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Concrete

Edited by: **Max D. Woodworth** and **Cecilia L. Chu**

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Concrete:
An Introduction

Max D. Woodworth and Cecilia L. Chu

As a journal dedicated to the critical study of infrastructure, *Roadsides* consistently interrogates the mediums by which humans attempt to shape their environments and manage the connections between and among human and nonhuman systems. Understanding infrastructure in this broad sense, we are compelled to reckon with concrete, the second-most widely used substance in the world by volume, surpassed only by water. On a molecular level, concrete is created through a chemical reaction triggered by water, which binds its constituent components – cement and aggregate – into a solid material of varied, but generally extremely high levels of compressive strength and durability. While it can be adapted to diverse specifications and needs, the making of any concrete structure necessitates the contribution of labor, capital, processed and raw materials, energy and planning (Harkness, Simonetti and Winter 2015; Choplin 2023). Implicit in this understanding is that the chemical genesis of concrete represents merely one moment within the extensive geographies and temporalities associated with this material. Looking backward and forward from concrete's chemical transformation, we can discern a vast network of connections and implications.

Though it has been used for millennia, concrete gained prominence as a modern material thanks to its extensive application in the construction industry over the twentieth century (Forty 2012; Oleson et. al. 2014). As a substance that offers ideational promises of modernity, development and nation-building, concrete has long been deployed by state authorities and industrialists, who highlight its potential to improve quality of life and to transform societies. At the same time, its widespread informal use by self-builders in poor regions around the world adds another facet to its association with the 'modern'. The geographical scope of concrete usage has also grown immensely over time, replacing other local building materials as it becomes favored in new places. In a most basic sense, then, the widespread adoption of concrete is tied to the creation of a more flexible (read: cheaper) labor force than the specialized craftsman-led trades that dominated construction in earlier times. As a result, the growing use of concrete is inextricable from the expansion of cities, industry and what more broadly gets referred to as 'modern development' in its various guises (Gandy 2003; Campanella 2008). We can scarcely imagine the contemporary built environment without concrete.

Recent scholarship has challenged longstanding explanations that attribute the emergence of new building materials to the march of progress. Adrian Forty's (2012) examination of the cultural histories of concrete, for example, sheds light on the diverse usages and interpretations of the material in different spaces and times. While concrete has been a symbol of modernization under capitalist and socialist regimes and has featured prominently in the construction of iconic modern architecture and infrastructures, it is also intertwined with the failures of certain political projects and the consequences that emerge therefrom (Pétursdóttir 2013; Arboleda 2017; González-Ruibal 2017; Bennett 2021; Littlejohn 2021).

Ethnographic studies of concrete in different settings capture how such a mundane material in infrastructural construction achieves a significance that stretches from the everyday to the geopolitical (Abourahme 2014; Elinoff 2017, 2019; Zeeve 2019; Choplin 2020; Schwenkel 2020; Menon 2022). Some of these works are informed by a burgeoning subfield known as 'new materialism', which argues that matter has a life force of its own and hence its performance does not always correspond with human intentions (Bennett 2010). The material agency of concrete and its inherently temporal nature are exemplified in Penny Harvey and Hannah Knox's (2010) study of concrete road construction and state-building in Peru. Despite its presumed association with stability, durability and strength, the concrete used there in paving roads – which naturally aimed to bolster connectivity – tended often to break up; this led not only to physical hazards but also caused significant damage to the legitimacy and public image of the governments sponsoring these projects. The decay of poorly maintained concrete structures has, in fact, been linked symbolically to various kinds of social and political erosion in contexts as diverse as Sikkim (McDuie-Ra and Chettri 2020) and Italy (Arboleda 2017). Finally, concrete figures centrally in the problem of climate change due to the enormous, embodied carbon content tied to the production of cement, its key ingredient. Attempts to deploy alternatives, such as "aircrete" (Degani 2020), may bear fruit in the coming decades; but for now, concrete remains the dominant source material of the built environment.

Ultimately, the burgeoning critical literature addressing concrete alerts us to its vitality as a complex symbolic referent and as a material medium connected to a spectrum of social and environmental processes. All of these aspects are dense with contradictions and possibilities, and all of them are tied to vast geographies, intertwined infrastructures and varied histories. Building on insights derived from the scholarship outlined above, contributions to this edited collection consider the potency of concrete and its social, technical, ecological and political entanglements in a variety of contexts. These dynamics are explored in Matthew Gandy's essay, which looks at four ways of understanding concrete through the analytical lens of urban political ecology to extend insights gleaned through concrete to a variety of scientific and cultural developments. Moving on to the discussion of concrete's ecologies, the next two contributions – by Susanne Trumpf and Aaron Bradshaw, respectively – describe the unseen encounters between concrete and other nonhuman agents, including soil and trees, to make the case that cementitious surfaces must be seen as part and parcel of the living environment and urban biosphere. The liveliness of concrete is further delineated in Lukas Ley's article, which features recent experiments with 'ecological concrete' that enhances marine habitats, allowing the construction of port infrastructures to align with discourses of sustainable development.

Concrete sub-dam, Plover Cove Reservoir, Hong Kong.
Photo: Natalia Echeverri, 2020.

Although concrete is a prominent feature in numerous state-led modernization and infrastructural development programs, its usage has been adapted by local communities on their own terms. In his study of the soil-cement brick technology used in workers' housing in Taiwan and supported by overseas development assistance from the United States, Yu-Han Huang illustrates how the program's eventual failure was inseparable from the materiality and normative assumptions of what is modern amongst targeted beneficiaries. Turning to the context of northern Vietnam, Jean Michaud and Sarah

Turner detail how concrete has been selectively adopted by Hmong households in order to maintain cultural conventions amidst ongoing state efforts to modernize rural areas. The conflicts between different agencies in shaping concrete infrastructure are explored in Natalia Echeverri's photo-essay, which documents the remaking of the lush valleys of Hong Kong's Lantau Island through a set of stunning images, revealing the formal and informal interventions in the landscape that continue to transform their concrete constructions at different scales.

The next three contributions reflect on the political and social roles of concrete in shaping the production of urban space and economies. In his study of the Lafarge cement plant in Casablanca, Daniel Williford traces how concrete in Morocco followed a trajectory from an instrument of colonial rule to a central node within postcolonial imaginaries of autonomy. In a different context, Pierre Wenzel considers how vernacular concrete construction in contemporary Senegal is heavily mediated by new social-media technologies. The malleability of concrete in such instances is harnessed by non-professional designers who collectively inscribe urban landscapes with expansive spaces of poured concrete that inter-reference images of concrete cityscapes around the world. Focusing on the Abidjan and Lagos corridor in West Africa, Armelle Choplin uncovers how concrete is seized upon locally as the material of choice across a spectrum of construction projects – to the point that a regional concrete-scape is taking form. Referring to recent building experiments that promote local knowhow and the use of alternative materials, the essay ends by contemplating the potential role of African cities in enacting more sustainable urban futures.

The final photo-essay by Eli Elinoff seeks to unsettle the boundaries between the city and the countryside and to dissolve the distance between sites of extraction, production and consumption of concrete. By deploying the conventions of pastoral landscape photography to document quarries, mines and manufacturing sites, the images serve as reminders that such places should be understood as part of distributed urban ecologies deeply connected to the urban centers they help to construct.

In examining the processes through which concrete has been used to construct different assemblages of built forms and its uneven impacts on ecologies, communities and economies, the essays here significantly expand our understanding of the sociocultural significance of concrete and its material agency in the ongoing remaking of the living environment. Perhaps most fundamentally, we have invited this collection's authors to drill down into concrete at the material level and attend to its temporality and precarity. In so doing, they reveal new, overlooked layers of connection between the gritty nature of concrete and social-ecological life.

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An Urban Political Ecology of Concrete

Matthew Gandy

Concrete is integral to the material landscapes of modernity, encompassing roads, tunnels, reservoirs, airports, bridges, tower blocks and almost every other type of physical structure that we might associate with urbanization. Around 80 percent of the "average city" is built from concrete (Dunford 2020). Some 30 billion tonnes of concrete are used every year for construction purposes, with cement manufacturing now responsible for as much as 8 percent of global carbon dioxide emissions.[1] As the architectural theorist Adrian Forty (2012: 11) notes, however, the materiality of concrete has consistently spilled over into other registers of meaning, so that a "cursory inspection of even the most debased lump of concrete rapidly takes us into a fugacious world of beliefs and counter-beliefs, hopes and fears, longings and loathings."

[1] See, for example, Editorial (2021) in *Nature*.

In this essay, I consider how useful the analytical lens of urban political ecology might be in taking us on a critical itinerary through the world of concrete. In broad terms, the urban political ecology literature is concerned with the production of space as a historically contested field of developments, driven in large part by the circulatory dynamics of capital and its intersection with a series of structural inequalities spanning class, gender, race and caste.[2] In comparison with water, though, concrete has received comparatively little attention within the political ecology literature. More often we encounter a metaphorical rendering of concrete through reference to "concrete practices" (Escobar 1996: 341), "concrete solutions" (Radonic and Kelly-Richards 2015: 403), "concrete utopias" (Gómez-Baggethun 2020: 6), or in philosophical terms "a concrete understanding of class and nature" (Ekers 2015: 546). In other contributions the physicality of concrete has been approached, sometimes obliquely, through studies of sand, gravel and other materials, often allied with the analysis of mining, extractive frontiers and wider geopolitical concerns with resource extraction (Myers 1999; Dawson 2021; Lamb and Fung 2022; Miller 2022). Yet as we move closer to the lived experience of urban space, the analytical lens of urban political ecology becomes less certain. The everyday realm of concrete, with its interweaving of cultural, material and affective elements, becomes increasingly elusive as an object of study.

[2] I have suggested elsewhere that the fields of political ecology and urban political ecology are closely related yet not synonymous (Gandy 2022).

Minhocão elevated highway, São Paulo. Entrance from Consolação Avenue.
Photo: Laura Belik, 2016.

Concrete clearly forms part of the political economy of urbanization as a distinctive element in the "secondary circuit of capital" and the speculative dynamics behind the production of urban space (Harvey 1985: 7). The theorization of capital à la Harvey can be supplemented by post-positivist empirical insights such as forensic accountancy. A forensic approach to the study of infrastructure opens up new possibilities for the production of counter-hegemonic knowledge. As the investigative journalist Jonathan Watts (2019) points out, the construction industry is characterized by a scale of bribery

and corruption that dwarfs every other sector, including mining, energy, real estate and the arms industry. Watts highlights the example of the 3.5km-long elevated expressway known as the Minhocão (Portuguese for 'big worm') in São Paulo.[3] Completed under the military dictatorship in 1971, and masterminded by disgraced former mayor Paulo Maluf, this expressway was the largest reinforced concrete project in Latin America, and involved kickbacks on a vast scale that have been traced to a variety of offshore bank accounts in the British Virgin Islands and elsewhere. More recently, public perspectives on this moribund structure have become divided between its complete removal or transformation into a linear park (Belik 2020). Indeed, the conversion of former infrastructure networks into new kinds of public space is now an integral element in landscape design discourse (Acosta 2023).

[3] See also Eli Elinoff's (2017) study of concrete structures in Bangkok.

Concrete as microbiome. The darker patches contain cyanobacteria. Bedford Way, London. Photo: Matthew Gandy, 2021.

Turning to the ecology of concrete itself, the material offers a series of distinct surfaces that form part of the urban biosphere. The formation of microbiomes, for example, constitutes part of the largely unseen or unnoticed dimensions to urban ecology. The presence of algae, bacteria, fungi and other organisms is often only betrayed by blotches, streaks or other visual clues (Gandy 2024). These organisms can also act as sensors for ambient parameters such as levels of air pollution, moisture or temperature gradients. The study of lichens, in particular, connects with the longstanding fascination with the flora of walls, ruins and other kinds of artificial substrates. The presence of microbiomes illustrates a blindspot within the existing urban political ecology literature: namely, a lack of engagement with recent developments in the science of urban ecology, including the significance of epigenetics, the intensified evolutionary dynamics of urban space, and methodological advances in fields such as DNA barcoding. Indeed, attempts to develop an analytical framework that spans the social and biophysical sciences remain much more frequent within the dominant systems-based approaches to urban ecology, despite the limitations of existing models of epistemological unity.

Urban political ecology has a potentially distinct role to play in highlighting the need for more nuanced conceptions of the interface between human and nonhuman forms of agency. Concrete itself can be regarded as a component of "accelerator landscapes" within which the epigenetic and evolutionary dynamics of urban space have been accentuated (Gandy 2023: 3).

Concrete channel section of the Los Angeles River at Glendale Narrows. Photo: Matthew Gandy, 2013.

Concrete represents a decisive contribution to the surface topographies of urban space, making cities warmer than their hinterlands and rendering them more susceptible to flooding. The predominance of concrete in poorer neighbourhoods, often characterized by fewer trees and parks, exacerbates thermal inequities across urban space (Mojaherani et al. 2017; Marks and Connell 2023). The capacity of concrete to retain water also has significant epidemiological implications in terms of providing ideal breeding grounds for insect-vectors for disease, and especially the dangerous *Aedes* genus of mosquitoes that has substituted tree-hole ecologies for the diverse micro-niches available in urban environments. The capacity of concrete to accentuate existing sources of epidemiological risk is often greater in low-income neighbourhoods where poor-quality housing and inadequate infrastructure systems can foster perfect conditions for the rapid spread of dengue, Zika and other health threats. The absence of reliable water supply necessitates the use of multiple means of temporary water storage, whilst lack of drainage infrastructure can allow the proliferation of standing water (Acevedo-Guerrero 2022). Concrete is thus intricately related to the socioecological hybridity of urban space, corporeal vulnerabilities and epidemiological forms of slow violence.

When we consider modes of cultural representation in cinema, literature and other media we can discern the presence of a 'concrete imaginary' evolving in parallel with a variety of ecological imaginaries. Both utopian and dystopian modes of representation can be delineated, in some cases for the same structures. The exuberant Autopia described by architectural critic Reyner Banham (1971) in response to his experience of the Los Angeles freeway system in early 1970s can be contrasted with the eerie disorientations of the David Lynch movie *Mulholland Drive* (2001). Similarly, the concretized channel of the Los Angeles River has served as both a lived space of resistance for working-class Latino communities, as captured in the poetry of Luis J. Rodríguez, as well as a locale for postwar nuclear anxieties such as the threat of giant ants in *Them!* (1954) directed by Gordon Douglas. More recently, these quotidian concrete landscapes have become a focus of contestation between competing ecological imaginaries under the speculative dynamics of capitalist urbanization. The introduction of new kinds of ecological approaches to flood control, for instance, has been accompanied by wider interest in the revalorization of riverside settings (Gandy 2014).

The abandonment of concrete structures forms part of a distinctive scenography of urban ruins, invoking a science fiction ambience with plants sprouting from empty roads or cascades of vegetation that resemble green walls or other aesthetic motifs deployed in ecological design. Concrete features widely in the near future of J.G. Ballard's fiction, for example, taking inspiration from London's then recently completed Westway in *Concrete Island* (1974), modernist housing complexes in *High-Rise* (1975), or the motif of the abandoned swimming pool in *Super-Cannes* (2000) (Gandy 2011). Concrete is also used to depict an absence of nature in dystopian future worlds such as *Blade Runner 2049* directed by Denis Villeneuve (2017), where conventional agriculture has collapsed and the industrialized rearing of insects has become a focal element of food production. Such scenarios suggest the persistence of global capital under post-apocalyptic conditions, so a key objective for urban political ecology as an idiom of cultural critique must surely be the delineation of alternative future imaginaries. In this vein, feminist science fiction literature exemplified by writers such as Octavia E. Butler and Ursula K. Le Guin, has consistently challenged the ideological perpetuation of structural inequalities that are pervasive within what we might term mainstream speculative fiction.

Concrete illustrates a series of problems and possibilities for a revivified field of urban political ecology that can extend to a wider variety of cultural and scientific developments, ranging from future ecological imaginaries to the epigenetic characteristics of urban environments. The exposed surfaces of concrete provide numerous insights into the complexities of the urban biosphere as well as meteorological and epidemiological challenges for future cities. The weathering of concrete intersects with the temporalities of capital to produce distinctive ecologies of decay and abandonment. Equally, the presence of concrete within a variety of imaginary landscapes offers a powerful motif for making and remaking urban worlds, both utopian and dystopian. Concrete has simultaneously suffused the promise of modernity and also exposed its multiple interstices and contradictions.

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The Impact of an Interface:

Exploring Concrete–Soil Entanglements

Susanne Trumpf

Introduction

In this essay about the subterranean environments of our urban landscapes, I revisit concepts of urban habitat and ecologies from the perspective of a cement interface. I advocate for a multidimensional examination of concrete and soil, considering their interrelationships and complexities to better understand the urban underground. The essay uncovers a fragile material interrelationship by questioning common practices that assess materials in isolation. This approach aligns with the premise that it is not the objects themselves but their relationships that form the foundation of a milieu (Prominski 2014).[1] To illustrate that concept, I will unpack the dynamic material relationships between concrete, soil and water. Here, concrete acts as an interface, forming the boundary between soil and water systems that are essential for urban ecological processes.

[1] Prominski (2014) uses the French geographer Augustin Berque's translation of 'milieu' referring to *fudo*, a Japanese concept integrating nature and culture.

The idea of using concrete as an interface between soil and water goes back to Roman times. In fact, the water-management strategies employed in the *pozzolane*-based roads[2] back then have not fundamentally changed: cambered road surfaces, combined with channels and ditches along the sides, are still frequently used to address runoff. Contemporary updates to these cementitious urban interfaces include drainage channels many kilometres long, underground floodwater storage and interception tunnels.[3] Such engineering solutions addressing flood control and stormwater management have long served to contain water that could not drain. However, by prioritizing technical efficiency, these single-function approaches have led to alterations in natural landscape systems that are now critiqued in light of climate change concerns. Extreme weather events, exceeding the capacity of these water-management solutions, have underscored the importance of facilitating water infiltration into the soil and spurred the development of concepts and materials that emphasize enhanced permeability of urban surfaces. Indeed, landscape architecture and urban planning discourses have long focused on addressing the effects of sealed surfaces (Margolis and Robinson 2007; Cupers and Miessen 2018), stressing the need for a more holistic and time-sensitive approach to effectively implementing nature-based concepts[4] in the urban realm (see Acosta and Ley 2023).

[2] Pozzolane, a volcanic ash material, was commonly used as a key ingredient in ancient Roman concrete. When mixing it with lime and water, a chemical reaction binds the material – similar to cement used today.
[3] Interception tunnels, typically constructed underground, divert water away from areas where it could cause flooding.
[4] Nature-based concepts embrace the integration of natural materials and processes. While concrete is commonly utilized in applications like eco-shorelines, permeable paving and as recycled aggregate, the need and scope of its use is frequently a subject of debates on material sustainability and environmental impact.

Understanding Concrete and Soil

From both cultural and scientific perspectives, perceptions of soil and concrete differ considerably. Soil is formed through processes of decay, decomposition and sedimentation, with physical components like sand, silt and clay being eroded and weathered by wind and water. In contrast, concrete is shaped into objects, surfaces and finishes, with the exothermic reaction of mixing water, sand and cement representing a process of creation. However, considering the intricate formation processes of both materials, the perceived dichotomy between soil and concrete is less distinct than it may initially seem. In urban settings where concrete and soil interact, the processes of decay and creation overlap – becoming indistinguishable. Similar to soil, concrete experiences deterioration processes, such as cracking, weathering and erosion, over time. Building upon Ingold's (2007: 7) assertion that "the surface of materiality is an illusion," I contend that cementitious interfaces must be understood as part of a living environment, encompassing an ongoing and generative process.

I walk around the densely populated streets of Mong Kok, Hong Kong, and observe one of the many excavation processes that unfold daily. A jackhammer breaks apart the patched concrete pavement, an excavator transfers the concrete rubble and soil onto a truck, and the excavated materials vanish from the urban scene as quickly as the noise of the tools once excavation is completed. The mixture of rocks, rubble and soil is transported to a fill bank located on the outskirts, where it is compacted and combined with excavated material from other construction activities around the city. Every day, approximately 36,500 tonnes of concrete and soil extracted from various locations are deposited at this site to weather, decompose and ultimately form a new soilscape. A portion of the displaced urban material is utilized for one of the city's reclamation projects, resulting in a new, likely sealed urban ground comprising a mixture of eroded concrete and soil.

[5] Public Fill Reception Facilities, also known as fill banks in Hong Kong, collect materials such as rocks, concrete, asphalt, rubble, bricks, stones and earth. These materials are collectively defined as public fill (CEDD 2019).

A streetscape in Mong Kok, Hong Kong. Drawing: Madison Appleby, 2022.

Whether the concrete particles in this mix are truly integrated as part of the soil is yet to be determined, questioning the often normative disciplinary definitions. For instance, it has been suggested that materials resistant to decay are problematic from an ecological standpoint, as they cannot be transformed into soil (Puig de la Bellacasa 2014: 29). Regardless of whether we view such residues as an integral part of soil, concrete can here no longer be considered as an urban surface but has turned into a (soil-)horizon in the terrestrial ecosystem. Given the vast timescale involved in this generative process of decay, reaching from two centuries (marked by the emergence of Portland cement) to geological time (estimated at 4.6 billion years), the chronology is complex. The multifaceted nature of urban residues has been explored under various temporal definitions, ranging from "slow humanly driven sedimentation" (Clemmensen 2022: 46) to "fast geologies" (Donald and Millar 2023). To enhance properly informed, time-based decision-making, I support the call for greater attention to abiotic processes of decay, such as erosion and sedimentation, within the landscape context (Clemmensen 2022). Adopting this approach will deepen our understanding of the critical factors that shape soil–concrete entanglements and their influence on urban-environmental processes.

Revealing Below-Ground Material Interactions

The interrelationship between concrete and soil remains even without blending the two materials. Sealed concrete surfaces not only affect urban-environmental processes above ground, but they also modify subterranean material interactions. Unlike soil, which gradually absorbs and captures heat before slowly releasing it, concrete rapidly takes in larger quantities of heat and releases it quickly. The combination of increased heat stress and diminished water infiltration into soil layers beneath concrete surfaces results in altered urban substrates that are typically drier, more compact and contain

Urban soils, redefined as construction waste and public fill, consigned to the Tseung Kwan O Area 137 Fill Bank, Hong Kong. Photo: Ceci Wong, 2021.

lower levels of organic matter. It is essential to recognize that moist soil ecosystems are vital for maintaining soil oxygen content, carbon storage and supporting greater amounts of microbial mass (Fierer 2017). Yet our understanding of the microbial world beneath our feet remains limited. Over the past century, the extensive use of concrete may have led to species adaptation or extinction, higher temperatures potentially accelerating the growth of certain fungi while retarding others, and the spread of invasive species without our knowledge (Geisen et al. 2019). These less-attended organisms represent part of a complex dynamic system interacting with and responding to anthropogenic material transformations.

The multitude of concrete interfaces in a street in Mong Kok once again serves as an apt example to illustrate the spatial complexity of such environments. From an above-ground perspective, one might easily overlook the presence of soil in one of the modestly vegetated pocket parks as it seamlessly integrates with the sealed surfaces. A handful of native shrubs, mostly Indian hawthorn, endure in the grey, lifeless, dry and hardened urban soil. In contrast, just a short distance away a seemingly contradictory phenomenon can be observed: a lush sprout of the same species thrives in a crack within the concrete pavement, appearing vibrant and resilient despite its apparently compromised habitat. In essence, the behaviour of soil systems beneath the interface does not always correspond with the observable above-ground conditions. The below-ground microbial world, for example, may be both negatively affected and positively supported by the concrete interface.

Previously considered unwanted weeds, such vegetation is now celebrated as "superheroes of ecosystem services" (Toland 2020: 137). Landscape architects and ecologists are increasingly recognizing the potential of these resilient and self-sustaining plant communities, which thrive in seemingly suboptimal habitats such as roadsides, cracks and building facades. Drawing upon this analogy, there is an opportunity to integrate the discourse on below-ground biodiversity into existing conversations about spontaneous vegetation, ultimately promoting a more comprehensive understanding of urban ecosystems.

Conclusion

The significance of landscape-centred temporal views for generating new insights into soil processes is increasingly apparent (Meulemans et al. 2017; Sieweke 2023). Landscape architecture practice and applied research have prototyped efforts that prioritize long-term material processes (Bargmann 2013; Kennen and Kirkwood 2015). While these approaches necessitate further development and monitoring, the avenues for integrating material transformations into urban practice are available and poised to enhance our understanding of the distribution, abundance and temporality of various material-related phenomena.

When assessing the urban-environmental values of concrete, it is crucial to further reframe our understanding of 'creation' by examining the dichotomy between relationship and object. We must delineate the role of concrete interfaces within this landscape approach that not only recognizes the complex and dynamic culture–nature relationships between

concrete, water and soil but also acknowledges that each facet of these relationships embodies properties that are not static. Instead, they continuously evolve and need to be reinterpreted over time and in each unique setting.

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Heaving Concrete:

Conversations Between Urban Trees and Sidewalks

Aaron Bradshaw

In Naples, Italy, a trunk penetrates the ground, its claw-like base levering the heavyset sidewalk curbstone out of alignment. In London, a tree rises from the paved earth, heaving concrete slabs upwards in a prolonged inhalation. Urban trees push, pull and tug against their concretized confinement, rendering the solid membrane of the city porous and permeable. The tree in the first image below appears to act almost purposefully, using rationally planned urban form as a fulcrum to leverage its own unruly strength. Through the profusion of their root networks, trees probe the vulnerabilities of their physical landscapes – and the social, political and technical indices of the latter's construction – and emerge as persistent coauthors of the urban topography. Paying attention to street trees and their encounters with anthropogenic surfaces raises questions about how best to live with other-than-human agents in urban environments that have classically been thought of as human spaces. The laborious passage of roots through solid surfaces acts aesthetically to draw out easily overlooked registers of the city, such as subsurface materials, flows and different scales of urban ecology. Tree–infrastructure encounters also unfold in the context of shifting imaginaries

and discourses surrounding urban nature, and foreground a series of tensions in conceptualizations of urban nature's independent agency and its role in changing climates. Bringing these aspects together might be generative for reframing how we think about concrete and its ecological registers.

In London, street trees were not systematically planted by the municipality until the mid- to late 1800s; before this, they had been confined to formal parks and gardens. Such tree planting was part of a programme of urban beautification and a response to growing issues of industrialization, pollution and health concerns (Roman and Eisenman 2022). During the early phases of street tree planting in London, sidewalks and roads were commonly assembled from wooden blocks. Later, and particularly following the rebuilding of London following the two world wars, tarmacadam, asphalt and concrete were favoured (Winter 1993: 38; Renier 2012). Concrete enclosure represents a relatively recent phase in the life-history of urban trees, opening up a series of new ecological interactions. Due to their low surface permeability, materials like concrete and asphalt force tree roots to radiate farther from the trunk in order to access water from more readily infiltrated areas. Roots may also gravitate towards subterranean infrastructures such as leaking pipes, sewers and hidden rivers. The ever-extending roots exert forces on the surface above them, leading to heaving and cracking. The localized uptake of water also produces imbalances in the moisture distribution of the soil, causing it to shrink and swell, further stressing the surface above it (British Geological Survey n.d.). The formation of cracks subsequently increases local rates of infiltration, causing more swelling and structural disturbance and setting up a process typical of positive feedback: as one crack forms, it becomes easier for newer ones to do so.

← A tree leverages a curbstone out of alignment, Naples, Italy. Photo: Aaron Bradshaw, 2023.

→ Concrete slabs swell upwards at the base of a growing tree, London. Photo: Aaron Bradshaw, 2023.

The roots of a London plane tree crack an adjacent wall (left) after meandering below the paved sidewalk (right). Photos: Aaron Bradshaw, 2023.

A curb is removed to make space for an expanding tree, London. Photo: Aaron Bradshaw, 2023.

As I walked through the residential streets of Hackney in East London, I observed many trees, some up to eighty years old,[1] breaking through paved surfaces, cracking walls and lifting curbstones. This heaving, cracking and splitting is the result of a complex interplay between biological tropisms, pedological properties and sociotechnical interventions. The action of roots growing in confined spaces and dense environments brings the surface layers of asphalt, tarmac and concrete into conversation with the deeper layers of ground below – clay, silt, sand and a variety of urban technosols. Through attention to these fissures, uneven surfaces and crevices, we can follow not

[1] See the London Street Tree map at https://apps.london.gov.uk/street-trees/

only the pathways of root growth beneath the surface of a road, but also attune to the properties of subsurface materials, subterranean gradients of water and nutrients, and a compressed history of freezing, thawing, shrinking and swelling. When sidewalk upheavals are repaired, often through improvised sealing with asphalt or pebbledash resin, this erasure leaves its own scar. Interventions into various subsurface utility infrastructures – such as (waste)water, gas, electricity – leave other distinctive marks on the paved surface that articulate with root-induced fissures to produce a material patchwork. Through the intermingling of dendrological, concrete and human agency, these surfaces become a *medium* upon which the machinations of the subsurface are registered, and where we can witness a translated map of the world below.[2]

[2] See Schuppli 2020.

As root networks interact with the various hard materials out of which cities are constructed, the results also index social divisions in urban mobility: roads are often made from tarmac, which is relatively plastic and therefore accommodating to extending roots. The concrete slabs out of which sidewalks are assembled, on the other hand, are brittle and have many joining edges, resulting in large displacements and upheavals that impact both bipedal and wheeled locomotion. The differing effects of tree roots on these substances echo the privileging of certain mobilities over others in cities and mark divisions between different infrastructural publics. For instance, as tree growth may impact sidewalks more destructively than it does roads, the former also gathers less investment for repair (Gibson and Marshall 2022). These tensions are further complicated by the growing awareness that, in North American cities at least, tree-canopy coverage (or lack thereof) strongly correlates with socioeconomic inequalities and systemic oppression; urban forests tend to be concentrated in more affluent

← Concrete paving stones are replaced with pebbledash in a neat repair, London.
Photo: Aaron Bradshaw, 2023.

→ A pavement scarred by many repairs and root cracks. The original pavement is visible at the top of the image, London.
Photo: Aaron Bradshaw, 2023.

neighbourhoods and less so in poorer and racialized areas (Schwarz et al. 2015). As they pass through and uproot urban architecture, root networks mark out a series of sociopolitical, material and ecological strata across multiscalar geographies.

In this respect, urban forests are increasingly framed as critical infrastructures, offering ecosystem services and nature-based solutions. This framing is typical of resilience discourse that marks a shift in the scientific and political apprehension of urban trees; an aestheticized and ornamental view of urban nature is replaced by a utilitarian framework in which trees are enrolled for their beneficial effects on human lives. Through their ability to counter the urban heat island effect, filter pollution, retain water and provide habitats for other organisms, street trees are further coopted as dampeners of erratic environmental change. On the one hand, this can be seen as productive for getting more nature into our cities and (possibly) for protecting that which is already there. On the other, by focusing on specific quantifiable parameters (such as carbon capture), resilience discourses enact an operationalization and depoliticization of arboreal agency. This risks devaluing certain forms of other-than-human life in urban contexts and disregarding the unquantifiable meanings of different trees to certain people. Resilience discourse further embodies contradictions whereby the self-organizing properties of (urban) nature are seen to both secure *and* undermine life (Meriläinen 2020). The radiation of root networks is an emergent property of trees' own resilience, yet their encounters with the urban infrastructures have the potential to disrupt certain mobilities and are often framed as a conflict.

Miniature ecosystems form in the cracked surfaces around trees, London.
Photos: Aaron Bradshaw, 2023.

As resilience discourses fail to grapple with the entangled and indeterminate trajectories of urban nature, the lives of trees are gaining a new appreciation in the cultural imaginary. One particularly provocative image is that of underground mycorrhizal networks that link trees together and facilitate the exchange of nutrients and chemical signals (Karst et al. 2023). In the context of city trees encased in concrete, mycelial imaginaries might be seen as an allegorical solution to the image of urban ecosystems as cut off, separated and fragmentary (Watson 2016). Yet, as Matthew Gandy (in Sholis 2023) comments, responding to the technocratic and sterile modernism that concrete often evokes, "the surfaces of concrete support complex constellations of algae, bacteria, and other microorganisms." Microbial agency may enact its own erosion of concrete, creating crevices and proto-soils in which seeds colonize and germinate (May 2003; Gaylarde and Baptista-Neto 2021). These reciprocal effects foster above-ground connectivity between various organisms in the city, thereby linking different scales of ecology together as they draw on concrete as a generative substrate.

Trees inhabit urban space in their own manner and their slow, meandering mobilities mark out specific ways of urban knowing and becoming. By teasing out the literal permeability of the city, urban trees challenge modernist ontologies that split culture from nature and which view the city as a space controlled primarily by human agency. Recognizing the agency of trees faced with concrete points to the limits to human agency in separating out the entangled and indeterminate facets of dendrological lives. In a wider context, this also means recognizing our own entanglement with, and reliance upon, the other-than-human world.

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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.

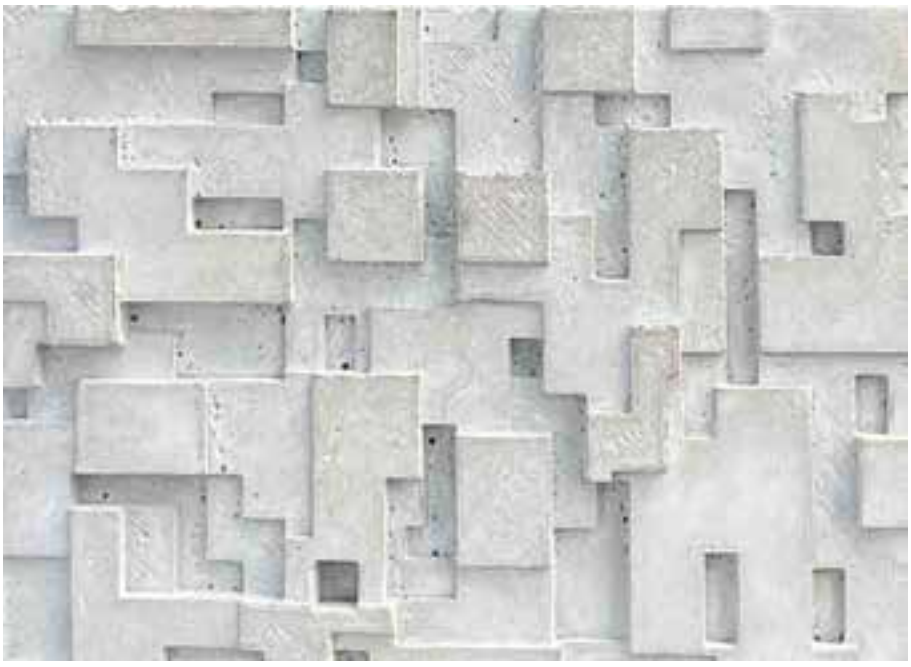
the port authority. The Living Ports project proposes to improve the sustainability of port infrastructure by using a type of concrete that requires less maintenance and which bolsters biodiversity. To do so, this collaborative project, led by Israeli company ECOncrete and funded by an EU Horizon 2020 programme, proposes using concrete designed to attract microscopic plants and crustaceans. ECOncrete 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."

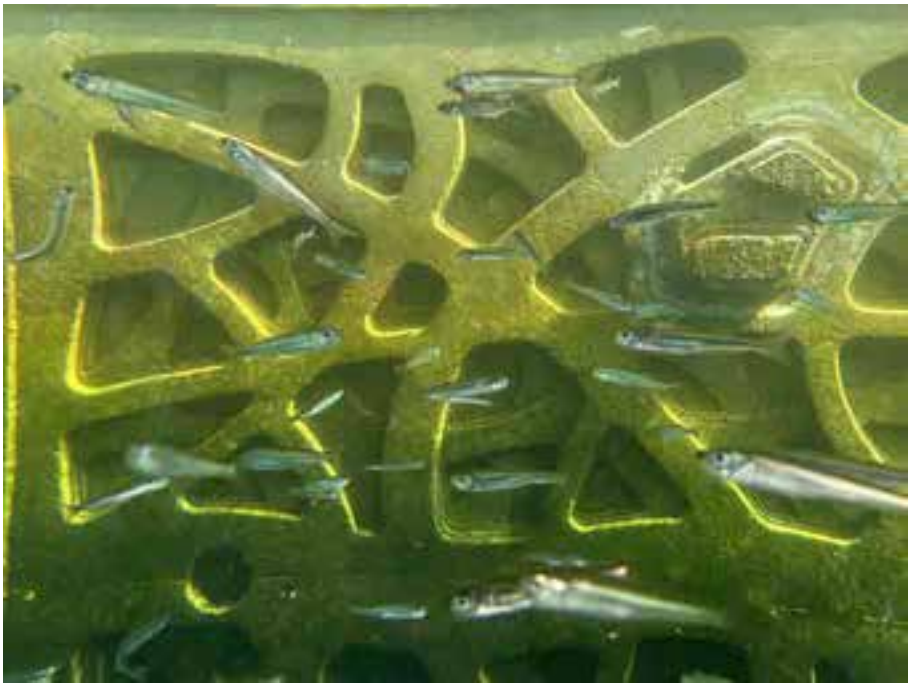
"Mangrove" structure designed by ECOncrete.
Photo: Maria Moltesen, 2023.

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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Between Concrete and Earth:
Soil-Cement Brick and Its (Failed) Promises

Yu-Han Huang

This essay surveys the soil-cement brick (SCB) technology and its utilization in US-aided workers' housing projects in 1950s Taiwan. Half-concrete half-rammed-earth, SCB was considered an ideal material for constructing modern low-cost housing and was employed in American foreign housing aid programs across Asia. However, SCB's modern nature was not necessarily equally true for every party engaged – be they American advisors, local technicians or the homebuyers themselves. The divergent opinions of these different groups reflect their individual ideas about material and housing modernities. This brief scrutiny of SCB reveals that its political and social roles in a state-driven modernization program are inseparable from its materiality.

Make Bricks, Own a House

The term soil-cement brick refers to bricks made of a compressed earth mixture of natural soil and a limited amount of cement. The use of cement as a binder enhances the clay minerals in the natural soil, resulting in a higher coagulation strength of the mixture. Unlike traditional mudbricks, SCBs are produced using 'human-powered brickmaking machines', or brickmakers (高壓手工製磚機, in Chinese). The soil-cement mixture is placed in standardized modules and pressurized by the brickmaker, achieving higher compaction density. The moulded compressed mixture is then taken off and dried in the shade. Finished bricks can be utilized for house construction without any further processing, such as firing. The advantages of SCB are evident: theoretically, SCBs can be made of soil from housing excavations and produced on almost any construction site, which minimizes raw material and freight costs. Additionally, the simple technology allows unskilled or DIY workers to make standardized bricks and floor or roof tiles with only a few hours of training. More importantly, for American housing and foreign aid technocrats, the SCB appeared a perfect fit for the "aided self-help housing" program (Harris 1998).

***SCB-making process, stills from film* It Can Be Done.**
Source: ICA 1956.

Since the late 1940s, American housing experts have considered mortgage-driven mass homeownership to be a critical element necessary for capitalism and democracy. Housing aid to allied countries thus became a strand of US Cold War deployment to counter the expansion of the Communist Bloc (Kwak 2015). In order to encourage mass homeownership in 'underdeveloped' economies, the aided self-help method redirected government investment towards housing market infrastructures – especially a sustainable housing finance system and construction capabilities – to enhance potential homebuyers' affordability (Harris 1998). To achieve these goals, American housing technocrats suggested utilizing homebuyers' "unused leisure time" so they could contribute their labour in house construction and "improve [their] shelter[s] through [their] own efforts."[1] By doing so, lower-income workers could obtain mortgages more easily and better engage in a mortgage-based housing finance system. The SCB can thus be understood as an infrastructure for aided self-help housing in both material and financial terms: the technology enabled the mass manufacture of standardized building materials in countries that lacked construction industries; meanwhile, considering that brickmaking required a large amount of labour, it allowed more lower-income workers to participate in the program.

[1] "Aided Self-Help Housing Abroad," National Archive and Records Administration, RG469 UD409 box 118.

Keelung Dockworkers' Housing (1954) marked the first aided self-help project applying SCB in Taiwan. US Foreign Operations Administration (FOA) officials introduced SCB to the Keelung project, initially using it as a substitute for concrete blocks due to inefficient local cement production. Regarding the Keelung project as a significant success that indicated a solution for the pressing housing crisis across Asia, FOA and the Taiwanese government introduced the aided self-help approach and SCB technology to other low-cost housing projects nationwide. In March 1954, with the guidance of FOA, a joint working group was formed under the Taiwanese Ministry of the Interior (內政部) to supervise the US Aided Salt Workers' Housing (SWH) projects in Qigu (七股) and Budai (布袋) Saltworks in Taiwan's southwestern coastal area. However, SCB's once-overlooked problems of materiality would be exposed in this new program.

Too Salty to Be Durable

As mentioned above, American advisors believed that SCB technology could provide cheap and standardized materials, enabling the mass manufacture of low-cost modern housing in 'underdeveloped' societies. Yet, from the outset, skepticism emerged among salt workers regarding SCB's promises of reduced costs and good durability. While FOA crews conducted material experiments and concluded that the soil excavated at SWH's proposed construction sites had an ideal clay–sand ratio for brickmaking, saltwork technicians pointed out that the FOA experiment only analyzed samples from the surface layer and did not reflect the characteristics of the subsoil, which contained more sand and less clay. This uneven soil composition posed challenges in standardizing SCB manufacture as technicians struggled to develop a formula for soil–cement mixtures with an accurate soil–cement–water ratio. Consequently, precise calculation of cement demand and control over the quality of finished bricks proved unexpectedly difficult.[2]

[2] National Archive and Records Administration, RG207 A1 130 box 4.

The salt content in the soil emerged as another significant problem. From the housing project's early stages, homebuyers and local saltwork technicians expressed concerns about the high soil salt content in this coastal area. Fearing that excessive salt in soil–cement mixtures might weaken the finished bricks, homebuyers repeatedly argued for the necessity to increase cement usage in brickmaking. However, grappling with material shortages and budget overrun, project management and engineers sought to regulate cement usage by adjusting the brickmaking formula. Lacking confidence in the SCB, homebuyers in Qigu went on strike at a brickmaking workshop and petitioned the joint working group to replace SCBs with standard red bricks.[3] In Budai, homebuyers also refused to manufacture bricks, citing instances of the surface of some finished SCBs flaking off within weeks. They attributed this problem to excessive salt and sand content in the soil–cement mixture.

[3] 國史館臺灣文獻館, 臺灣鹽業, folder 006-430759.

Consequently, the joint working group was forced to suspend brickmaking at both locations and sought engineering solutions. To convince homebuyers to resume construction, project engineers ultimately agreed to use more cement in the soil–cement mixtures. Additionally, they decided to coat a layer of cement mortar on the finished brick wall surfaces to prevent cracking.[4] The SWH project's first phase was completed in October 1955. SCB would no longer be utilized in subsequent projects, though, due to opposition from local salt workers.

[4] 國史館臺灣文獻館, 臺灣鹽業, folder 006-430927.

SWH housing at Budai Saltworks.
Source: 鹽光文教基金會, file no. cca-200119-hp-ph_a_238_030_001-l

Not Concrete Enough

If regarding concrete as a modern material is by no means natural (Forty 2012), the modern characteristics of SCB appear even more equivocal. American technocrats depicted SCB as a more economical alternative to industrially produced concrete blocks and a replacement for more traditional materials like red bricks and mudbricks. In other words, the SCB was regarded as a material positioned between concrete and

rammed earth, yet it behaved more like the former. In practical terms, however, the manufacture of SCBs was hardly standardizable, given that natural soil characteristics varied significantly in different locations. Homebuyers acknowledged this unpredictability, and the SBC, along with the houses made from it, failed to "present the possibility of being modern" as well (Larkin 2013: 333).

For SWH homebuyers, it was the cement that provided a major, if not the only, measure to fix SCB's reliability problems. Yet the increasing use of cement in SCB making and the overall SWH construction highlighted the failure of an aided self-help housing model embedded in low-cost 'modern' materials and homebuyers' own labour contributions. It is not surprising that Taiwanese homebuyers reverted to materials that were more familiar and credible to them. From the second phase of the housing program onward, local homebuyers gained more influence in managing the project, deciding on favoured designs and material purchases. Red bricks remained the primary material in subsequent projects until the early 1960s, when domestic cement production capacity was established in Taiwan.

Houses from the second phase of the SWH project at Qigu Saltworks.
Photo: Yu-Han Huang, 2020.

Scrutiny of SCB prompts a reconsideration of local citizens' initiatives in state-driven modernization programs. Like concrete, the SCB can be analyzed as an aspect of the US empire's global expansion in ideological and physical terms (Martinez 2020). If aided self-help housing aimed at reforming the built environment and creating modern

citizens, its promises could be seen, sensed and examined through building materials. The SCB-built houses, although designed to satisfy modern living conditions, were never successful in delivering a "modern world of future positive" to their tenants (Harvey 2017: 90). To some degree, Taiwanese salt workers' preference for red bricks over SCBs indicates a reversal of the material modernity/non-modernity dichotomy defined by American housing experts and a rebuttal of their promises of housing. In this story, it was the local people deciding which sort of modern they desired.

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Cultural Concretions:

Hmong Creative Adaptation in Vietnam

Jean Michaud and Sarah Turner

The proliferation of concrete, entwined with the expansion of transport networks, water-management systems and educational infrastructure, is reshaping the tangible and intangible landscapes of the rural uplands of northern Vietnam. This metamorphosis is not merely physical but deeply cultural too, altering the symbolic meanings of the very notions of home and life. We focus on consequences of such transformative effects for Hmong, who number about 1.5 million individuals in Vietnam and are one of the ethnic minority societies dwelling in these remote uplands.

Our analysis is anchored in the recent infrastructural turn, urging a re-evaluation of infrastructure not just as physical entities such as roads and irrigation systems, but as dynamic systems entwined with sociopolitical, ecological and cultural processes (Amin 2014; Wilson 2016; Datta and Ahmed 2020). This infrastructural perspective underscores concrete's role both as a building material and as a sociomaterial agent,

intricately involved in the reconstitution of cultural norms and the articulation of new forms of community resilience within the evolving landscapes of modernity (Harvey and Knox 2016; Turner 2022). Through ethnographic engagement with Hmong communities conducted over three decades, we scrutinize their shifts in livelihoods and the increasing integration of industrial technologies, including concrete, within their social fabric.

Concrete Flows

Until recently, many Hmong were rotational swidden farmers. They practised a semi-nomadic way of life, in which an immovable dwelling was neither practical nor desirable (Lee and Tapp 2010). Hmong houses have long been characterized by earthen floors, with construction materials such as bamboo and wood, along with plant stalks or foliage for thatch. Building techniques were dependent on the availability of natural resources, which varied across altitude, climate and vegetation cover. Hmong villages have now been permanently settled, some for generations, yet their dwellings continue to be culturally embedded with beliefs coherent with Hmong animistic worldviews.[1]

[1] There are Hmong who have turned to Christianity or Buddhism, but we focus on the majority who maintain an animist worldview.

Typical Hmong house built on dirt, Hau Thao Commune, Sa Pa District, Lào Cai Province. Photo: Authors, 2014.

The escalating prevalence of concrete in Vietnam during the twentieth century, driven by French colonialism and market trends, has instigated a paradigm shift that transcends mere architectural logic. To this historical process must be added a steady push by Vietnam's socialist government to harness the full potential of the natural resources of these uplands – such as minerals, hydroelectricity, water and the rich flora and fauna (Scott 2009; Michaud et al. 2016). Here, "infrastructure, as a material force and ideological tool, has been a key avenue for the reorganization of territory and the domination of nature" (Buier 2023: 56).

Interior of a Hmong house with a dirt floor, Su Pan Commune, Sa Pa District, Lào Cai Province.
Photo: Authors, 2011.

Once road networks reached previously secluded communities, industrial goods soon followed: metals, fabrics, machinery, petrol, roof-tiles, bricks and cement. In time, even cash-strapped, semi-subsistence Hmong farmers were able to purchase bags of cement. They quickly realized concrete's potential as a robust material that could take virtually any shape with a rough frame, sand, aggregate, water, and simple gravity. Gradually, dirt tracks gained a thin concrete surface for the smoother circulation of small vehicles during the rainy season, while concrete water channels, pig pens and domestic water reservoirs proliferated. We have also observed the adoption of concrete within houses over time, but this has occurred last. A Hmong woman explained: "we preferred the soil under our feet and the concrete seemed unnatural"; while a Hmong man stated, "well, we have it now, but we had to work out what the spirits would do" (interviews 2019, 2022). In other words, this delay was due to the sacredness associated with human homes and the enduring habitus of life events – birth, rituals, death – which have historically unfolded on dirt floors.

Hmong Households Navigating Concrete

Concrete floors in houses are gaining popularity as a practical way to shield inhabitants from increasingly cold weather events (Delisle and Turner 2016). In areas like Đồng Văn District (Hà Giang Province), where timber is scarce, cinder blocks – an alternative form of concrete – are frequently used for Hmong buildings. In economically booming upland areas, such as Sa Pa District (Lào Cai Province), many Hmong houses have started doubling as homestays, catering for tourists. This has led to a surge in the use of concrete, bricks and mortar for construction, complete with concreted outhouses for showers and flush toilets. Inside houses, concrete is now commonly used for the constantly wet kitchen area. The socialist state's push for modern standards nationwide

has influenced this trend (Kleinen 2015; Turner 2022; Michaud and Bilodeau 2024). For example, through its New Countryside Programme (Nông Thôn Mới), initiated in 2009, the Vietnamese state seeks to "build a new countryside with a gradual modernization of socioeconomic infrastructure [...] and to increasingly improve people's material and spiritual life following a socialist orientation" (Socialist Republic of Vietnam 2010, our translation). Moreover, rural communes that meet specific criteria are deemed New Communes, rewarded "with funds to build particular items of infrastructure" (Nguyen 2017: 5; World Bank 2017).

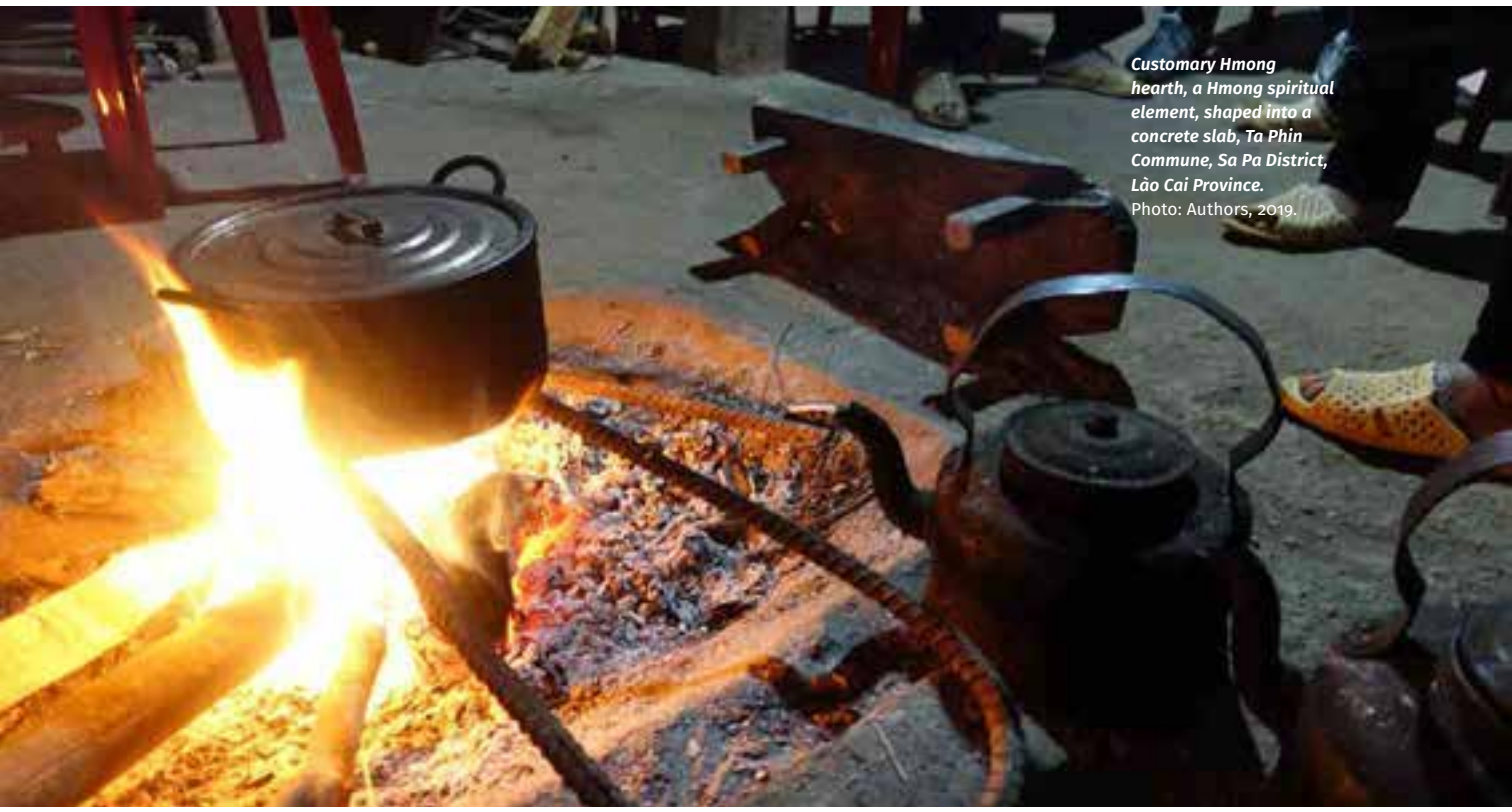
New Hmong house on a concrete slab with low brick walls, Seo Mi Ty Commune, Sa Pa District, Lào Cai Province.
Photo: Authors, 2023.

While the adoption of concrete in isolated communities happens the world over (Forty 2012), such changes to Hmong houses have been accompanied by careful consideration for the safe travel of the souls of the deceased. For Hmong, ancestors linger in the form of ghosts, using specific routes to move around. An important ritual in this regard is thus the burial of the newborn's placenta.[2] The placenta (*tsho*) is customarily interred within the home for a connection to the ancestors. In the case of sons, the father digs a hole in the dirt floor for the placenta "by the center house post, and a spirit bridge stretches from the shaman altar, via the center post, to the door" (Symonds 2004: 17). For daughters, it is generally buried under the parents' bed "to ensure that she will be the mother of many children" (ibid.: 46). This ritual is perceived as essential for the soul of any deceased family member to safely return, retrieve their placenta and wear it to travel to the ancestors' world (Fadiman 1997; Helsel and Mochel 2002).

[2] A ritual practice also found among the Māori of New Zealand, the Navajo and in regions of Cambodia and Bolivia, to name a few (Buckley 2006).

Modern construction, especially reinforced concrete, disrupts this ritual. As Star (1999: 380) observes, "what is one person's infrastructure is another's topic, or difficulty." In response, Hmong families have found ways to continue this practice and avoid hindering the safe flow of spiritual essence. A recent Hmong mother in Sa Pa district explained that her husband dug into the concrete slab of their house using hand tools to bury their daughter's placenta: "We left the hole open for a month. If our daughter had had

Kitchen area of a new Hmong house with concrete floor and cinder block walls plastered with mortar, Su Pan Commune, Sa Pa District, Lào Cai Province.
Photo: Authors, 2023.



Customary Hmong hearth, a Hmong spiritual element, shaped into a concrete slab, Ta Phin Commune, Sa Pa District, Lào Cai Province.
Photo: Authors, 2019.

a bad cough at that time, we'd have poured warm water on the placenta" (interview 2023). The warm water would promote the child's health both immediately and in the long term. After one month, her husband resealed the hole with fresh concrete, thereby maintaining both the physical integrity of the house and the spiritual needs of the family. Other interviewees in both Lào Cai and Hà Giang provinces concurred with such an approach.

Lee and Tapp (2010) note that Hmong who have migrated to urban settings or to Western countries tend to abandon these practices. The impracticality of performing the ritual on Western-style flooring is a significant factor, as is the challenge of obtaining a newborn's placenta from a hospital.[3] There is a likelihood that the same may occur in rural Vietnam over time. Nonetheless, interviews conducted as recently as early 2024 indicate that this is not yet the case.

[3] In upland Vietnam, Hmong women giving birth in local hospitals often encounter the same situation, where predominantly ethnic majority Kinh doctors retain the placenta for incineration.

Hmong Everyday Politics: Digging Through State Modernization Priorities

This transition to concrete-based infrastructure by Hmong in Vietnam not only represents an architectural transformation, it also triggers cultural adjustments. Practices deeply embedded in the natural and supernatural worlds are renegotiated as they are influenced by political policies and market forces. For the government, the adoption of concrete is a visible marker of modernization, aligning with state-driven initiatives to enhance infrastructure and foster economic growth in the uplands (Duncan 2004; Chettri and Eilenberg 2021). For Hmong households, these opportunities are sometimes welcomed for their practicality; yet they can also be met with a selective embrace in order to maintain core elements of vernacular cultural practices wherever feasible (Michaud 2017).

Hmong households' discreet maintenance of rituals, such as the burial of a new-born's placenta beneath the concrete, embodies a form of everyday politics woven into the rhythms of their lives (Kerkvliet 2009). These acts, though seemingly mundane, are entwined with affirmations of identity and autonomy, supporting the argument that "the materiality of infrastructure shapes affective bonds and practices of solidarity" (Abel and Coleman 2020: xxiii). The disruption of placenta burial practices by concrete is emblematic of broader tensions between customary lifeways and the imperatives of state-led modernization. This intersection becomes a fertile ground for the infrapolitical tactics of Hmong households, subtly embedding new material landscapes within their particular worldviews (Michaud 2012).

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Concrete Agencies:

Transforming Contested Watersheds in Rural Hong Kong

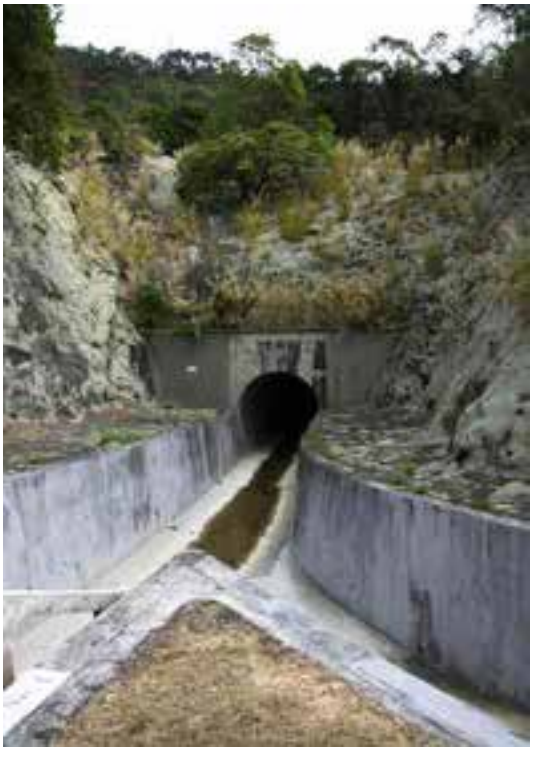
Natalia Echeverri

Lantau Island, the largest in the Hong Kong archipelago, is host to a simmering debate over socioeconomic development and cultural and environmental conservation. Here, large country parks and villages dating back to the Ming Dynasty, sit alongside mega-infrastructure works. This photo-essay illustrates the transformation of a series of Lantau valleys, documenting the concrete and cement artifacts and infrastructures arising from a process that began with Lantau's colonial development and which continues today.

Two subjects are central to this narrative: a meticulously engineered water-diversion project begun in 1956 by the British colonial administration's Public Works Department (PWD), and a more recent network of informal dams, paths and platforms initiated by local residents, which has given rise to a thriving social and recreational space. These contrasting approaches – one marked by formal precision and disruption, the other by improvisation and bricolage – are a story of multiple agencies constructing a

rationalized space against a background of ecology and weathering within a subtropical landscape (Brenner and Schmid 2015). These two sorts of agency can be seen together as a practice of assemblage incorporating not just a series of connected concrete artifacts, but also the material resources, bodies, technical and local knowledge, and types of community (Durose et al. 2022) that are visible in the forms, details and textures documented in the photographs below.

Shek Pik catchwater discharge into the reservoir during the dry season.
Photo: Natalia Echeverri, 2024.



Two catchwaters divert into a tunnel that distributes the water to the reservoir across a mountain ridge. Artificially engineered slopes of concrete protect the catchment from erosion.
Photo: Natalia Echeverri, 2024.

The Shek Pik Reservoir was the colonial administration's largest and most complex water-diversion project as it attempted to service a rapidly expanding population (Trenerry 1962). The works required novel construction techniques to confront uncooperative landscapes – a frequent problem when infrastructural ambition met with unfamiliar soils in the colonies (Broich 2007). The deep deposits of decomposed granite mixed with alluvial gravels were extremely porous, so engineers developed a solution of injecting cement mortar through interlocked pilings to create an underground cement wall that blocked groundwater flows (Public Works Department 1963). Together with these innovative subgrade works, a network of in-situ concrete water-collecting structures cut across the hillsides to enact a major transformation of the surface watersheds by intercepting water from neighboring valleys and streams, feeding into the reservoir through underground supply tunnels.

Catchwater with secondary stepped channel next to the Southern Lantau trail during the dry season. Photo: Natalia Echeverri, 2024.

The twenty-one kilometers of catchwater channels feeding Shek Pik reservoir are carved into the hill slopes and lined with smooth concrete trapezoidal cross-sections, capturing surface water runoff before it reaches the sea. Natural streams are drawn into the artificial catchments by concrete weirs and overflow gates. Through points of weathering and algal colonization that disrupt the otherwise monolithic gray bulk, these terminal elements reveal how the original formwork could not be easily resolved against the uneven and rocky terrain. The swinging sluices and control gears set into the concrete structures display moments of human agency in the management of this massive infrastructure (Wang et al. 2018).

Concrete water grate intake in the upper reaches of the Tung Chung River's western stream.
Photo: Natalia Echeverri, 2021.

The stream intakes installed in Tung Chung River and Wong Lung Hang Stream are perhaps even more violent interruptions of Lantau's natural hydrological system. Typical intake structures feature a broad concrete dam cutting across the entire streambed. Waters thus impeded overflow through a prefabricated concrete grate before dropping into covered channels and then into the supply tunnels. The stream intakes, brutal as they are, are also weathered by the continuous flow of water and fine sediments passing over them, their pebbly surface blending into the environment despite their intrusive form.

Detail of a prefabricated conical structure with a water intake set inside.
Photo: Natalia Echeverri, 2023.

The weirs, catchwaters and stream intakes filling Shek Pik significantly altered the natural watersheds in the catchment's lower regions. The Lantau riverine ecology was abruptly fragmented and the critical seasonal flows were lost (Dudgeon 1996). Agricultural villages in the affected watersheds were left without sufficient water and were mostly abandoned within a generation. Resources were reconstituted for urbanized Hong Kong while villages in Lantau, such as Tai O, lacked adequate water supply until the 1970s (He 2001; Greatrex and Mok 2024). Even today, some small and remote villages still rely on wells and traditional rainwater collection (Fung 2014).

22-meter-wide dam with a linear intake intercepts the Wong Lung Hang Stream, leaving a rocky streambed exposed. Photo: Natalia Echeverri, 2023.

While conserving catchments for the provision of water for human use has protected Hong Kong's upland streams (Dudgeon 1996) under the Country Park Ordinance (AFCD 2023), lower portions of watersheds are constantly modified to accommodate urbanization. In the 1990s, the lower sections of the Tung Chung River and Wong Lung Hang Stream were transformed into open concrete channels to accommodate the Yat Tung Estate, a public housing project for 40,000 residents and an integral part of the Tung Chung New Town project. This development, along with the construction of a new airport, brought significant changes to Lantau.

Despite the hydrological and ecological degradation of streams in Shek Pik's indirect watersheds, these watercourses continue to host new forms of life. Taking advantage of concrete's versatility and availability, some local community members gradually reactivated these streambeds. As explained in December 2023 by a frequent visitor to the Wong Lung Hang Stream, an 80-year-old man with the nickname 'village head' (村長, in Chinese), the history of adaptation has been an ad-hoc but ultimately collective effort. An example is the so-called 'swimming pool', which was first created by unknown hikers who shifted rocks from a shallow water trough to establish the pool's footprint. More than ten years ago, Mr Lau, a nearby resident and construction worker with access to cement, continued these efforts by raising and reinforcing the pool edges with

small amounts of concrete carried bit-by-bit to the site. Eventually, others joined in or donated money or materials as the recreational space gradually emerged from the river.

A community swimming pool. The dam seen in the background divides the pool water from the washing area.
Photo: Natalia Echeverri, 2023.

Bridge made from a wood span and layers of topping cement supports a steady traffic of local residents carrying bottles filled with fresh water.
Photo: Natalia Echeverri, 2023.

Upstream, the concrete adaptations made to the rocky riverbed are more domestic in form. Gathered around a screen of large boulders, concrete is sculpted into hand-smoothed wash basins filled with running water for cleaning fruits and vegetables. Hoses lead from other cemented pools for residents to fill bottles with ease. Rough concrete patches host makeshift tables of wood and brick. The space manifested is both social and utilitarian. We found users for whom this concrete infrastructure of paths, steps and basins facilitates access to a water source that is preferred to government-supplied taps for its better taste and purported health benefits.

A woman washes her fruit and vegetables in a concrete basin while her husband fills empty bottles with fresh water. Photo: W. K. Yeung, 2024.

However, not all residents are in favor of these informal spaces, and the use of concrete for reclaiming the river is contested. Mr Ho, an elected representative of a nearby settlement, laments the nuisance of litter, noise and stray dogs. He asserts that indigenous villagers have never participated in the illegal construction of ponds or collected mountain water. Other areas feel private, not public. One section of stream, graced with a large shade tree, has been gradually constructed by a Filipina domestic worker who spent the last five years sculpting concrete banks, terraces, benches and tables, gathering sand and aggregate for her mixes straight from the stream. Her air of ownership is projected by how she occupies and maintains the space through concrete works. In contrast, Mr Lau, who helped initiate the swimming pool is no longer willing to build structures along the river as he finds that today people feel he is compromising the natural beauty of the place.

Recently cast concrete texture constructed by Filipina domestic worker who uses concrete to flatten and prevent erosion of a gathering area.
Photo: Natalia Echeverri, 2023.

The concrete and cement adaptations in and along the stream ultimately construct a shared and inclusive space through the negotiation of daily practices and shifting community needs (Durose et al. 2022). Li's (2007: 265) descriptions of assemblage in the context of ecological resource management are useful here and underline the fluidity between seemingly opposed technical and material components of the Shek Pik Reservoir catchments and the Wong Lung Hang Stream modifications. Her notion of "reassembling" indicates the importance of adapting pre-existing systems toward new ends. The pictures here also reveal the nonhuman agents complicit in this reassembling – nature and climate, acting over time, have slowly eroded all the concrete in these systems. Thinned upper surfaces now expose the inner constituent aggregates of their formation. New finishes reveal important functionality, while coverings of moss and lichen pull the concrete back into the underlying geology of Lantau.

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Postcolonial Imaginaries:

Care and Concrete

Daniel Williford

Concrete's contemporary ubiquity risks obscuring the conflicts and contradictions that have shaped this substance's global rise to prominence. As transnational construction firms and today's global cement industry promote technological fixes for curbing carbon emissions, there is also a need to confront the complex colonial histories that rendered concrete central to grand visions of development as well as to intimate forms of coercion and care. In Morocco, concrete's trajectory from an instrument of colonial rule to a central node within postcolonial imaginaries of development has been troubled by the ambiguous ways in which workers within the country's cement industry experienced changes to their livelihoods in the aftermath of formal independence.

Under the French Protectorate (1912–56), cement production and concrete construction in Morocco supported colonial projects to build roads, ports, military outposts and police stations – structures and infrastructures for extending French influence over land, labor and everyday life in the country. After Morocco's independence, the production of cement played a key role in nationalist conceptualizations of modernity, development and decolonization. When mixed with water and aggregate to form concrete, cement bound together postcolonial programs to deliver water, electricity and low-cost housing,

as well as a powerful "sociotechnical imaginary" (Jasanoff 2015: 4); these were public promises and performances of a safe and comfortable future for Moroccan citizens. From the speeches of public works ministers to the pages of industry journals, this sociotechnical imaginary oriented large development projects as well as the minute details of building codes. Officials, engineers and architects after independence argued that the material stability and calculability that concrete enabled – though essential for achieving national autonomy – would require maintaining certain forms of technical surveillance, labor organization and professional hierarchy inherited from the Protectorate. In this sense, concrete stabilized a paradoxical relationship between the ideals of independence and progress on one hand, and the reality of ongoing colonial relations on the other. This imaginary was interwoven, in intimate and uneven ways, with the lives and labor of workers at what was once the country's largest cement plant.

Shade and shadow in concrete alleyways are vestiges of Lafarge's designed social space, the Cité Lafarge, Casablanca. Photo: Daniel Williford, May 2017.

In colonial Casablanca, Cité Lafarge, today also known as Bashar al-Khayr (بشار الخير), was the heart of Morocco's cement industry. Designed by the French architect Edmond Brion and completed in 1932 to house workers at the nearby cement plant, the project was among the first of its kind in Morocco with 142 dwellings, a mosque, collective fountains and artisanal decorative features typical of the Neo-Moroccan style (Pauty 1936: 140). By reproducing the trappings of 'traditional' life, the Lafarge company's managers sought to limit the mobility of plant workers, many of whom had been recruited from the Sous region in the south and would periodically return to their villages of origin

(Hubert 1946: 7).[1] Colonial officials cast the careful management of this labor force as critical for producing urban modernity elsewhere in the city – as cement from the plant was employed to make concrete apartment buildings for European residents, in addition to utility poles and subterranean pipes.

[1] On the design and development of the Cité Lafarge, see also Cohen and Eleb 2002: 233–34.

Decolonization only heightened cement's importance to the Moroccan polity. On the eve of independence, an article appeared in the construction industry's leading professional publication, *Construire*, on the future of cement in the country. Given its status as "the foundational material for the building trades and for public works, the premier industries of a new country" and as a core "economic indicator," cement production, Morocco's "oldest local industry," was a source of both anticipation and anxiety for investors, officials and urban professionals during the transfer of power (Bonnett 1955: 815). Morocco's new administration would declare mass homeownership a national priority and single out autonomy in cement manufacturing as a form of decolonization and a metric of development. Cheap cement would fuel the fabrication of cinderblocks for building low-cost housing which had uncomfortably poor levels of thermal insulation.

The end of the Protectorate in 1956 brought few changes, however, to the day-to-day operations of the Lafarge cement plant. One long-term resident, Mustafa, described how for many years after independence inhabitants of the Cité continued to live without running water in their homes, relying on a handful of fountains as well as the collective oven in the middle of the neighborhood. [2] Electricity was rationed, but Lafarge covered the costs of the housing project as a whole. For Mustafa, shared water and electricity – and the resulting limited opportunities for personal consumption – engendered a deep sense of solidarity among residents. Company repairmen fixed cracks that appeared in the walls of workers' homes. Through the regular maintenance of the Cité's concrete dwellings, Lafarge appeared to deliver, at the scale of the project, on a promise of limited prosperity that was central to nationalist visions of progress. Yet state violence formed the backdrop to this corporate social pact. The entrance to the Cité Lafarge lies less than a hundred yards from the site of Derb Moulay Cherif (درب مولاي الشريف), a secret prison for political detainees during King Hassan II's reign (1961-99). Built in concrete beneath a local police station, the facility and its victims remained invisible to most of those living in the neighborhood.

[2] I have anonymized the former cement plant workers and residents of the Cité with whom I conducted interviews from May to July of 2017.

In the decades after independence, the company organized celebrations for state and religious holidays, such as 'Id al-'Adha (عيد الأضحى), 'Ashura' (عاشوراء) and Throne Day ('Id al-'Arsh, عيد العرش), inserting itself whenever possible into the social worlds of workers. Lafarge sponsored a New Year's festival (Ra's al-Sana, رأس السنة) during which representatives of the company gave cement sacks stuffed with candy to the children of the Cité. At the time, it offered an array of welfare programs to workers: basic healthcare, schooling and small, low-interest loans. Cement sacks filled with candy presented semiotically rich moments where the company, already acting as employer, physician and banker, aimed to effect enjoyment in workers and their kin. Cement production supported stable structures, electrified homes and other forms of collective wellbeing, but for many in the project the material itself was bound up with imagined relations of familial provisioning. A single phrase recurred in interviews with former plant workers: "Lafarge was a mother" (كانت لافارج أماً).

The company's investment in sustaining these performances of limited prosperity extended from the designed space of the housing project to the factory itself. Ahmed, a former worker, discussed developing a distinct expertise during his time at the plant. Beginning as a day laborer in 1975, he participated in professional training programs that the company sponsored and eventually became a mechanic, responsible for assembling machine parts and maintaining and repairing the plants' pumps, grinders and conveyor belts. "Lafarge was a school" (لافارج كانت مدرسة), he explained, a space to acquire meaningful technical knowledge through practice. As we spoke, in a moment of excitement, Ahmed took my notebook and quickly sketched a detailed diagram of the production process.

Another former worker, ʿAziz, lamented never learning about the operations of the machines he worked alongside. He characterized his first experiences at the factory in Casablanca as "forced labor" – inserting the French term, *travaux forcés*, to emphasize the harsh working conditions. As an example, he mentioned manually carrying cement to the silos for drying, without elevators or forklifts. ʿAziz alluded to hierarchical forms of discipline on the factory floor where many of the managers and foremen were still European when he started at the plant in 1974. Later in the conversation, he referred to his early days at Lafarge as a form of *la corvée*: the infamous regime of colonial forced labor. He also compared working at the plant to mandatory military service. In both subtle and explicit ways, ʿAziz underlined continuities between the colonial period and the nationalist project – linking unpaid labor for the colonial state and service to the Moroccan nation to his experience at the country's largest cement plant.

← The collective oven that once served all of the Cité's residents, Casablanca.
Photo: Daniel Williford, May 2017.

→ The entrance to Bashar al-Khayr whose archways offer manifold openings – to doors, streets, courtyards, and toward new possible lives and livelihoods, Casablanca.
Photo: Daniel Williford, May 2017.

As production declined at the factory during the 1980s in favor of new sites, Lafarge gradually withdrew from direct management of the Cité, which was turned over to Casablanca's Urban Agency. The inhabitants gained ownership of their homes, and the city installed individual meters for water and electricity. Residents constructed additional storeys, overshadowing the shared streets that the company gradually stopped maintaining after waves of corporate restructuring. Fresh coats of paint every few years, tree-lined avenues and clean sidewalks – these were material manifestations of a corporate social pact that has fallen apart along with the Cité's walls and alleyways. Imaginaries of development that once rested, materially and symbolically, on cement have withered since the era of structural adjustment. For former residents like Mustafa, the decay of the neighborhood's shared spaces indexes a deeper loss: the decline of forms of sociality and care which were intertwined with the extractive projects of the company.

In contemporary Morocco, concrete remains central to state-supported megaprojects such as the Casa Anfa (الدار البيضاء أنفا) business district, even as the corporatized vision of urban renewal underlying such endeavors leaves little room for the ambiguous solidarities associated with postcolonial developmentalism. For those who resided in the shadow of Morocco's first cement plant after independence, concrete still embodies surveillance and stability – two sides of a corporate social pact that has since collapsed. From the space of Cité Lafarge, cement's capacity to hold together the built environment as well as forms of life seems diminished. Yet colonial and nationalist imaginaries of modern concrete cities – with all of their contradictions – are still a lively presence here, embedded within the materialities and memoryscapes of Casablanca.

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Shaping Concrete on Social Media in Dakar

Pierre Wenzel

Dakar is a city undergoing rapid construction, typical of many fast-growing urban areas where concrete is ubiquitous in building, rebuilding, transforming and developing the cityscape. Concrete is often praised for enabling rapid, tall and cost-effective construction (Forty 2016; Jappe 2020; Choplin 2023). In contemporary practice, alongside floorplans and traditional tools like shovels and buckets, smartphones are widely utilized on construction sites, allowing workers to remain connected and browse the internet – a phenomenon referred to by Haider and Sundin (2019: 2) as the "search-ification" of everyday life. Drawing on twelve months of fieldwork, this article analyzes the interplay between social media, concrete and construction practices facilitated by smartphone usage.

In Dakar, over 90 percent of construction projects employ concrete (Kostreva 2014), including reinforced concrete structures, concrete blocks, floors and roofing. Welcome to the concrete jungle!

Concrete jungle in Yoff, Dakar, Senegal.
Photo: Pierre Wenzel, 2023.

According to Jean-Charles Tall, a Senegalese architect, less than 10 percent of new buildings in Dakar are completed with the involvement of an architect. Due to budget constraints, people often avoid hiring an architect and may circumvent construction and urban planning regulations in order to build more affordably. In this context, the proliferation of construction-related content and information on social media platforms plays a significant role in the construction sector and in shaping the city. Our focus here is this phenomenon as realized through the private, small- to mid-scale construction sites that abound in the city. It poses the question: how does social media serve as a place to envision the city and future constructions? More specifically, how does social media, with its vast array of data and content accessible worldwide, contribute to shaping concrete – a tangible mixture of cement, gravel, sand and water?

Internet technologies are very accessible in Senegal (Kemp 2023), but the reciprocal relationship between smartphones, social media and construction sites has often been overlooked in terms of its impact on the widespread use of concrete in urban contexts like Dakar (Perera et al. 2015). By tracing the journey of concrete on social media and the chronological progression of architectural projects that rely on this material, we can see the ways in which concrete is visually, aesthetically and socially embedded in global imaginaries disseminated through social media and translated into localized construction projects in Dakar. Furthermore, delving into the micro-scale dynamics of construction sites reveals that social media is part of a broader system of specific values and construction knowledge negotiated on-site, influencing perceptions and implementations of concrete as a building material.

Global Concrete Aesthetics

On 15 March 2023, I sat with two young civil engineering technicians in Parcelles Assainies, a northern district of Dakar. Focusing on their computers, their smartphones were lying across the table. They worked diligently on the plans for a two-storey building, utilizing a pirated version of ArchiCAD, a renowned architecture software package. Completing the task swiftly, within a couple of hours they had turned their attention to designing the main façade. One technician reached for her phone and started to scroll on Pinterest with the search query "Façade; Inspiration; Dakar." A plethora of computer-generated images showcasing concrete facades adorned with tiles and various types of render flooded the screen. At first glance, these images appeared strikingly similar: geometric motifs encircling balconies and windows, modular elements defining the façade, grey, brown and white as the dominant colors, and plenty of plants for decoration. Upon closer inspection, however, it became apparent that these images might derive from diverse locales, as various languages were used in their titles, including Arabic, Spanish and English.

Examples of façades on Pinterest.
Screenshot, 28 May 2023.

Scrolling further, she remarked "I want to create something extraordinary (*quelque chose d'extraordinaire*, in French) for my client," adding that "some districts in Dakar resemble Paris now!" Other interlocutors would also refer to Manhattan or Dubai in order to reflect representations of the desirable city. This dual pursuit of "extraordinary" and desirable spaces echoes the concept of "good urbanism" (Gastrow 2017: 225) alongside processes of globalization. Such images on social media platforms are instrumental in locating desires elsewhere (Watson 2014), eroding certain cultural specificities in a process of acculturation (Wen 2020). Here, concrete emerges as the driving force behind particular aesthetics and architectural solutions in rapidly expanding urban landscapes which adhere to international standards and global visions of modernity.

Following that afternoon with the civil engineers, I began searching for such content via my own personal social media accounts. Soon, my feeds on Pinterest and Instagram were inundated with similar representations. The algorithms quickly discerned my preferences, saturating my digital space with construction-related content – from developers' and architects' pages to online tutorials and myriad façade designs. "[S]ocial media's algorithms 'learn' … for the collective and future searches in general. Vice-versa social practices, including, of course, human actors, are (re)constituted through search technology" (Haider and Sundin 2019: 71). The power of the algorithm (Cardon 2018) made the field of construction available on my phone. Echoing Ghertner (2011), we can see how aesthetics plays a pivotal role in shaping urban environments; the images available seem to fuel imaginaries and desires for very neat, somehow impersonal houses, which function as a marker for prosperity and social status. The digital serves as a platform for establishing trust, by allowing easy visual comparison of the quality and value of construction projects (Watson 2020), thereby working as a possible launchpad for other construction projects and the further spread of concrete in the city.

Global aesthetic of concrete in Dakar, Senegal.
Photo: Pierre Wenzel, 2023.

Construction in Practice

Despite the global influence of social media, construction remains a grounded practice, attributing concrete particular significance and value in a city such as Dakar. In 2016, SOCOCIM, Senegal's main cement plant, released a YouTube advertisement recreating a well-known but almost extinct construction practice in Dakar in "The Song of the Masons." The Sereer featured in the video are one of the main ethnic groups in the country. The Sereer masons used to sing rhytmically while shoveling concrete mix in sync, proceeding in an almost choreographed fashion as they created each new slab – an intensely physical task. Although this practice has largely faded with the wide spread of load-lifts in the 2000s, this exemplifies the distinctive entanglements between construction practices in Dakar, masons' bodies and concrete itself. I was often told about how this Sereer song served as a source of courage and how it praises workers' strength. While reappropriating this practice for commercial purposes, the video nevertheless revives memories and imaginaries on social media, and conveys a narrative about the resilient, determined construction workers who elevate their craft to an art form, with concrete at its core.

Building on Achille Mbembe and Sarah Nuttall's (2004) invitation to understand African metropolises through the figure of the worker, Senegalese masons anchor concrete in practices unique to Dakar through their gestures, languages and stories. The interrelation of rhythm and work (Hänsch 2019) illustrated in the video is still connected to imaginaries and identities surrounding concrete and construction methods in the city, where workers often rely on physical labor to compensate for the lack of certain equipment, such as concrete mixers. It might appear, meanwhile, that social media articulates global trends, reflecting worldwide aesthetics and processes of globalization that seem disconnected from Dakar and local concrete materialities. Yet the figure of the mason serves as a bridge between international standards and the sociocultural realities of construction projects in Senegal. Here, labor, strength and endurance are shared and remembered on social media, infusing the qualities and perceptions of concrete in Dakar.

Expertise Exchange Online

Completing the perspective offered by SOCOCIM's video spot, the YouTube channel "Maçons du Sénégal" managed by Dieye, a mason-influencer, shows actual construction sites. Dieye provides firsthand insights from these construction sites, demonstrating and explaining the intricacies of building a house in concrete while promoting his business. Here, social media is also used as an arena for knowledge and information dissemination accessible to all – planners, workers and residents alike. In addition, Facebook also serves as a platform facilitating transactions around essential construction materials such as gravel, cement and sand. During construction site visits, WhatsApp was often used as a tool for supervision and archiving, with entrepreneurs, masons and landlords exchanging videos of construction advancements. Smartphones and social media support informal economies and activities (Diallo et al. 2020; ANSD 2022). They participate in shaping roles and networks on construction sites, sometimes blurring the boundaries between various areas of expertise related to the built environment (Di Nunzio 2019). Indeed, as knowledge seems to become more accessible, concrete

expertise is sometimes redistributed – where a mason may claim knowledge of an architect, an entrepreneur may present themselves as a technician, and a landlord may adopt the role of a developer.

Concrete is embedded in a global aesthetic fostered on and by social media, promoting tacit construction norms and *concretification* of the urban. If the cityscape takes shape at the crossroads of labor, sweat and concrete, social media becomes a place to document, learn, inspire and ultimately create with concrete. Online sharing is part of the network shaping concrete's materiality, reflecting the desires and aspirations of Dakar's residents for the city's future. The two realities of social media and construction sites are thus inseparable and mutually influential.

Streetscape in Dakar and recent concrete buildings. Photo: Pierre Wenzel, 2023.

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Concrete Made in Africa

Armelle Choplin

"I dream of being a footballer like Samuel Eto'o or… a cement manufacturer like Aliko Dangote," explains Olumide, a 12-year-old boy, when I meet him in Lagos. Olumide, like many West African children, knows about Dangote, the richest man in Nigeria and in the whole of Africa (and 190th richest in the world according to Forbes Magazine 2024). Aliko Dangote made his fortune in Africa by producing and selling cement: the precious grey powder which, mixed with sand, gravel and water, is used to make concrete. Concrete has become a symbol of the continent's frenetic urbanization, construction boom and capitalist emergence. By tracing flows of building materials along the urban corridor appearing between Abidjan and Lagos, I propose to unpack the major role of cement and concrete in shaping contemporary African landscapes and societies (Choplin 2023). A mega-urban region is under construction along this 1,000km strip linking the cities of Abidjan, Accra, Lomé, Cotonou, Porto-Novo and Lagos: here there are more than forty million people who live, move and build in concrete (Choplin

and Hertzog 2020). Based on thirty months of fieldwork between 2016 and 2019 and complementary field visits in April 2023, this article highlights the tensions around the use of concrete. This material has various positive associations – such as affordability, widespread availability, modernity – but at the same time there are growing concerns about its unsustainability and vulnerability, as the cement industry is responsible for eight percent of greenhouse gas emissions globally (IPCC 2022) and sand has become a strategic asset and scarce resource (UNEP 2022).

Cement Depot in Cotonou, Benin. It is possible to buy bags of cement at any hour of the day or night. Photo: Armelle Choplin, 2018.

Cementification

In West Africa, cement and concrete are increasingly common: both lifted by the cranes which build skyscrapers in the city centres, and in the distant suburbs where poor households incrementally construct their homes. The pervasive grey colour of concrete offers a regular reminder that the city is constantly under construction. Rich or poor, decision-makers and ordinary urbanites have something to say about this material of great banality. From Eko Atlantic City, the artificial island in the heart of Lagos, to the outskirts of Dakar, to the new city of Diamniadio or Akon City, created by the famous Senegalese-American singer and named after himself, futuristic concrete towers are

constantly being erected. In West African coastal cities such as Abidjan, Accra and Cotonou, bridges, bypasses, and social housing programmes are being launched, at a cost of millions of dollars but also, and above all, employing tons of concrete (and of sand and gravel).

Cities in emerging countries are the new frontiers of concrete. Cement consumption is now used as an index of development, often compared to GDP. The world average is around 550 kilograms per capita. In West Africa, the ratio is just under 150 kilograms (T*he Global Cement Report 2024*). The market is promising, and the major European cement companies, such as the Franco-Swiss LafargeHolcim and the German Heidelberg, understand this and aim to compete with Dangote. Since the 2000s, in the space of two decades Dangote has managed to open more than ten integrated cement plants in West Africa. He has created a new model of cement production in which the regional construction industry can be owned by Africans and its materials are sourced and processed in West Africa. Cement is now presented as a 100 percent African product, rather than an imported colonial material.[1] It is often subsidized by governments as a basic necessity to provide low-cost housing for the masses of poor people. The World Bank (2016) itself has seen the cement industry as a lever for development and a way to boost African economies.

[1] For the history of cement in Mozambique, see Morton 2019.

A concrete house is a symbol of modernity and success. Concrete also requires less maintenance than bamboo or mud, Ganvié, Benin.
Photo: Armelle Choplin, 2019.

A Social Binder

Concrete is a material, a commodity, a business, but it is also affectively charged (Archambault 2018). Behind this inert mass, there are many lives and the hopes of millions of men and women who seek to shelter their loved ones. In the Global South, where social security and protection systems are usually failing and access to the banking system is difficult, buying bags of cement and investing in concrete is a way of saving money. In the slums especially, building with concrete makes it possible to legitimize one's presence, to break away from the precariousness of wood and sheet

metal, and to negotiate compensation in case of eviction policies. Cement becomes a product of first necessity and the concrete block materializes the right to the city and one's belonging to it.

Unlike its production, which requires very advanced and energy-consuming technology, cement is simple to use. Mixing it does not need a steady electrical power source, nor does it require formal training or literacy. Pictograms on the bags sold are there to remind people of the proportions, which are generally known, including by women. Many women build by themselves in order to have their own house and no longer suffer the family yoke. For them, concrete becomes a symbol of emancipation and independence. The success of individuals is measured by the tons of concrete they have poured. "For retirement, we offer the professors two tons of cement. It's a sign of recognition and success," explains a university colleague in Cotonou, Benin. And it is common for lovers to offer each other bags of cement as a declaration of love, as 'durable' proof of their commitment to each other.

Women on a construction site, Cotonou, Benin. Many women know how to build their own houses.
Photo: Alice Hertzog, 2019.

Uninhabitable Concrete City

But in the context of global environmental change, concrete means heat islands, soil impermeability and mandatory air conditioning. It also means limestone extraction, massive sand removal, release of harmful particles, rubble and ruins. Concrete is ecologically unsustainable and does not age well. Several tragedies remind us of its obsolescence, especially when it is reinforced with corrodible steel: the collapse of the Morandi Bridge in Genoa in 2018 killing forty-three; the destruction of the Ikoyi

Tower in Lagos in 2021 resulting in the death of forty individuals. In Africa, collapses are part of everyday life (Smith 2020). These tragedies raise questions about the choice of construction materials, their environmental footprint and their maintenance, which is lacking in many cities due to insufficient financial resources or political will. Obsolescent concrete is creating uninhabitable cities.

I met François in Cotonou, the economic capital of Benin. I had come to visit him and see his new house, located on the outskirts of the city. He told me how happy he was to see his sacrifices bear fruit in the form of a home. But he also revealed one of its major flaws: "The problem is that it is too hot inside. At night, I sleep outside because it's too hot for me. But outside, there are mosquitoes." François has built an uninhabitable house. Concrete is not suitable for tropical climates as it retains heat. The widespread use of concrete implies a growing presence of air-conditioning systems, which are energy intensive and increase the carbon footprint of a dwelling. Cooling makes concrete cities and houses habitable but contributes, in however small a way, to making the planet uninhabitable.

Many houses, like François's, are built without windows and have little natural ventilation. These concrete houses are uninhabitable without air conditioning, Cotonou, Benin.
Photo: Armelle Choplin, 2018.

Building Africa With(out) Concrete?

In March 2022, Burkina Faso architect Francis Kéré was awarded the Pritzker Prize, the equivalent of the Nobel Prize for architecture. This distinction marks the recognition of African architecture, which has long been ignored and denigrated (Meuser and Dalbai 2021). Kéré invites us to explore alternatives, proposing a more considered use of concrete, a material now widely criticized for its carbon footprint. Architects and engineers increasingly want to move away from all-concrete construction. Experiments by the CRAterre research centre in Grenoble, France, and the FACT Sahel+ collective in the Sahel countries are promoting constructions with recognized thermal values, local knowhow or the use of local materials such as straw, earth or bamboo (Vandermeeren 2020). In Senegal, the company ElemenTerre advocates earthen construction using compressed raw earth blocks. The Worofila collective offers buildings made of earth and Typha reed (also known as bulrush or cattail), an invasive plant that grows in the wetlands on the outskirts of Dakar. In the Sahel region, La Voûte Nubienne employs clay: this technique, which originated in Nubia, Egypt, and was revived by Egyptian architect Hassan Fathy in 1973, is used to construct earthen arches and domes to cover buildings without the need for wood or corrugated iron.

AI image, Prompt: "Afrofuturist and ecofriendly city in Africa, with a majority of buildings made out of mud, in the style of Francis Kéré."
Image: Bing 2024.

At the moment, these initiatives seem scattered and limited to just a few individuals. Yet the emergence of these networks and exchange platforms helps to give visibility to such ecological alternatives. In addition, the international recognition of Francis Kéré's work is a major breakthrough, particularly in terms of architectural training (with new courses in vernacular architecture and local materials appearing in schools of architecture). These experiments show that African cities will play an important role in the future of the planet and can be the sites of a new Afrotopia (Sarr 2020), a utopia that takes Africa as its starting point.

The proliferation of concrete cities is not just an African phenomenon. On the contrary, this process of cementification, generalized in the Global South, reveals many of the contradictions of our ever-more urban world: over-consumption of resources, polluting industries, profits of large private companies versus the need for housing and infrastructure, the positive image of concrete associated with modernity and success, the rhetoric of development… This rapid growth of concrete cities calls for further research and broader discussions on uneven development, gender dynamics, land claims, alternative building materials and more. Concrete invites us to reconsider the links between materiality, inhabitability and our urban futures.

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The Concrete Pastoral

Eli Elinoff

In Thailand's limestone belt, small farms – like the one in the first image on the following page – sit adjacent to monoculture fields planted with rice or industrial crops such as jute, sugarcane and corn.[1] Here, a breeze rustles through neat rows of chili plants. Behind, a sea of corn stalks grows among islets of palm and bush. Puffy clouds drift over crags in the distance, a gash of exposed limestone where peaks once stood. Their stone has become aggregate, which is crucial for making concrete, comprising up to 80 percent of its volume.

This is the concrete pastoral: an aesthetic of jarring spatial proximities and disjunctive superimpositions produced by the transformation of stone into cement, concrete and aggregate. Dusty quarries bisecting placid hills; industrial installations amidst emerald fields; the material shadow of the city erupting into the countryside.

[1] In this short piece, I bracket the specificities of the Thai case, which I have written about extensively elsewhere (Elinoff 2017, 2020).

A quarry sits high above a small farm, Ban Mo, Saraburi, Thailand.
Photo: Eli Elinoff, 2023.

One of the largest cement factories in Thailand standing above a field of industrial sugarcane, Kaeng Khoi, Saraburi.
Photo: Eli Elinoff, 2019.

Japanese photographer Naoya Hatakeyama's work on Japanese quarries and cement factories in *Lime Hills* (1986–91) and *Lime Works* (1991–94) has far-reaching resonances in this context. His photographs mobilized this aesthetic to disrupt the perception of distance between extractive centers and urban spaces. Hatakeyama suggested that quarries and cities are "like negative and positive images of a single photograph" (Hatakeyama 2018: 255). By reappropriating the aesthetics of pastoral landscape photography, his images remind us of the urbanist Lewis Mumford's insight that cities always come from something being un-built somewhere else (Mumford 1970 [1938]: 150–152). Hatakeyama's work also presaged more recent theorizations of "planetary" and "extended" urbanisms (Brenner 2014; Brenner and Schmid 2015: 167, respectively), which emphasize the expansive, seemingly inescapable, reach of the enmeshed webs of urban space and capital.

This conveyor belt (below) feels like an apt embodiment of this analytic. Running for several kilometers, it links the quarry where limestone is mined with a cement factory, where the mined stone is milled and then cooked at 1400C becoming clinker. The clinker is then ground again and mixed with gypsum, becoming cement. That cement is then shipped through webs of depots, trucks and distribution centers. It is either bagged and sold to individual consumers or it is combined with aggregate and water in the form of ready-mix concrete for larger projects traveling across vast landscapes in churning mixers. These logistics are materially dense, linking the quarry and city in intimate ways. The city has an insatiable demand for stone. From this angle, it has no outside (Brenner 2014).[2]

[2] My ongoing research traces political ecologies of Thai concrete employing archival, ethnographic and visual methods. The photos here are from that project.

A conveyor belt moves stone from a quarry to a cement factory below, Kaeng Khoi, Saraburi. Photo: Eli Elinoff, 2019.

Yet, beyond, around and within webs of extraction and construction, life continues in complex ways. Is it possible to read the concrete pastoral, particularly its aesthetic of paradox and inversion, differently? Can the aesthetics of ecological disjuncture, so common across extractive landscapes globally, but especially in Southeast Asia where I work, draw attention to the "messy webs" where the "material and the symbolic intertwine" (Oswin 2018: 544)?[3] Can we ask different questions of these paradoxes, leveraging their irresolution to consider the other forms of life that subsist within concrete pastoral spaces?

[3] Southeast Asia has been a rich space for debate about the reach and limits of planetary urbanism (see Gillen, Bunnell and Rigg 2022).

Doing so requires rejecting the ideological smokescreen of the pastoral (Williams 1975) while also holding the totalizing nature of the planetary urban in tension. Stone from this quarry has gone somewhere, becoming that building, highway or dam. In this, the concrete pastoral asserts relations.[4] Stone cement and aggregate draw worlds together, creating tense connections that foreground concrete's richly social properties (Elinoff and Rubaii 2024).

[4] See Harvey 2010 and D'Avella 2019.

↑ A mound of tires sits in a depot outside a cement factory, Khaeng Khoi, Saraburi.
Photo: Eli Elinoff, 2023.

← Buddha waiting to cross the highway, Khaeng Khoi, Saraburi.
Photo: Eli Elinoff, 2019.

At the edge of a cement factory, a pile of tires collects in a depot. The mound of worn rubber suggests another vision of the work of moving stone. Rubber bears the weight of materials in motion. Worn tread makes visible the effects of bad roads made worse by the weight of the materials that move across them as cement, aggregate and concrete

are plied between sites of extraction, production and consumption. Can frayed rubber push us to consider the exhausted bodies of laborers who travel through the same difficult conditions?

The concrete pastoral also leverages gaps, interruptions, inversions and negative spaces to set an analysis into motion. The temple across from this cement factory is not a piece of rural ephemera lost within the extended urban sprawl, but evidence of ways of living sustained in and through stone extraction. Temples are common in such extractive spaces, where sacred mountains sit adjacent to or even within profane, dangerous quarries. Temples mediate the risk of precarious work. Occasionally, they

← This pond is where F.L. Smidth & Co. extracted marl for the cement that was eventually exported to Thailand in the early twentieth century, Aalborg, Denmark.
Photo: Eli Elinoff, 2018.

↓ A golf course at the Mae Moh Lignite mine in Lampang province, Thailand.
Photo: Eli Elinoff, 2020.

In the last few years, this defunct quarry in Chonburi became a sought-after backdrop for selfie takers.
Photo: Eli Elinoff, 2023.

even forestall further development. The mountain behind this temple was not mined for fear of disturbing its spiritual potency.

At the same time, the pastoral also emerges out of the extractive. Ducks splash in the flooded hole of a moribund Danish quarry. Below lies a whole history of the future, an important early source of cement exported to Asia at the turn of the twentieth century (Pedersen 2021). Golfers enjoy a day out on the rim of the open-pit lignite mine once used to fuel Cold War cement factories in northern Thailand. An abandoned aggregate mine in central Thailand becomes a backdrop for a picnic and a selfie. For an entry fee of 300 Baht (10 USD) you can take your picture here too. As extractive sites are depleted, they become something else – new environments for an afternoon idyll. In the right light they are oddly beautiful.

Aggregate waiting to be incorporated into a renovated sidewalk in Bangkok.
Photo: Eli Elinoff, 2020.

A pile of rubble becomes a mountain made strange, Bangkok.
Photo: Eli Elinoff, 2020.

If you're looking for them, even weirder pastoralisms erupt in the city. Piles of gravel, sand and rubble that clutter the sidewalk in Bangkok not only look like the mountains they came from but, upon closer inspection, reveal themselves to be the selfsame materiality made strange. These piles are on their way to becoming something else, perhaps a fancy new hotel or just a blockage in the city's sewer systems as rain washes them down the drain. Either way, they make up a fleeting and novel urban ecology. Or, perhaps they become just the right kind of nuisance: an interruption in a city-dweller's walk to the bus stop that plants a seed of irritation that inspires a vote for regime change at city hall. A few years after the photos above were taken, a new Governor of the Bangkok Metropolitan Administration was elected on the back of a range of technocratic promises to fix the city's ensnarled infrastructure. Within his platform, the jumbled condition of its sidewalks received special attention.

The concrete pastoral reveals the city and the countryside enmeshed in one disjunctive, distributed material ecology. Simultaneously, it suggests that urban forms and extractive spaces are never straightforward. The planetary urban may not have an outside, but the concrete pastoral reveals that it has plenty of withins, throughs, arounds and beyonds.[5]

[5] Natalie Oswin's (2018) important critique of planetary urbanism raises this point.

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