

Marine self-healing concrete with biomineralization-enhanced construction waste for long-term decarbonisation

基於生物礦化技術增強建築廢料製備的海洋自癒合混凝土以長期脫碳

PC: Prof. Xiangdong LI (李向東)

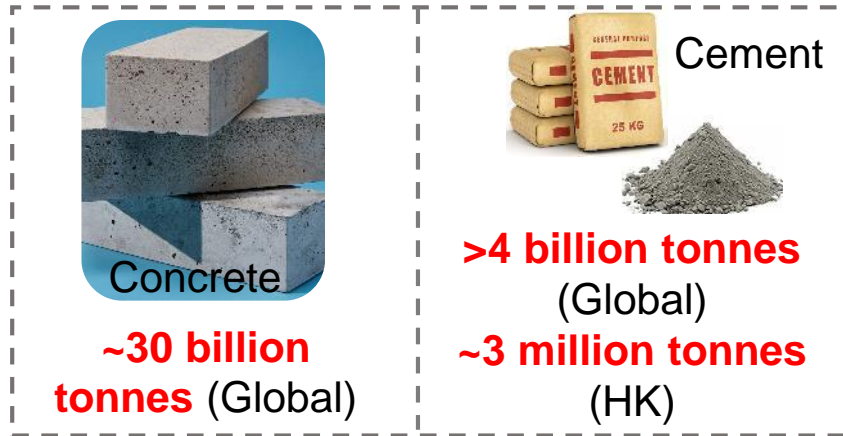
Co-PI: Dr. Xiaohao SUN (孫瀟昊)

Applicant: The Hong Kong Polytechnic University

Collaborating Members: Prof. Chi Sun POON, Prof. Tao YU, Prof. Zhen LENG

Collaborating parties: Multiway Concrete Ltd., CCCC Fourth Harbor Engineering CO., LTD., Southeast University

Industry consumption per year



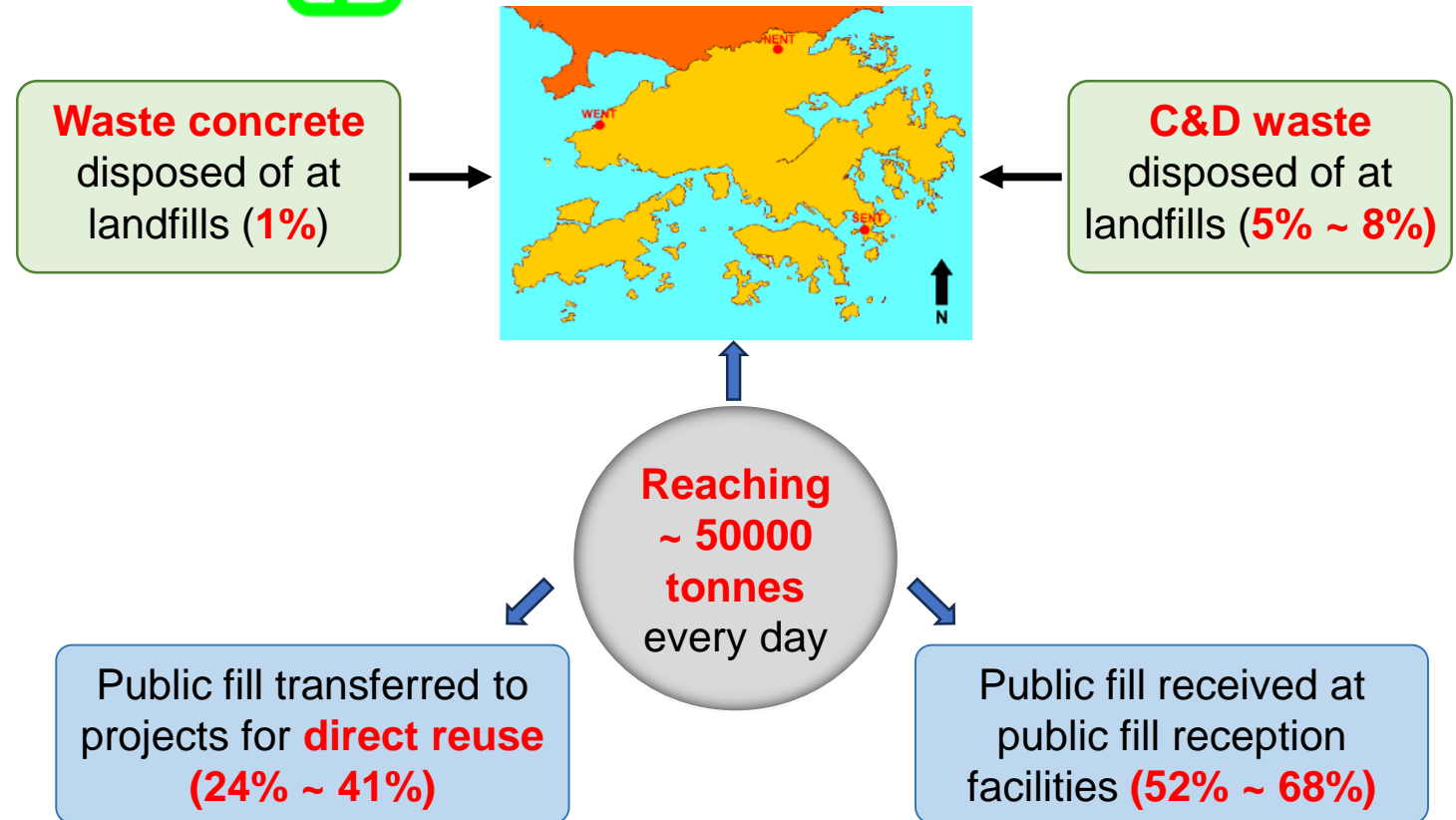
~2.5 Gt per year, equivalent to ~7% of total CO₂ emissions

Construction waste (CW) in HK (from 2018 to 2022)

❖ In HK, ~7% CO₂ emission comes from **waste**



Environmental Protection Department
The Government of the Hong Kong Special Administrative Region



❖ It is essential to provide **large-scale outlets** for reusing CW

Team Members and roadmap

Dr. Xiaohao SUN

Biomining & self-healing



Prof. Chi Sun POON

Construction waste (CW) & Carbonisation



Prof. Xiangdong LI

Project coordinator & marine ecology



Prof. Tao YU

Marine concrete & field testing

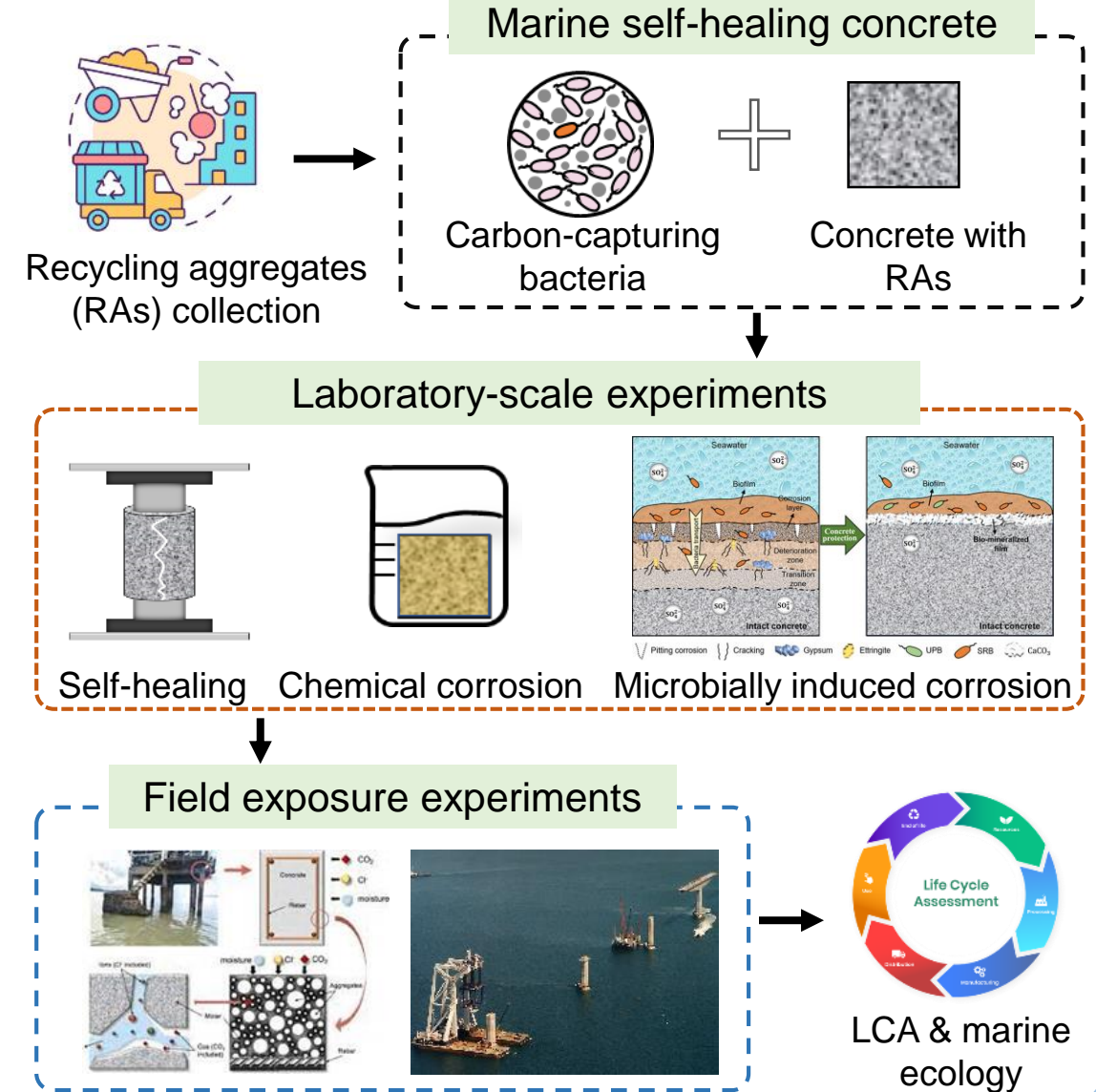


Prof. Zhen LENG

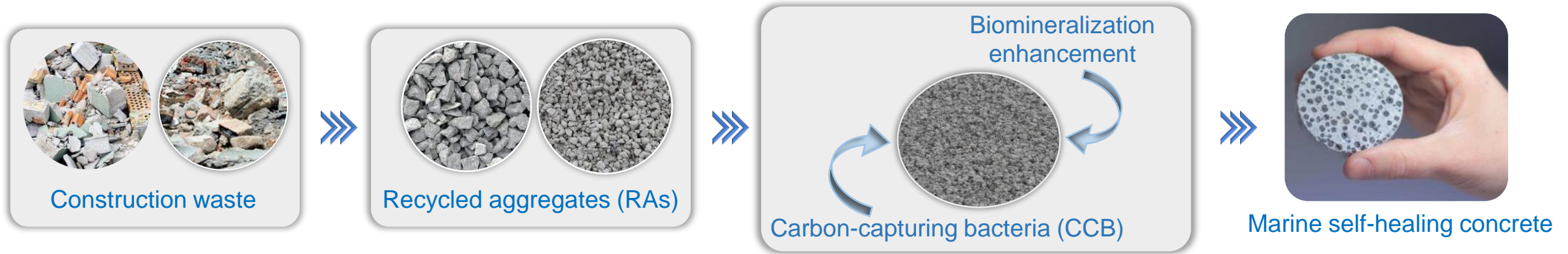
Lifecycle assessment (LCA)



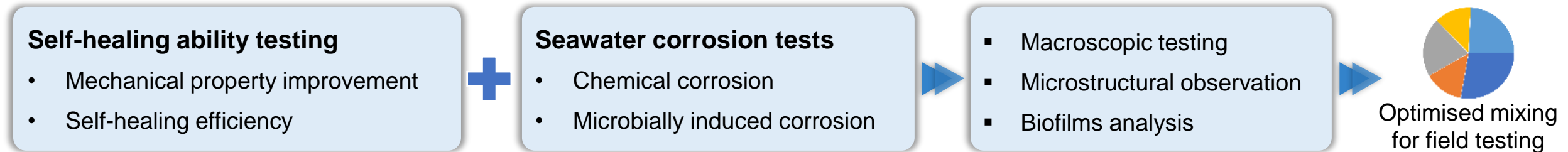
Outline of Recycling of CW



1 A low-carbon marine self-healing concrete design and preparation



2 An optimized mixing for marine self-healing concrete based on laboratory-based experiments



3 A comprehensive marine self-healing concrete design guideline according to field experiments

4 Reports indicating the environmental performance and the influence on marine ecology

Marine self-healing concrete design

- Pre-process of RAs
- Accelerated carbonization and biomineralization enhancement
- Preparation of marine self-healing concrete

Task 1

Field exposure experiments

- Complex corrosion performance
- Resistance performance in real marine environments
- Marine self-healing concrete design guideline

Task 2

Task 3

Task 4

Self-healing ability testing and marine corrosion resistance

- Self-healing ability
- Chemical corrosion
- Microbially induced corrosion
- Macroscopic and microstructural properties
- Biofilm analysis

Lifecycle assessment and marine ecology

- LCA report
- Marine biofilms attached to other natural surfaces
- Marine ecology influences

Novelty and Competitive advantages



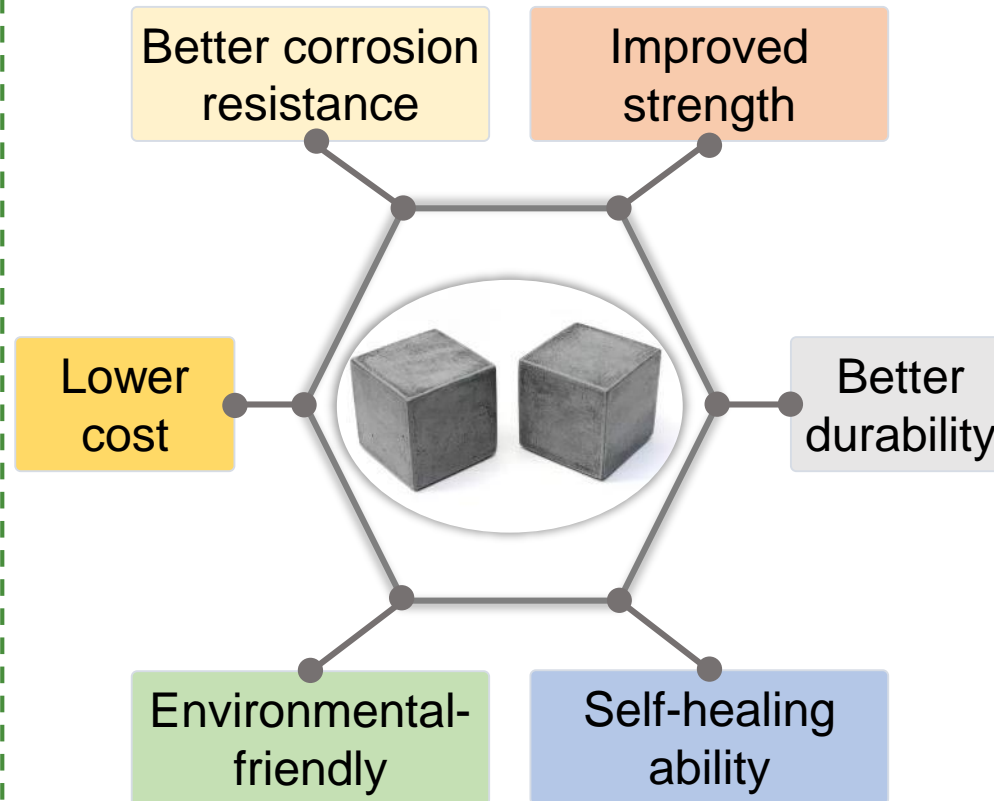
THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

❖ Recycling of CW and Cost Saving



Reusing **13,396 tons** CW
Saving **4,445,036 m³** landfill
volume per year

❖ High property and resistance of marine construction materials



香港邁向 **碳中和**
Carbon Neutral@HK

✓ Decarbonisation of **214,269 tons** CO₂ per year



✓ Sustainability of coastal cities