CO_2 emissions: (left) with current technologies and (right) with low carbon technologies

- **Emission Reduction Targets**: Reduce CO_2 emissions from structural concrete by 50% by 2035 and achieve net zero by 2050 for both new and existing structures.
- **Life cycle-Based Approach**: Actions are aligned with the four lifecycle stages defined in EN 15978 – Product and Construction (A), Use (B), End-of-Life (C), and Beyond End-of-Life (D), each requiring tailored strategies.
- **Stakeholder Roles**: All parties – suppliers, designers, builders, and owners – are responsible for reducing emissions across different lifecycle stages through material innovation, design optimisation, construction quality, and end-of-life planning.
- **Technology and Innovation**: Emphasis is placed on adopting mature low-carbon technologies for early lifecycle stages (A & B). In contrast, Stages C & D require innovation and systemic change.
- **Focus on Existing Structures**: Prolonging the life of existing structures is prioritised over demolition, with interventions guided by lifecycle assessment and carbon pricing to ensure carbon-efficient outcomes.
- **Progress Monitoring and Collaboration**: Progress will be reviewed annually, with a major milestone in 2030 at the fib Congress in Japan; the roadmap may be refined based on collective advances by members.

fib Roadmap to 2050

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Brazil

Flooding death toll in south Brazil rises to 75 as over 100 people remain missing

Officials in Rio Grande do Sul state say more than 80,000 have been displaced by record water levels





Rescue workers in Osmaniye, Turkey, after an earthquake in February 2023.W ikipedia



Geopolitical Crises Effects

SUSTENTABILIDADE SÓ ACONTECE COM A FORÇA DE TODA A CADEIA

Do projeto à demolição, a sustentabilidade da construção em concreto depende da atuação integrada de todos os elos da cadeia produtiva.

CADA ELO IMPORTA. JUNTOS, CONSTRUÍMOS UM FUTURO MELHOR.



FORNECEDORES DE MATÉRIAS-PRIMAS
Extração responsável, uso de recursos naturais e redução de impactos.



INDÚSTRIA DO CIMENTO E ADIÇÕES
Inovação, menor teor de clínquer, uso de materiais suplementares e baixo carbono.



CONCRETEIRAS
Produção eficiente, qualidade e controle de emissões.



PRÉ-FABRICADOS
Industrialização, padronização e rastreabilidade.



CONSTRUTORAS E MONTAGEM
Planejamento, execução qualificada e gestão de resíduos.



PROJETISTAS E ARQUITETOS
Soluções eficientes, desempenho e ciclo de vida.



USUÁRIOS E SOCIEDADE
Infraestrutura, moradia, qualidade de vida e inclusão social.



GESTÃO DE RESÍDUOS E RECICLAGEM
Aproveitamento de materiais e economia circular.



UNIVERSIDADES E CENTROS DE PESQUISA
Conhecimento, inovação e desenvolvimento de novas soluções.



GOVERNO E REGULAÇÃO
Politicas públicas, normas e incentivos para um ambiente mais sustentável.



ECONOMIA CIRCULAR | INOVAÇÃO E TECNOLOGIA | RESILIÊNCIA E SEGURANÇA | BAIXO CARBONO | IMPACTO SOCIAL

SUSTENTABILIDADE É UM ESFORÇO COLETIVO.
É A SOMA DE TODOS.

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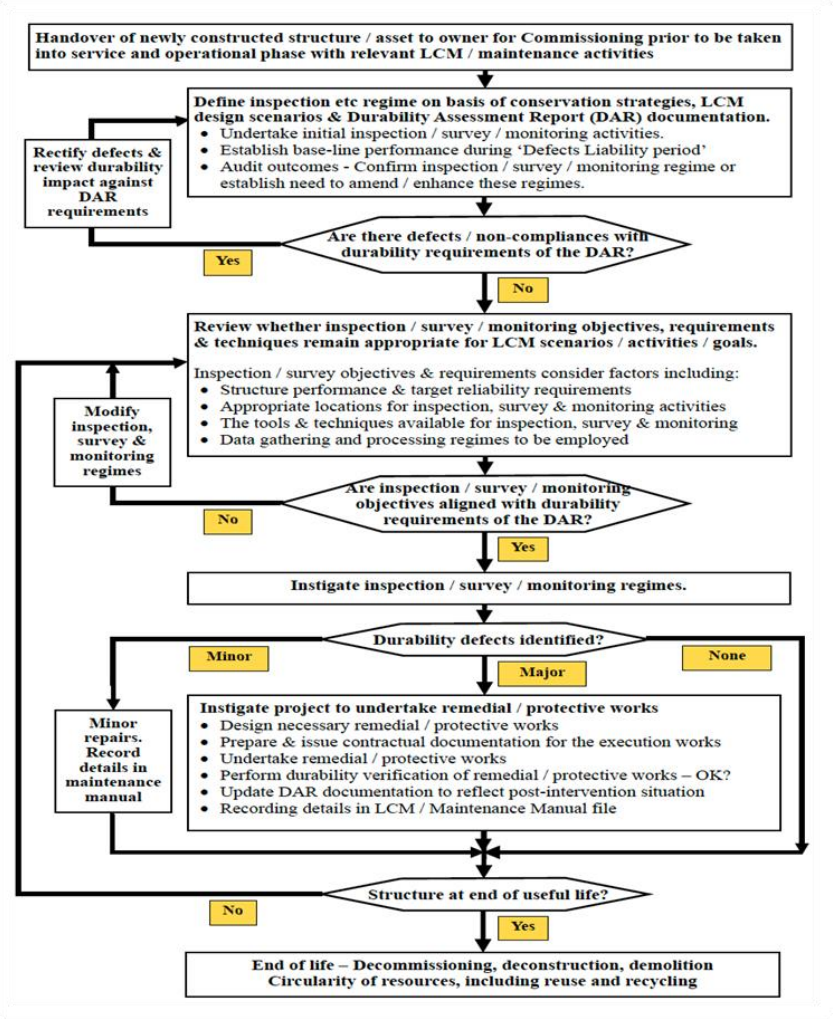
fib MC2020 Highlights: durability planning



Developing guidance documents for effective and efficient life-cycle management (LCM), the durability design, and the associated conservation processes

- For life-cycle management, it is necessary to incorporate durability considerations into the design and execution processes and maintenance operations to avoid premature deterioration of concrete structures. This holistic process is referred to as **Durability planning**

  - formal durability planning
    - structures requiring formal durability planning
    - structures not requiring formal durability planning
  - Conceptual & detailed durability design studies
  - requirement for expertise
  - execution aspect

fib MC2020 Highlights: conceptual design

- Conceptual design is not optional but a necessary intellectual act -An engineer's opportunity to solve the structure in their **mind before touching a computer**. ***Hugo Corres (Spain) – MC 2010 and promoted the 1st Edition***
- A structure must be a solution, not just an arrangement of elements.
- The structure should be easy to build; the conceptual design must consider this.
- The best structures are not only efficient but **elegant**, with **minimal material used in a maximally expressive way**.
- Conceptual clarity, **performance-based design**, **sustainability**, and **integration of design, construction and maintenance (whole life cycle)**.
- "Structures must be logical, buildable, and beautiful." ***Jörg Schlaich (Germany)***
- ***4th Editions: Spain, Switzerland, Norway, and Brazil. The next will be in Lecco-Como, organised by Prof. Marco di Prisco.***

fib MC2020 Highlights: Conceptual Design

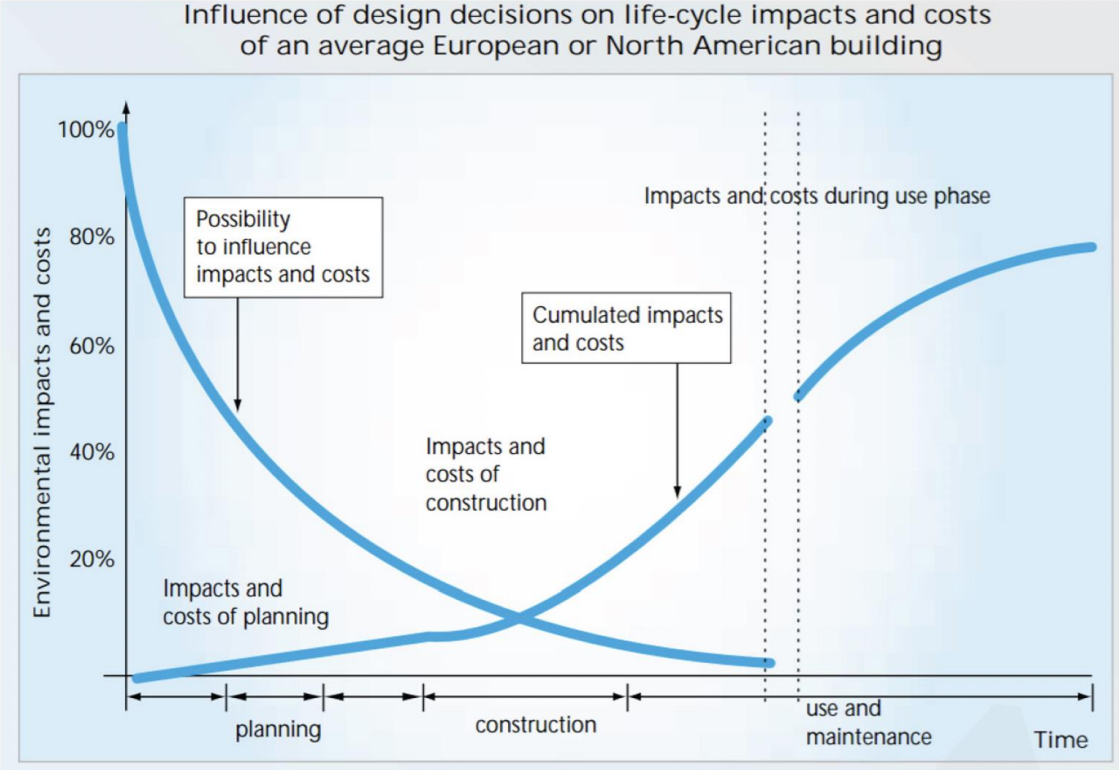


Figure 26.1-1: Impact of design decisions made at various stages of the life-cycle (Crawford 2011[26-12] Rice[26-2] and/or Kohler[26-13] and/or Schlaich[26-4])

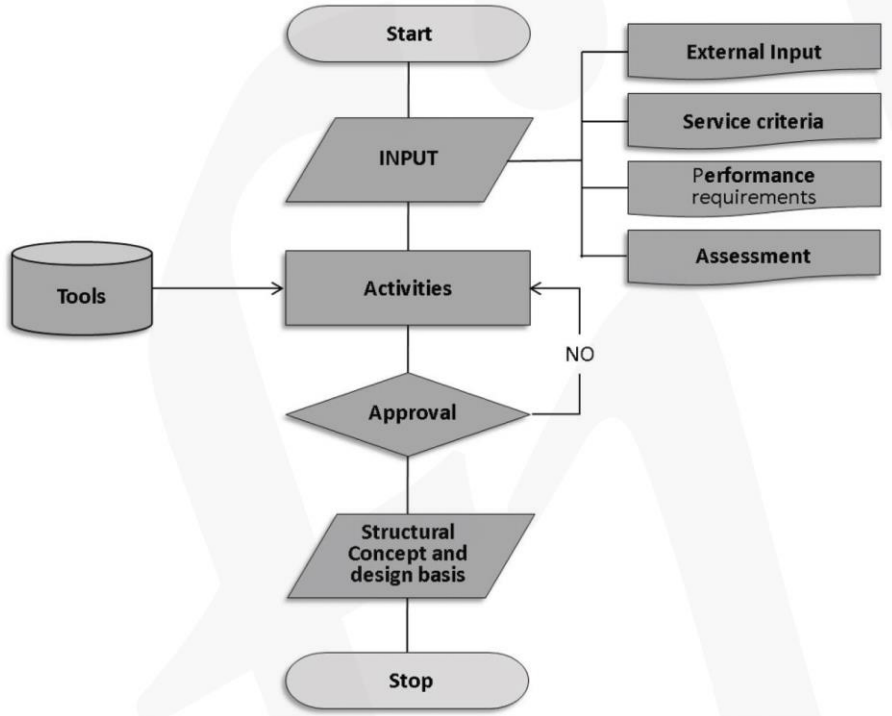


Figure 26.1-1: Methodological flowchart for conceptual design of new structures and adaptations/interventions/restorations upon existing structures

Source : MC 2020 Chapter 26 –page 351

Conceptual Design Symposium:

fib International Symposium on Conceptual Design of Concrete Structures
Rio de Janeiro 2025
fib CEB-FIP Young Members Group

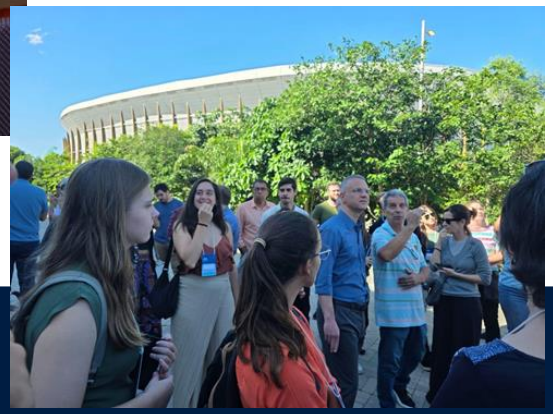








International fib Symposium on Conceptual Design of Structures
Lecco 2027





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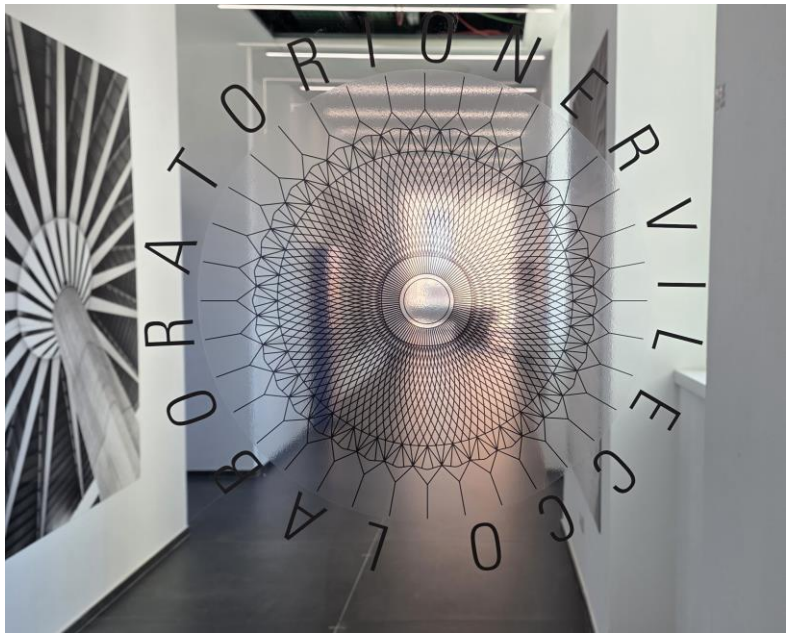
Conceptual Design

Pier Luigi Nervi (1891-1979)

- “The aesthetic result is a natural consequence of correctness in the structural conception. Beauty does not come from decorative effects but from structural coherence”
- “New forms must derive from new materials and new techniques.”





Stock Exchange Tower –Montreal 65

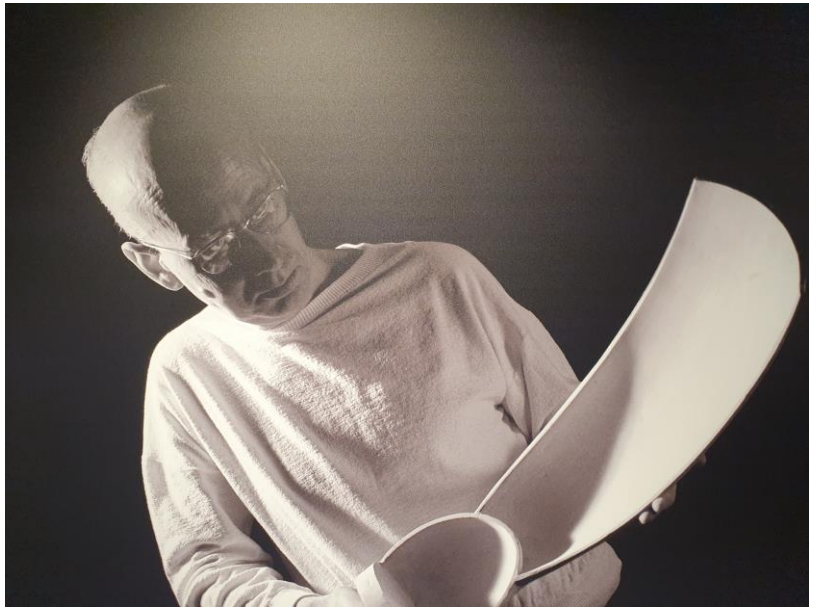


Embaixada da Itália- Brasília 77

Conceptual Design

"El nacimiento de un conjunto estructural, resultado de un proceso creador, fusión de técnica con arte, de ingenio con estudio, de imaginación con sensibilidad, escapa del puro dominio de la lógica para adentrarse en las secretas fronteras de la inspiración."

Eduardo Torroja



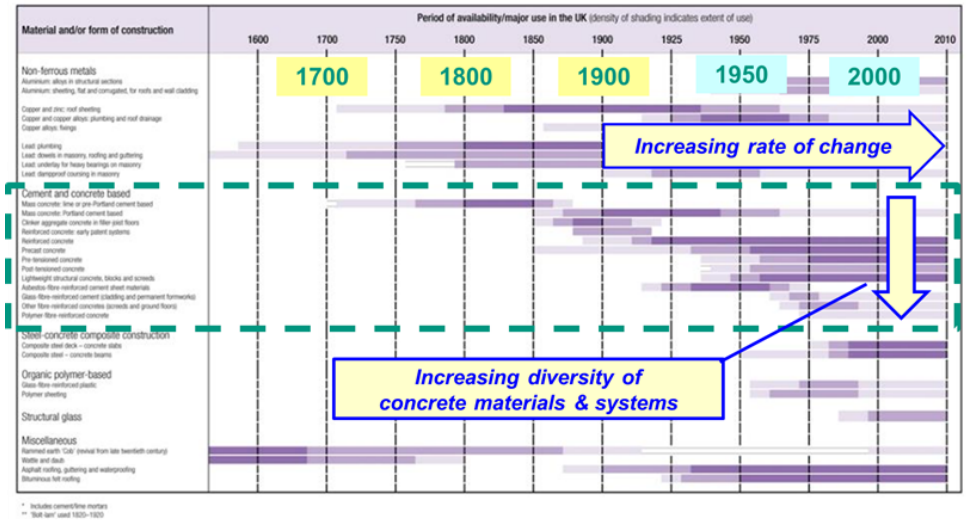
1889 - 1961

" Cuando creo que he creado algo es porque no he leído bien a Torroja"

Hugo Corres



fib MC2020 Highlights: innovative materials



Source : Dr. ir. A.J. Bigaj-van Vliet | TNO
Deputy-convener fib TG10.1 Model Code

Criterion	MC 1990	MC 2010	MC 2020
concrete strength	20 … 60 (90) MPa	20 … 130 MPa	20 … 130 MPa
concrete type	normal strength	■ normal strength ■ high strength ■ lightweight (10 … 90 MPa) ■ self-compacting ■ green (eco-concrete) → concretes comply largely with the provisions of EC2 and EN 206, resp.	■ normal strength ■ high strength ■ lightweight (10 … 90 MPa) ■ self-compacting ■ green (eco-concrete) ■ UHPC (…. 250 MPa) ■ intervention materials ■ old concrete
concrete loads	different ranges of applicability, depending on the related load (static, impact etc.); temperature range: mainly 0 ° C < T < 80 ° C		
tailor-made concrete	reference to test standards or recommendations		

The fib MC2020 covers a **wide range of traditional and non-traditional solutions. It covers various types of concrete and concrete structures (reinforced, prestressed, both pretensioned and post-tensioned, precast, and steel-concrete composite structures)**. Provisions cover static and non-static conditions, such as fatigue, seismic excitations, impact, and explosions, as well as an extreme range of thermal exposure, including fire and cryogenic conditions, across a full range of environmental exposure conditions.

Concrete Considerations MC 2020 Chapter 14

14.1 Scope

- MC 2020 applies to concretes where the primary binder is Portland Cement, eventually containing secondary cement materials (SCM), such as blast furnace slag, sílica fume, natural pozzolans, and or rock powders. Here, whether the SCMs mentioned earlier are added as a part of the cement (composite cement) or as cement replacement material in the concrete product process is irrelevant.

- Durability behaviour is important in green concrete. In case of doubt, such as in deformation-sensitive structures or structures with pronounced durability loadings, a performance-based approach (chapter 4) is recommended.

- Concerning Compressive Strength MC 2020 covers concretes up to a characteristic strength of 120 MPa, NSC 50 ≤ MPa, or
- HSC ≥ 50MPa

14.2 Concrete Classification

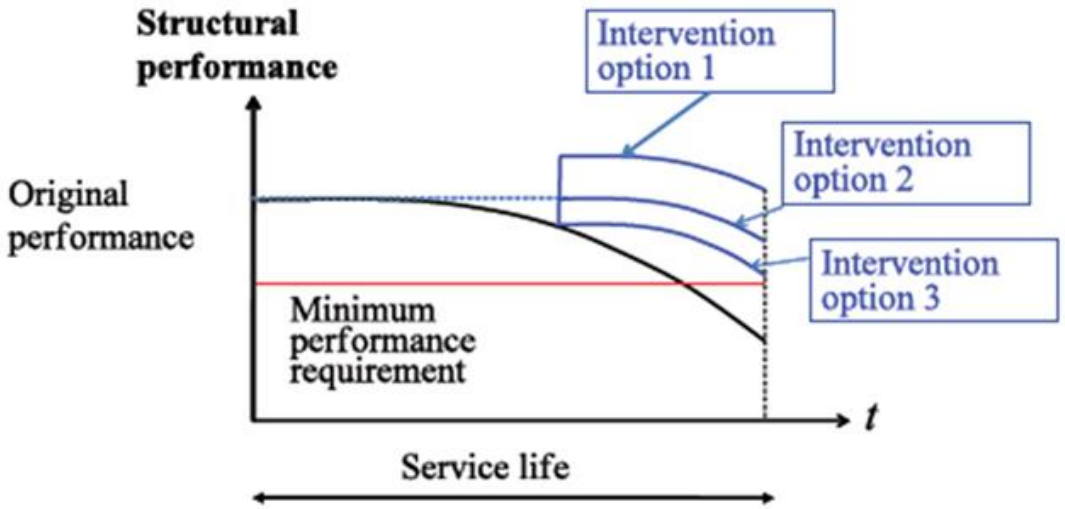
The standard reference age at which concrete properties are defined is 28 days. For specific cases to be evaluated on a case-by-case basis, other ages may be used, subject to verification concerning structural design and durability, e.g., for concretes made with binders containing active supplementary cementitious materials. Bull 111- Modelling the structural performance of Existing Structures brings information on the reduction of strength measured at an age higher than 28 days, which is more critical for tension than compression.

Nevertheless, it should be remembered that some specifications- for example, the requirements defined for different exposure classes—are based on 28-day compressive strength.

Model Code pages 161-163

fib MC2020 Highlights : Interventions

- Three possible conceptual options for intervention
- Factors considered:
  - the importance of the structure
  - its remaining service life
  - the deterioration mechanisms
  - the technical feasibility
  - time/space constraints for execution
  - the available budget
- Selection of intervention method considering the followings
  - deterioration mechanism
    - chloride-induced corrosion
    - carbonation-induced corrosion
    - frost damage
    - ASR damage
    - thermal/shrinkage cracking
    - fatigue damage
    - damage by seismic action
  - deterioration level (4 levels)



Note:
Option 1 is to upgrade the performance and to lessen the deterioration rate.
Option 2 is to restore the performance and to lessen the deterioration rate.
Option 3 is to lessen the deterioration rate only.

What about architecture and Design Influences?

1. **Freedom of Form Through 3D Printing**

- **Parametric design** + **robotic concrete printing** enables fluid, organic shapes that were once impractical or prohibitively expensive. *Example:* Zaha Hadid Architects and MX3D are already prototyping printable structural components.
- **Non-standard elements**: Complex curvatures or lattice structures created without formwork, drastically reducing material waste.

2. AI-Driven Optimisation:

- **Generative design**: AI tools suggest optimal structural forms with minimal material usage.
- **Digital twins**: Architectural projects will be fully simulated in BIM with real-time feedback on stress, temperature, or cracking potential—already influencing the detailing phase before construction begins.

Disrupção e Tecnologia:



- 3D Smart Slab Zurich (Swiss University –ETH Zurich)
- https://www.globalconstructionreview.com/3d-sand-printing-used-create-20mm-ceiling/
- https://ethz.ch/en/news-and-events/eth-news/news/2018/07/where-structure-and-ornamentation-merge.html



29º ENECE

Encontro Nacional de Engenharia e Consultoria Estrutural

ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA E CONSULTORIA ESTRUTURAL

ABECE

Commissions and Task Group
Special Activity Group 2. AI & Digitalisation



Commission Chair
Sylvia Kessler

Motivation

This initiative marks a decisive step in *fib*'s strategic vision to support and guide the civil engineering community through the digital transformation that is reshaping the construction industry worldwide. *fib* recognizes the critical importance of this moment and reaffirms its commitment to proactively guide this transition by initiating the Special Activity Group on AI and Digitalization.

Scope and objective of technical work

The SAG will operate through three dedicated working groups, ensuring AI integration is addressed at both the strategic and operational levels, with a strong foundation in ethical responsibility and human oversight.

- Working Group 1 - "Ethical AI Integration in Structural"
- Working Group 2 - "*fib* Large Language Model"
- Working Group 3 - "Research Databases"

O que estão fazendo as principais instituições?

Instituição	O que está fazendo	Foco ético
fib	Criou o **SAG2 – IA e Digitalização**, incluindo um **Grupo de Trabalho específico sobre Integração Ética da IA na Engenharia Estrutural**	IA responsável, supervisão humana, implicações profissionais e governança de dados
IStructE	Publicou **orientação específica sobre IA para engenheiros estruturais** e ampliou sua orientação ética em 2026	Julgamento profissional, verificação, competência, transparência, segurança e responsabilidade sobre a tecnologia
ASCE	Adotou a **Policy Statement 573 – IA e Responsabilidade na Engenharia**	IA como ferramenta — não como substituta do julgamento e da responsabilidade do engenheiro
Engineering Council / RAEng	Criou um **grupo de trabalho sobre IA** e incorporou a responsabilidade pelo futuro da tecnologia aos princípios éticos	Ética, competência, transparência, impactos sociais e adoção responsável de tecnologias emergentes
ISO	Estabelece uma estrutura internacional para **governança e gestão de riscos de IA**, por meio da ISO/IEC 42001	Governança, responsabilidade, gestão de riscos, transparência e melhoria contínua

Consenso emergente :

A IA pode apoiar a prática da engenharia, mas o julgamento profissional, a responsabilidade e a segurança pública permanecem sob responsabilidade humana.

Concluding remarks:

- Climate change and geopolitical tensions are shaping our world today. Despite rapid technological progress, many critical challenges remain, and concrete engineering plays a key role in creating effective solutions for a more sustainable, resilient future.
- Constructing a comprehensive global vision, through our entities, will become increasingly necessary in pursuing sustainable development.
- As engineers and professionals, we need to rethink our approaches and explore innovative strategies to respond effectively to these global issues.
- Therefore, we need to integrate the entire value chain, bringing together academia, industry, designers, and constructors. Isolated discussions have not led to the implementation of the solutions we need. Only through collaboration and alignment across all stakeholders can we achieve meaningful and effective change.
- We have great potential in this regard, whether acting individually or together. We can make a difference locally, but in an integrated way that provides sustainable support for development. Our unity is essential when addressing issues that affect society as a whole.
- Constructing a comprehensive global vision will become increasingly necessary in pursuing sustainable development.



fib Model Code 2020 | ENABLING ADVANCEMENTS FOR NEW AND EXISTING...



fib Model Code 2020 | PERFORMANCE-BASED APPROACH : WORKING ON THE...



fib Model Code 2020 | SUSTAINABILITY PERSPECTIVE: CONTRIBUTION OF...



fib Model Code 2020 | VALIDATION OF THE HARMONIZED PARTIAL FACTOR METHOD...



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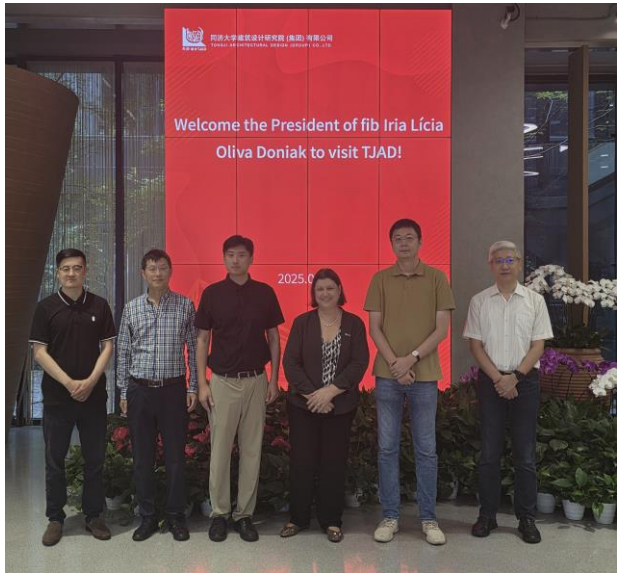
https://www.youtube.com/@fib-international


Welcome the President of fib Iria Lícia
Oliva Doniak to visit TJAD!






ACF Workshop on
Concrete Technolog
—For 20th Anniversary of the Asian Concr
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70. BETONTAGE
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A *B*ridge between *R*esearch and *P*ractice

International Federation for Structural Concrete

Let's keep in touch

- Social media
- *fib*-news
- e-newsletter



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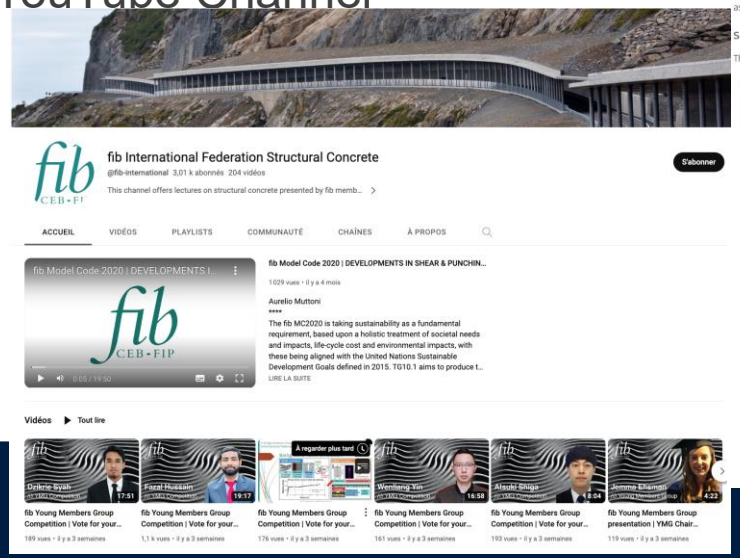
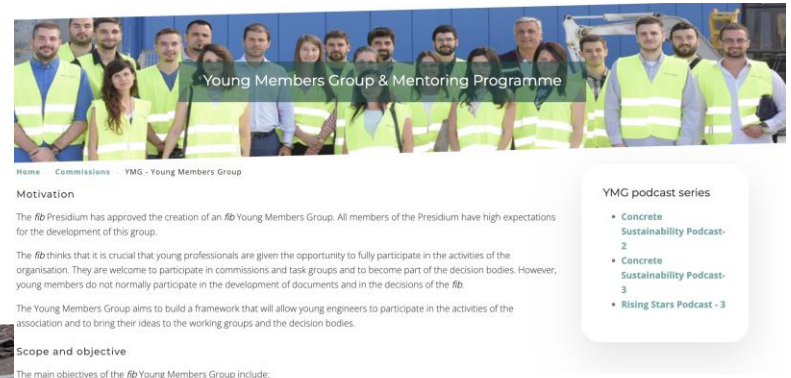
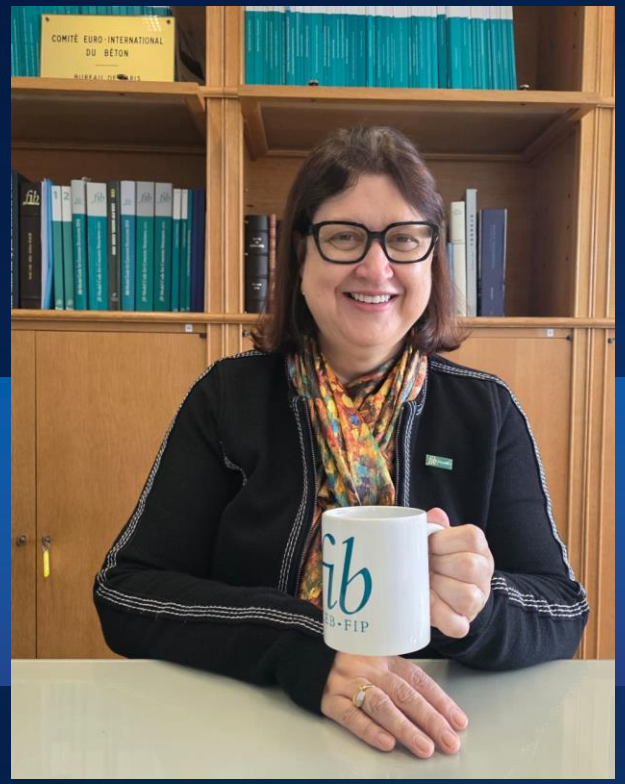


Join the *fib* Young Members Group!



- Events
- Podcast series
- YMG competition
- And more!



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ABECE

OBRIGADA

Até o próximo ENECE

www.fib-international.org.br

www.abcic.org.br

iria@abcic.org.br

Escritórios Projetos