

Reframing Ports with Ecological Concrete

Lukas Ley

Drawing on ongoing ethnographic research in European port cities, this article demonstrates how the use of sustainable concrete taps the liveliness of shore ecologies to stage alternative futures of capitalism. I focus on Living Ports, a pilot project carried out in the city of Vigo (Spain), which aims at reducing the negative impact of concrete on the marine environment. Combining photographs obtained from scientists studying the durability of modified concrete with data from participant observation, I describe the labour of humans and nonhumans that goes into producing a type of “bioinfrastructure,” a vibrant set of lithic materials and organisms that responds to and becomes vital in maintaining economic growth (Acosta and Ley 2023: 3). The case of Living Ports deserves attention because it shows how port operators can respond to growing concerns about the sustainability of port infrastructures. Changing concrete to factor in the wellbeing of wildlife reframes port infrastructure technologically and culturally. The project, however, may turn nature into a mere spectacle in order to justify continuous economic growth. In that case, it could end up tightening ports’ grip on the productivity of marine ecologies.

Concrete and Seaports

Until the 1830s, most ports used mined rock for the construction of docks and seawalls. As Bartolotti (2020) points out, successful experiments with precast concrete blocks by Victor Poirel marked a major turn in maritime construction and hydraulic infrastructure. Concrete offered many advantages to port developers: “the blocks’ massive heft resisted powerful waves and their rectangular shape allowed engineers to stack vertical walls rather than simply piling stone on the sea floor” (Lee 2019: 57). By the end of the nineteenth century, concrete framed harbours in many European cities and their colonies. Today, making concrete for use in ports requires Portland cement, aggregate and water. Sometimes, supplementary cementitious materials to reduce the carbon footprint of concrete are employed. Studies demonstrate that conventional concrete deterioration can leach harmful pollutants into the hydrological cycle (Esterhuizen et al. 2022) and marine environments. Deterioration caused by corrosion further means regular expenses for infrastructural repair or replacement. The lifecycle of concrete is thus an incentive for port authorities to consider alternative ways of constructing at the sea’s edge.

The port of Vigo is a major European base for fishing companies and one of Spain’s leading sites for shipbuilding. It processes dry and liquid bulk as well as containers and cargo, such as fish or granite. Its quays reach a total length of 11 kilometres. While some quays were built with granite, which is far more sustainable than concrete, the engineering required to construct with this material is now judged too expensive by

Algae growing on a concrete panel.
Photo: Siff Nejst Lørup, 2023.



the port authority. The Living Ports project proposes to improve the sustainability of port infrastructure by using a type of concrete that requires less maintenance and which bolsters biodiversity. To do so, this collaborative project, led by Israeli company EONcrete and funded by an EU Horizon 2020 programme, proposes using concrete designed to attract microscopic plants and crustaceans. EONcrete calls this concrete “ecologically active” due to its ability to recruit marine species (Perkol-Finkel and Sella 2014: 9). What provides the conditions for biological proliferation is the material’s “bio-enhanced” coating (ibid.), which is conducive to the growth of marine flora and fauna.

Permeable Ports

Living Ports is currently testing and monitoring this ecologically active concrete at two sites in the port of Vigo – in Portocultura and Bouzas. In March 2024, I spent time with project members in Portocultura while they were in town to carry out the extraction of concrete samples for lab analysis. I also interviewed employees of the Port Authority. My focus was the Nautilus, a public underwater observatory open on weekends and wheelchair-accessible from a floating dock. When starting their tour, visitors to the Nautilus are lead towards an informational plaque that depicts three concrete control panels before they were installed on the seawall in early 2022. The first image shows a conventional concrete finish; it displays a flat surface representing ‘traditional’ concrete.



‘Traditional’ concrete.
Photo: Maria Moltesen,
2023.

The second panel – named “Azuri” – looks like a maze. Multiple irregular, rectilinear elevations create recesses of varying depth. All shapes are angular and have sharp corners. In addition, the surface presents holes and crevices.



“Azuri” structure designed by EConcrete.
Photo: Maria Moltesen, 2023.

The third panel, finally, exhibits more fluid forms and resembles the cell structure of an organism. Linearity and recurrence have been replaced by sinuosity and structural uniqueness. This pattern adumbrates a natural habitat, which is probably why it is called “mangrove.”



“Mangrove” structure designed by EConcrete.
Photo: Maria Moltesen, 2023.

While showcasing the control panels serves to elucidate the structural differences possible in precast concrete, boarding the Nautilus allows visitors to witness its varying

ecological impacts. When I visited the Nautilus, which was launched in early 2023 and had already attracted more than 30,000 visitors, people often watched the underwater world in complete awe.¹ Coming face-to-face with organic growth on submerged parts of the seawall – mainly algae, barnacles and blue mussels – they were able to see firsthand the life-giving effects of concrete. Two guides hired by a subcontracted company narrate the story of the project and offer biological explanations. Both were outspoken fans of the project, as it revealed an “amazing product” and allowed them to “learn about” the marine environment.

¹ Source: <https://atlantic-maritime-strategy.ec.europa.eu/en/news/atlantic-project-awards-celebrating-winners-2023>

The Nautilus brings the port into view as an environment that is co-inhabited by nonhuman others – crabs, fish and bivalves. Concrete, here, is not just a protective boundary, but a lively membrane. This pulsing and breathing layer provides shelter, nutrition and even evolves with the seasons, reflecting periodic shifts in sunlight exposure and the nutrient saturation of seawater. I noticed how ecological concrete captures the human imagination in interesting ways: perhaps like a shell, it appears as “inhabited stone” (Bachelard 2009 [1958]: 115), a natural artifice that retains and fosters life.



Sand smelt (Atherina sp.), a shoaling fish roaming the Mangrove seawall in front of the Portocultural office complex in Vigo. Photo: Maria Moltesen, 2023.

Concrete Futures

To assure potential clients of the corrosion-resilient nature of this new type of concrete, sample tiles are extracted and shipped to Denmark for analysis after exposure periods of six months and twelve months. In Copenhagen, PhD researcher Siff Lørup monitors changes in mineralogy by, for instance, measuring levels of chloride. She is also interested in the mechanical aspects of biological enhancement, such as changes in the hardness of concrete after seawater exposure and successive biological colonization. Is there an increase of carbonation? How is the structural integrity of the material affected by organic growth? For Lørup, concrete can still be optimized in many ways.

An improved concrete formula not only promises a livelier port environment but sets the stage for new social relations. As Living Ports put it recently, port infrastructure should eventually become “a meeting point where the relationship between the port and the city is strengthened.”² Improving this relationship depends on making the whole port more permeable, as Port Authority employee Elisa Rumero informed me. Building on Living Ports, it wants to create further spaces where residents can experience the harbour and its relation with larger ecosystems, such as the estuary and the Atlantic. Indeed, the success of the Nautilus underlines the enormous potential of such educational campaigns. Yet, as project funds are running out, the future of ecological concrete in Vigo remains highly uncertain. After exhausting days of extracting the submerged tiles, the Living Ports team of biologists, engineering scientists and project managers often enjoyed a relaxing dinner in the lively streets of Vigo. Conversations among them often revolved around the fate of the Nautilus. While some believed that the city would continue running the observatory, others were less optimistic and expected it to be discontinued. After all, regular maintenance of the Nautilus, such as cleaning the windows of algae, and staff salaries meant expenses for a public institution that it could not easily justify. Without further EU funding, continuation of the project is currently not in the cards. Ecological concrete is therefore currently just a fancy innovation to captivate audiences and perhaps assuage concerns about the damaging operations of the port. The project is far from effecting a lasting change to the imagination of what ports ought to be. It remains to be seen whether ecological concrete can scale its formula to compete with conventional products.

² See EConcrete's response to being shortlisted for the ESPO award:

<https://www.espo.be/news/espo-award-2023-let-us-present-th>



Industrial diver being assisted in cleaning the algae-stained window of the Nautilus.

Photo: Lukas Ley, 2024.

Epilogue

As this article shows, marine biologists and scientists are attempting to use concrete to undo ports' destructive relationship with the ocean. Changing the chemical composition and structure of concrete can turn a noxious material into a viable habitat. Choosing an organic aesthetics over flat surfaces may convert hitherto inhospitable seawalls into shelters for lifeforms under duress. Based on these findings, I suggest viewing concrete as an experimental technology that acknowledges different ways of inhabiting nearshore ecologies and enrolls nonhuman port-users in cementitious formation. Not just minerals, but also plants, molluscs, crustaceans and other organisms get drawn into this infrastructure and participate in "cementitious earthwork" (Elinoff 2019). This framing of concrete, the second most-used substance in the world after water, allows port infrastructure to align with discourses of sustainable growth.

On a conceptual level, I believe that the example of ecological concrete is apposite to humanities' "focus on the active materials that compose the lifeworld" (Ingold 2012: 429). The Nautilus makes tangible the complicity between geos and bios and the complicated, social nature of the oceanic lithosphere. Concrete, here, must be seen as a central component of urban political ecologies, one that anchors human and nonhuman lifeforms in time and space and assigns them specific values. Over recent decades, ports have been rather avoided by coastal residents and shunned as toxic environments by activists. Port authorities are now searching for strategies to curb the negative impact (and image) of ports. Reframing ports with ecological concrete affords a chance to stage encounters with an inhabited sea. As a bioinfrastructure, this concrete represents not just strength and durability. It also allows us to glimpse the roles that nonhuman others and cementitious materials will (be made to) play in making futures of capitalism possible.

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