Factsheets

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Annex A: Factsheet on BETA Catalyst Funding – Phase 2

Background

1 The BE sector is a key pillar of Singapore's economy, accounting for 10% of Singapore's GDP and 30% of total employment. Research & Innovation (R&I) is one of the key strategies to support the BE sector's transformation. A large proportion of R&I efforts in the BE sector are still driven by the public sector, while private sector R&I investments remain low.

2 The Built Environment Technology Alliance (BETA) programme is a long-term effort to foster industry R&I investments, build local capabilities and translate R&I outcomes for commercialisation and export. Phase 1 of the programme was launched in 2020. The BETA Programme Office (PO) in BCA also works closely with firms to identify and scope R&I projects, as well as connect firms with solution providers and RIE entities.

3 Projects supported under Phase 1 of the BETA Programme are led by progressive, needle-moving BE firms such as Woh Hup (Private) Limited and Pan-United Corporation Ltd, that demonstrated commitment to channel resources to pursue promising technological advancements in key construction domains such as deep foundation and sub-structural works, as well as ready-mix concrete.

About BETA Phase 2 Catalyst Funding

4 Under BETA Phase 2 (from FY2022 to FY2025), $20 million of BETA Catalyst Funding is available to support progressive and committed BE alliances' long-term R&I aspirations.

5 While conventional research programmes typically support public research performers in collaboration with firms on a project-based relationship, BETA Phase 2 seeks to build up competitive capabilities for entire value-chains of key progressive BE firms, via collaborative R&I over a sustained period.

6 Each research project should be anchored by a progressive, leading industry firm who involves their value-chain partners and works with public research performers from Institutes of Higher Learning (IHLs) or Research Institutes (RIs). By coming together as a BE alliance, firms can tap each other's strengths, pool resources together, tighten collaboration, and undertake more ambitious and complex R&I projects – thereby enabling the collective levelling up of key players and their value-chains.

7 With the goal of developing new, cross-cutting competitive capabilities for BE alliances, BETA projects must be aligned with the firms' strategic business priorities and demonstrate strong commercialisation potential, and be ready for market adoption and deployment within a short time frame (no more than three years project duration).

8 The BETA PO will continue to work closely with firms, take an end-to-end "hands on" approach to facilitate alliance-led R&I projects and leverage networks to help firms navigate the research, innovation and enterprise ecosystem.

Annex B: List of Projects Awarded under BETA Phase 1

S/N	Industry	Project Title
1.1	Woh Hup, SEN Singapore	Sub-project 1: Innovative Earth Retaining & Stabilising Structures (ERSS): Post-tensioned Waler System
1.2	Woh Hup, TTJ Design & Engineering	Sub-project 2: High Performance Plunge-in King Post for Top-Down Building Construction
1.3	Woh Hup, NatSteel	Sub-project 3: Economic Corrosion-resistant Concrete for Deep Foundation Elements with B600 Rebar
2	Pan-United Concrete	Artificial Intelligence for Mixing (AiM)

Annex C: Factsheet on Construction Technology Innovation Laboratory (CTIL) Project "Innovative Construction Technologies for Deep Foundation and Excavation"

Background

1 The Construction Technology Innovation Laboratory (CTIL) focuses on applied research for emerging and innovative technologies for building structure and sub-structures. Woh Hup has committed $2 million to set up CTIL and support its overall operations and projects over five years. To further the progress, BCA is happy to support projects undertaken by the CTIL through the Built Environment Technology Alliance (BETA) Catalyst Funding, that in turn is supported by National Research Foundation (NRF).

About the Project

2 The project "Innovative Construction Technologies for Deep Foundation and Excavation" seeks to develop an ensemble of underground construction technologies. Due to the complexity of deep foundation and excavation works, a single innovation is unlikely to improve its overall productivity. The project thus combines research in inter-related areas to bring about a systems-level productivity improvement across three sub-projects that features one industry collaborator working on each.

Sub-Project 1: Innovative Earth Retaining & Stabilising Structures (ERSS): Post-tensioned Waler System Industry Collaborator: SEN SG Pte Ltd
Conventional braced excavation systems require a complex system of structural support elements, including sheet piles[1], walers and struts[2].

[1] Sheet piles are sections of sheet materials with interlocking edges that are driven into the ground along the perimeter of the planned excavation to form permanent or temporary walls, used for excavation support and soil retention.

[2] Waler and struts are used to assemble a steel strutting system found in temporary works for excavation.

The sub-project's earth-retaining and stabilising structure (ERSS) makes use of an innovative configuration to reduce the need for intermediate supporting structures, thus increasing working space and resulting in improved site productivity. The project is expected to result in 25-30% cost savings in civil and structure works, due to improvements in excavation productivity with more open space created on the project site. Building on proprietary technology developed in South Korea, the project will also customise the ERSS to suit local conditions, with enhanced safety and built-in redundancy.
<u>Sub-Project 2: High Performance Plunge-in King Post for Top-Down Building Construction</u> Industry Collaborator: TTJ Design & Engineering Pte Ltd
King posts[3] are commonly installed to support the ground floor of building development so that superstructure and subterranean works can proceed concurrently, but existing processes to install king posts are labor-intensive, subject to manual techniques and costly errors. This sub-project will develop high performance steel (HPS) king posts that are up to 57% lighter than conventional king posts, and proposes solutions to automate the manufacture of HPS king posts. The reduction in weight and time-savings during the manufacturing process is expected to result in 10-12% cost-savings from fabrication to installation. A cost-effective and simple to use smart positioning system will also be developed to guide the installation of king posts. This is expected to reduce installation time by approximately 20 days and save up to 1000 man hours for a mid-sized project using 100 king posts.

[3] King posts are central vertical posts that supports a beam below from an arch or truss structure above. They are installed in pile shafts before excavation and support and brace the floors being built.

Sub-Project 3: Economic Corrosion-Resistant Concrete for Deep Foundation Elements with B600 Rebar Industry Collaborator: NatSteel Holdings Pte Ltd
Concrete structures typically feature rebars[4] as a reinforcement, which increase the tensile strength of the structure. The use of Grade 600[5] rebars is gaining interest, as its higher strength can reduce the number of rebars used. However, Grade 600 reinforced concrete needs to overcome serviceability and durability regulations before being widely adopted by the industry. Through investigating various additive proportions, this sub-project aims to develop an optimal and cost-effective novel concrete that is crack and corrosion resistant, enabling the use of Grade 600 reinforced concrete. The sub-project will also simulate the design performance of the concrete under different underground conditions, for use in deep foundation works. If Grade 600 reinforced concrete is successful, this could result in up to 20% reduction in steel tonnage, leading to a 15-20% improvement in construction productivity.

[4] Rebars are steel rods, typically incorporated to reinforce concrete.

[5] Grading system used to classify various steels by their composition and physical properties.