[14h05 – 14h25]

Making concrete more sustainable

– the use of alternative / non-conventional materials –

Workshop, 16 July 2021 – ONLINE

(Global Partnership for Sustainable Construction and Resource Efficiency)

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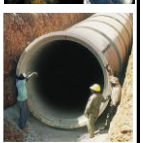
Introduction

- Most commonly used construction material
- Concrete is a mixture of:
  - ✓ cement
  - ✓ fine [sand] and coarse [stone] aggregate
  - ✓ extenders (supplementary cementitious materials, SCMs) e.g. fly ash, slag, silica fume, metakaolin
  - ✓ admixtures e.g. plasticizers, accelerators, etc
  - ✓ **(water)**



Mix proportions should be optimized to meet the desired fresh and hardened concrete properties…

Introduction

- Why concrete?
  - ✓ versatile
  - ✓ high strength-to-cost ratio
  - ✓ good fire resistance
  - ✓ durable
  - ✓ sustainable?

- Challenges facing use of concrete as a construction material:
  - ✓ Increased demand
  - ✓ Poor understanding
  - ✓ Need to make it durable and more sustainable

The sustainability challenges

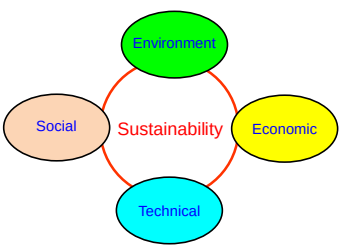
- What are the sustainability issues?

Direct & Indirect

- ✓ Cost
- ✓ Water
- ✓ Aggregates
- ✓ Admixtures
- ✓ Environment
- ✓ Social

The sustainability complex

- These challenges are inter-related and complex to address!



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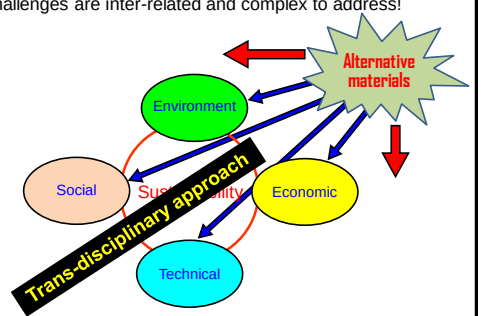




Alternative Materials

Fundamental aspects



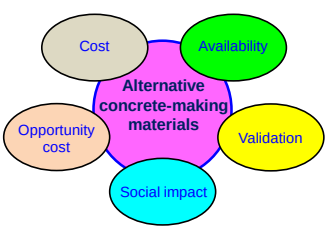
Alternative materials

What is an alternative / non-conventional material?

Alternative materials

…not all materials qualify to be Alternative Materials!

We also need to consider:



Alternative materials

Which conventional concrete-making materials can be replaced with alternative materials?

We also need to consider:

- ✓ Availability (quantity, short-/long-term, locality)
- ✓ Social impact e.g. acceptance by the local community

Alternative materials

Which conventional concrete-making materials can be replaced with alternative materials?

We also need to consider:

- ✓ Validation by local research – adequate trials carried out
- ✓ Opportunity cost (may not be directly related to concrete!)
- ✓ Cost:

Alternative materials – way forward

- How can we maximize the impact of alternative materials?
  - ✓ Advocating for flexibility / elasticity of local standards / codes
  - ✓ Investing in long-term research using alternative materials
  - ✓ 'Educate' local engineers

Alternative materials – way forward

- How can we maximize the impact of alternative materials?
  - ✓ Inclusion in curricula
  - ✓ Explore new building technologies e.g. pre-fabrication
  - ✓ Involve all stakeholders
  - ✓ Test methods

Which materials can be replaced?

- Cement
  - ✓ Bio/plant-based / Agri-based ashes
  - ✓ Other wastes
  - ✓ LC^3
- Water
  - ✓ alternatives?

Which materials can be replaced?

- Aggregates
  - ✓ Recycled concrete, clay bricks, etc
  - ✓ Industrial waste materials
- Admixtures
  - ✓ Plant-based / Bio-based

Explore the possibility of replacing more than one material…

Closing remarks

As we look for *alternative materials for making concrete*, we need to:

1. always think of sustainability and resource efficiency

2. keep in mind the pillars to implementing alternative concrete-making materials

Thank you…

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