

Collaborative Solution for Breakwater Stability Assessment: Teledyne's SeaBat T51 and SEABIM[®] Software



Product: Teledyne RESON
SeaBat T51 Multibeam and
SEABIM® Software

Application: Breakwater
Stability Assessment

Location: ACCROPODES
Breakwater, France

Introduction

Breakwaters play a critical role in protecting coastal structures and ensuring the safety of ports and harbors. Ensuring their stability is paramount, as any failure can lead to costly repairs, operational disruptions, and potential hazards. Correct block placement is a fundamental aspect of breakwater stability, governed by various factors such as contact, orientation, and density. Teledyne's SeaBat T51 and SEABIM® software have joined forces to offer a comprehensive solution in pursuit of accurate and efficient block placement analysis.

The Problem

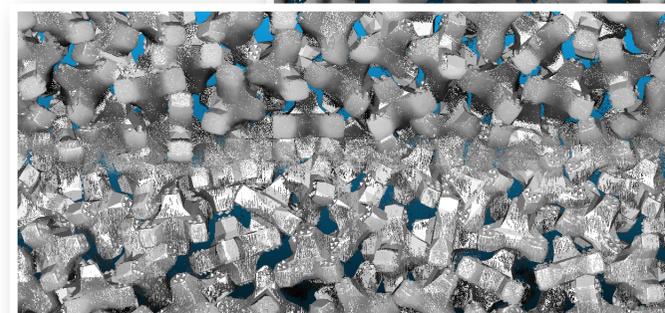
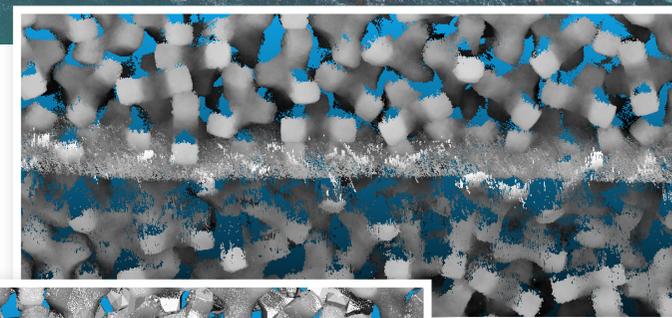
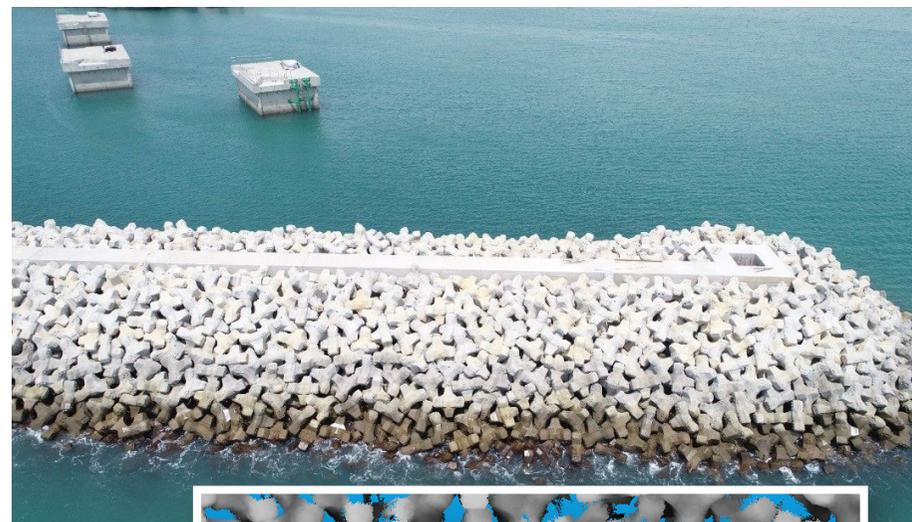
The primary challenge lies in precisely placing concrete blocks within the breakwater. Incorrect placement can compromise stability, leading to block movement, interlocking issues, and structural damage. Traditionally, diver-assisted surveys have been used for analysis, but these pose risks to human safety, lack reliability, and may not provide the necessary parameters for accurate assessments. Furthermore, identifying incorrect placement early in construction is crucial to prevent expensive rework.



The Teledyne RESON
SeaBat T51 Multibeam

Why SeaBat?

Data quality is paramount for accurate block placement analysis. Teledyne's SeaBat T51 is preferred because it provides high-resolution and clean data. The SeaBat T51 stands out with its finest beam widths across the swath, ensuring superior data quality. High-quality data is critical, giving the sharpest point cloud upon which SEABIM's® analysis is based.



Top: The ACCROPODES
Breakwater.

Middle: T51 multibeam survey
underwater and LiDAR survey
above water.

Bottom: Full 3D model
generated from the point cloud.

“After almost fifteen years of experience in monitoring maritime works and six years of port infrastructure surveys as the lead surveyor for the Occitanie region in the South of France, it’s a real pleasure to be able to monitor our structures with the Seabat T51. Its resolution, number of beams, large swath width, and quality of detection, even at the waterline, help us to greatly improve our survey time, analysis, and reliability.”

– Emilie Crasset
Hydrographic Surveyor Lead,
Sète and Port-La-Nouvelle
Harbours

The SEABIM® Solution

SEABIM® is a patented Scan-to-BIM process developed by ID OCEAN, explicitly designed for breakwater analysis. It allows for creating 3D digital twins of the breakwater’s external layer of precast concrete elements. This digital twin offers a fast, detailed, and optimal analysis of the breakwater’s condition during and after construction.

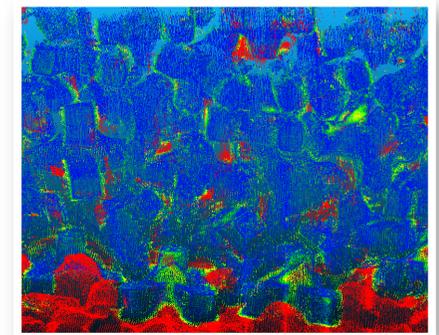
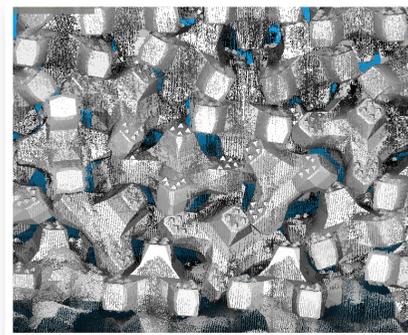
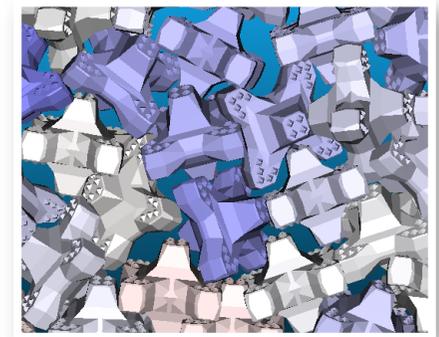
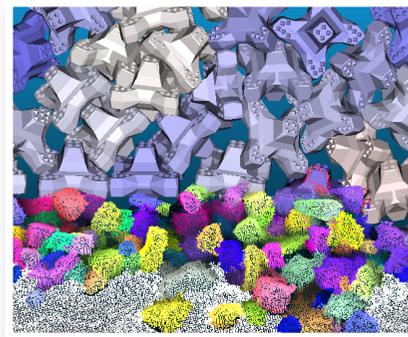
The SEABIM® Process:

- **Data Collection:** On-site measurements include multibeam bathymetry underwater, LiDAR, or UAV photogrammetry above water. This comprehensive data collection process generates a high-density point cloud.
- **Block Recognition:** SEABIM® matches the point cloud data with its database’s known Concrete Armour Units (CAUs) shapes. This recognition process includes CAUs such as ACCROPODE™ I and II, Xbloc®, Core-Loc™, Cubipod, Antifer block, and Tetrapod.
- **3D Digital Twin Creation:** SEABIM® quickly constructs a 3D model of the entire concrete armor using shape recognition, computer vision-based algorithms, and AI. This model precisely represents the position and orientation of each concrete block.
- **Condition Assessment:** The software enables the detection of broken blocks and the evaluation of the quality of interlocking between blocks. Comparing 3D models from different timeframes allows block movement quantification over time.

Benefits of the Collaboration

Teledyne’s SeaBat T51 and SEABIM® software offer a holistic solution for breakwater stability assessment. By leveraging the high-resolution data provided by the SeaBat T51, SEABIM® ensures accurate and detailed analysis of block placement, interlocking quality, and block condition. This synergy enables preventive maintenance operations to be planned efficiently, reduces the risk of structural failures, and minimizes costly rework during construction.

In conclusion, the partnership between Teledyne’s SeaBat T51 and SEABIM® software represents a cutting-edge approach to addressing the challenges of breakwater stability assessment. This collaborative solution sets a new standard for accuracy, efficiency, and safety in coastal structure management. It reinforces the importance of technological innovation in marine engineering and construction.



Clockwise from top left: Breakwater 3D model and natural rocks automatic segmentation; Breakwater 3D model with density filter grading; 3D model and T51 point cloud; Differential point cloud between the 3D model and the T51 dataset (blue is less than 2 cm difference).