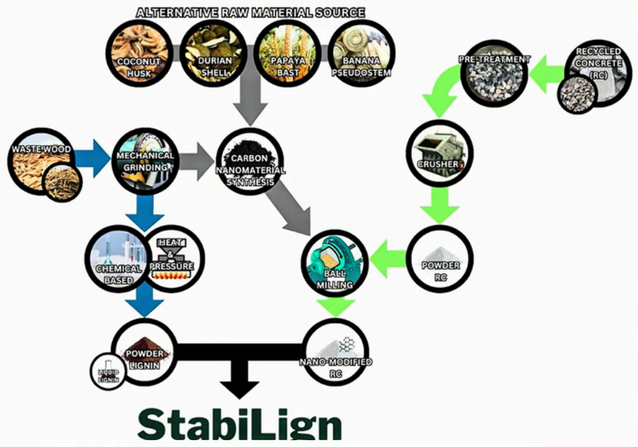
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

StabiLign: Sustainable Lignin-Based Soil Stabilizer Technology from Waste Wood and Recycled Concrete for Pavements

StabiLign is a research-driven innovation focused on developing a sustainable soil stabilizer made from lignin extracted from coconut wood sawdust and recycled concrete aggregates (RCA). The project aims to enhance the mechanical properties and long-term durability of pavement subgrades while promoting circular economy principles in road construction.

Specifically, it seeks to: (1) characterize lignin and carbon nanomaterials from wood and agricultural waste; (2) synthesize and test a nano- modified RCA and lignin-based stabilizer; (3) optimize its composition for moisture control and strength; (4) evaluate its durability under environmental stress; and (5) develop application guidelines for practical use.



In its first year, the StabiLign project focused on the synthesis and characterization of key components for a sustainable soil stabilizer: sodium lignosulfonate (SLS) extracted from coconut wood sawdust and recycled concrete aggregates (RCA) processed through mechanical ball milling. The extracted lignin was characterized using FTIR and TGA, confirming its chemical structure and thermal properties for further application. RCA was milled to fine powder form, preparing it for future integration into a composite stabilizer blend.

Geotechnical characterization was completed at three candidate sites in Kidapawan City in collaboration with DPWH Region XI. Based on initial CBR test results, Site 3 was selected as the pilot location, having the weakest soil strength with a CBR value of 6.7%, along with a low maximum dry density of 7.6 kN/m^3 and high optimum moisture content of 37.5%.

Preliminary pH tests showed that 0.5% lignin increased soil alkalinity after 24 hours of curing, suggesting promising chemical reactivity with local expansive soils. These outcomes lay a strong foundation for the next project phase, which will include component blending and mechanical strength testing for site 3.

With the successful completion of component synthesis and site characterization, the StabiLign project is now entering its optimization and performance testing phase. The following steps will involve the blending of sodium lignosulfonate and nano-RCA with locally sourced expansive soil from Site 3 in Kidapawan City, followed bya comprehensive set of geotechnical tests, including California Bearing Ratio (CBR),

Unconfined Compressive Strength (UCS), and Triaxial Shear Testing under various curing durations. These tests aim to evaluate the stabilizer'seffectiveness in enhancing soil strength, structural integrity, and deformation behavior under realistic stress conditions. StabiLign remains committed to advancing sustainable, waste-based infrastructure solutions for climateresilient development