

URBAN SOLUTIONS AND SUSTAINABILITY R&D CONGRESS 2023

BUILDING SUSTAINABLE, RESILIENT, AND LIVEABLE CITIES OF TOMORROW

4TH - 5TH OCTOBER 2023

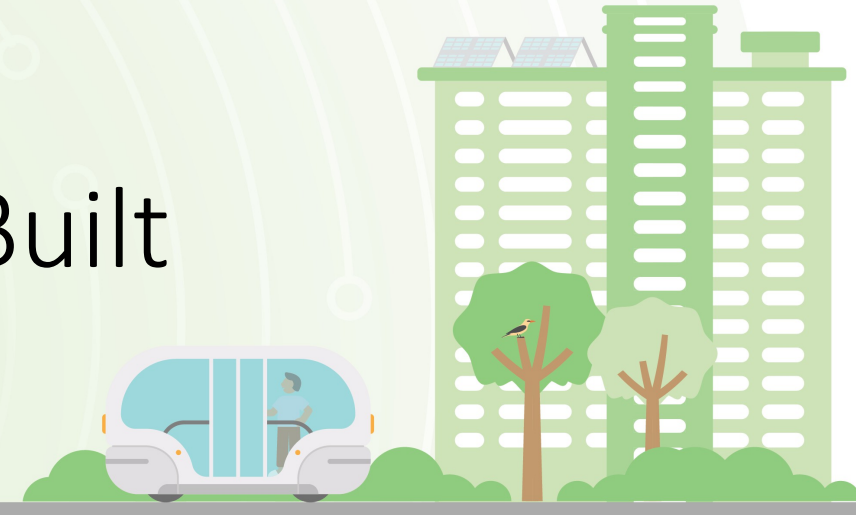


Sustainable Innovative Construction Material Solutions for the Local Built Environment Industry

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Centre of Innovation for Built
Environment - Advanced
Materials (COI BE-AM)

Advanced Materials Technology



Centre of Innovation for Built Environment - Advanced Materials (COI BE-AM)



Launched in 2022, the Centre of Innovation for Built Environment – Advanced Materials (COI BE-AM) is a joint effort between Singapore Polytechnic, Republic Polytechnic and Temasek Polytechnic focusing on uplifting local SMEs’ capabilities in advanced construction materials and chemical formulations, to meet industry requirements on **sustainability, design** and **construction**.

It will also provide support to accelerate transformation efforts in **building inspections, material characterisation, maintenance** and **repair solutions**.

Through working closely with BCA, ESG and other government agencies/trade associations, the centre aims to identify and develop material solutions for industry adoption and increase the competitiveness of our local SMEs.

Supported by:



Building and Construction Authority



BCA has developed the Advanced Materials Roadmap that aims to identify and develop material solutions for industry adoption to achieve desired outcomes in 3 domains

(1) Sustainability

(2) Productivity

(3) Maintainability

Features of advanced material solutions

Materials that are low carbon

Materials that are flowable, self-compacting or high strength

Materials that are durable, maintenance free (crack free) and self-healing

Desired outcomes that could be achieved with advanced materials

Reduce up to 40% Embodied Carbon by 2030 from 2015 levels

Improve site productivity by 25% by 2025 from 2010 levels

- Improve building repair efficiency by 50% by 2025 from 2020 levels
- Reduce cost for concrete repairs and maintenance by >30% by 2025 from 2020 levels

Types of advanced material solutions that would contribute to desired outcomes

- i. Carbon mineralization**
- ii. Low carbon materials**

- iii. Less 'labour-intensive' materials**
- iv. High strength and/or lightweight materials**

- v. Construction materials with enhanced durability**
- vi. External protective/repair material**

Focus Areas

Focus Area 1

Construction Chemicals

Waterproofing;
Sealer

- Advanced coating materials
- Green chemicals for BE materials
- High performance and functional materials
- Embodied carbon profile development

Sustainable Construction Materials

Environmentally-
friendly waste;
incorporated; Low-
carbon materials

Focus Area 2

Functional and High Performance Construction Materials for Buildability

Fire retardant,
thermal insulation,
noise reduction

- BE Materials for 3D printing
- Inspection technologies
- Maintenance and repair technologies
- Materials characterisation

Building Inspection, Maintenance and Repair Solutions

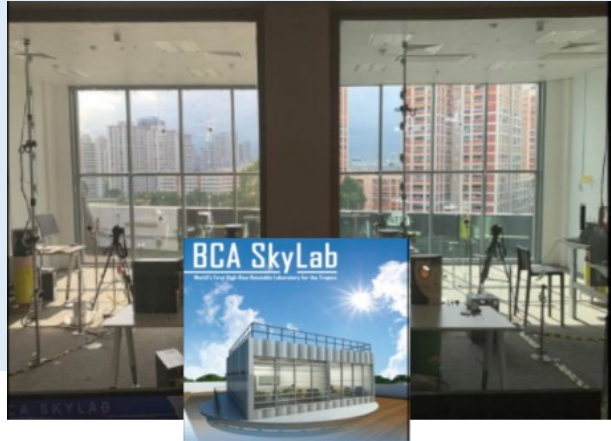
Structural
inspection,
maintenance and
repair solutions and
materials

Sustainability

Construction Chemicals

Applications:

Energy-saving Glass Coatings
Water Proofing Chemicals



Services:

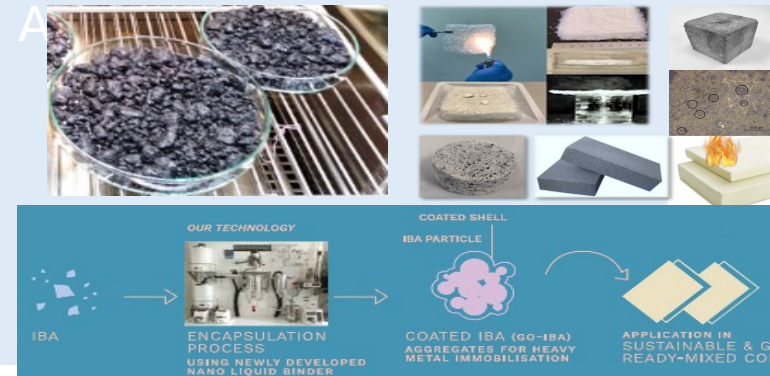
- Environment Impact Analysis (EIA)
- Energy saving evaluation
- Anti-corrosion evaluation
- SGBP / Green Mark Application
- BIP Clearance

Sustainable Materials

Waste/ Low Carbon Construction or Building Materials

Applications:

Road Pavement / Aerogel / Foam Glass / New Sand / Concrete



Services:

- Weathering and Durability
- Environment Impact Analysis (EIA)
- Mechanical Properties
- Thermal Evaluation
- BIP Clearance

Embodied Carbon Profile Development / Carbon Mineralisation through Carbon Capture, Utilisation & Storage in Advanced Building



Services:

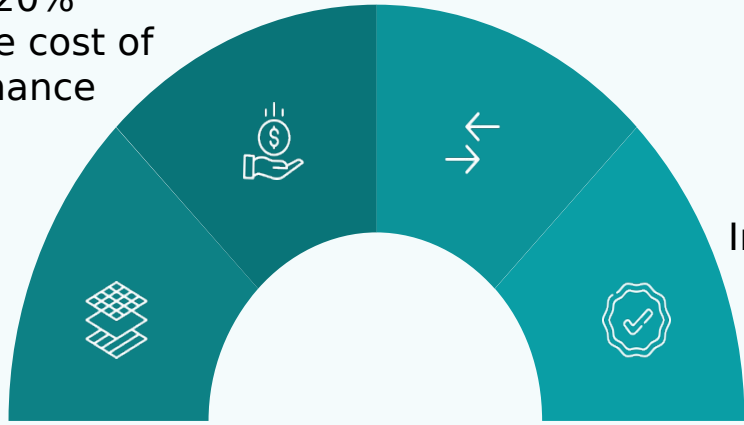
- Pre-EPD report that meets SGBC's requirement
- SGBP / Green Mark Application
- BIP Clearance

SP's Case studies in Sustainable Innovative Construction Material Solutions

The Use of Asphalt Containing Processed Plastic Waste for Durable Pavement

Innovative Journey

Among many recycle plastics, modified asphalt is 40% more durable and 20% savings in the cost of road maintenance



Optimized content and type of locally-sourced recycled plastic

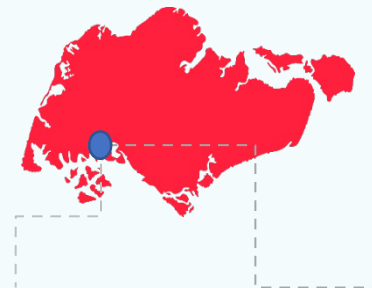
Environmental results of modified asphalt were comparable to conventional asphalt, but better than other plastics

Approved by Building Innovation Panel (BIP) for test-bedding on actual road pavement using modified asphalt

Test Bedding Journey

To incorporate recycled plastic into road pavement. Test bedded on real traffic and weather condition for 12 months Better durability yet meeting regulatory (LTA/NEA/PUB).

Pending regulatory approval for incorporation of plastic asphalt into LTA specs before production



Jalan Buroh Test Section



IES Prestigious Engineering Achievement Award 2022

ASEAN Outstanding Engineering Achievement Award 2022

Straits Times Sources:
<https://www.straitstimes.com/singapore/transport/lta-trials-use-of-plastic-waste-to-build-roads>

In response to queries, LTA said it is testing out two asphalt mixes that have plastic waste in them and are targeted at different road applications.

The trial in Jalan Buroh uses readily available clean plastic waste as an additive to enhance the performance of road segments that have heavy loads, such as industrial roads with slow-moving heavy vehicles.

Earlier tests of this mix, which is based on existing technology, showed a 30 per cent improvement in performance over the existing asphalt mixes, LTA said.

This project is a collaboration between LTA, the National Environment Agency, Singapore Polytechnic and local construction company Samwoh.

THE STRAITS TIMES SINGAPORE

LTA trials use of plastic waste to pave roads



Localized Accelerated Copper Patination Solutions of Building Structure

Background

- ❑ Conventionally FranzWood relies on technical support from oversea specialist to produce “black box solutions” for copper patination of building structure.
- ❑ A localized solutions are required to better control the quality and lead time of projects/works especially in Building Conservation & Restoration in tropical environment.



Value Added Product Development from SP to FranzWood via EDG **Final trial run of FranzWood Building Dome**

- ❑ Develop localized accelerated technical solutions for copper patination
- ❑ Optimize ratio of effective ingredients in the patination solutions
- ❑ Stability of the patina against the Singapore environmental conditions (UV, Temp, humidity etc.)
- ❑ Test run the copper patination solutions co-developed by FranzWood / SP on the copper dome or monuments in heritage buildings

Outcome and Next Steps of the Project

- ❑ Completed development of acceleration patination for turquoise/blue green, stability test completed.
- ❑ Trial run for the Building Dome provided by FranzWood completed.

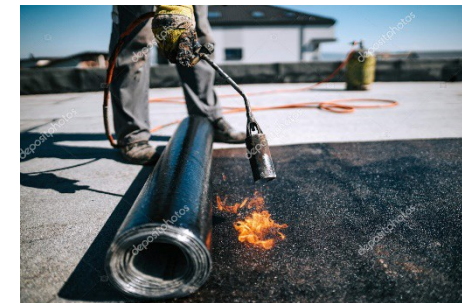


Room-Temperature and Lower Embodied Carbon Bituminous Coating for Waterproofing

Problem statement:

Contractor applies bitumen as a coating for waterproofing system. However, the conventional process involves melting at high temperature melting (>220 °C) before application.

Not only is the process higher in embodied carbon, it also emits harmful volatile organic compounds (VOCs) and a pungent smell, which is a concern by HDB and NEA.



High temperature melting of solid bitumen releases harmful VOCs and pungent smell

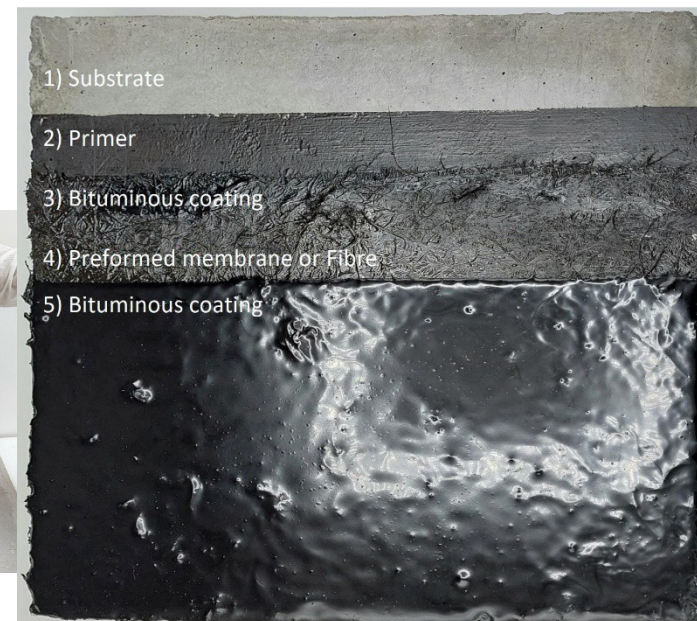
Solution:

SP is developing a flowable, fast-drying (<3h) bituminous coating (brownish-black liquid) that can be applied at room temperature. This coating also has the option to incorporate waste, further reducing the carbon footprint.

Surface touch-dry	≤ 20 mins	≤ 30 mins	≤ 30 min
Drying time (1-mm thickness)	3 h	2 h 30 mins	4 h
Total Solid Content#	75 %	57 %	74 %
Viscosity^	1000 cP	125 cP	700 cP
Coverage (1-mm thickness)	1.3 kg/m ²	1.1 kg/m ²	1.2 kg/m ²

Measured by A&D MS-70 moisture analyzer

^ Measured by TQC Sheen CPI cone & plate viscometer



SP's bituminous coating for waterproofing system

Fill free to visit and contact us for any enquiries



Thank You