

**TECH OFFER**

## Concrete Armour for Coastal Protection Structures



### KEY INFORMATION

TECHNOLOGY CATEGORY:

Sustainability - Low Carbon Economy

Materials - Composites

TECHNOLOGY READINESS LEVEL (TRL): **TRL5**

COUNTRY: **MALAYSIA**

ID NUMBER: **TO175464**

### OVERVIEW

Coastal regions are increasingly vulnerable to shoreline erosion and infrastructure damage caused by rising sea levels, stronger waves, and frequent storm surges. Conventional concrete breakwater designs often struggle under such harsh marine conditions due to inadequate interlocking, limited adaptability to diverse coastal profiles, and high maintenance demands.

This technology introduces geopolymer-based, geometrically optimized concrete armour units designed to enhance the stability, durability, and sustainability of coastal protection structures. By using fly ash-based geopolymer concrete, the technology not only reduces carbon emissions but also delivers superior interlocking performance and long-term resilience against dynamic wave forces, making it a sustainable solution for modern coastal defense.

The technology owner is seeking R&D collaborations with coastal engineering firms, infrastructure developers, and government agencies to co-develop, testbed, and commercialise this geopolymer-based armour unit technology, accelerating its deployment in sustainable coastal protection projects

## TECHNOLOGY FEATURES & SPECIFICATIONS

The technology consists of geopolymer-based concrete armour units enhanced with fly ash to deliver superior stability, durability, and environmental performance for coastal protection applications.

Key features include:

- Optimised geometric variants: three types of armour units are designed to perform effectively under varying wave conditions and structural requirements
- Modular and scalable design: compatible with multiple breakwater geometries and easily adaptable to different coastal profiles
- Sustainable material composition: incorporates fly ash as a binder, reducing carbon emissions and reliance on traditional cement
- High structural strength: engineered to withstand flexural and shear stresses from dynamic wave action, ensuring long-term resilience
- Enhanced interlocking mechanism: geometry improves inter-unit stability and minimizes displacement under turbulent sea conditions

## POTENTIAL APPLICATIONS

- Coastal and harbour breakwater systems
- Shoreline and beach erosion mitigation projects
- Infrastructure in climate-vulnerable coastal zones
- Island and offshore structure protection
- Military or industrial marine infrastructure
- Oil & Gas Sector:
  - Protection of offshore platforms, subsea pipelines, and LNG terminals from strong wave action
  - Structural reinforcement for shore-based oil depots and jetty terminals
  - Erosion and scour protection for underwater structures and coastal facilities

## UNIQUE VALUE PROPOSITION

- Sustainable material use: incorporates fly ash-based geopolymer concrete, lowering carbon footprint
- Versatile geometry: adaptable to various wave conditions and structural configurations
- Durability and stability: superior resistance against wave loads reduces long-term maintenance