

This work explores aggregates' material cycle and relationship with urban development and private interest, focusing on their critical role in shaping modern cities.

The study delves into aggregates' historical and economic significance, highlighting their role in capitalist expansion and their substantial environmental cost, especially in concrete, which contributes 8% of global greenhouse gas emissions. Particular attention is given to the Canton of Vaud, a region marked by its high degree of aggregate production autonomy and contentious gravel mining practices, as seen in protests like the Mormont ZAD (2020–2021). This region's increasing urbanization juxtaposes its growing opposition to extraction, underscoring tensions between resource consumption and environmental preservation.

By tracing the material flows, regulatory frameworks, and socio-environmental conflicts surrounding aggregate production, the research reveals the hidden spatial dynamics of construction. It adopts a critical stand toward aggregate commodification. Finally, the study analyzes the physical and socio-political spaces shaped by these practices, questioning the sustainability narratives often used to justify urban expansion and iconic architecture.

Aggregates Economies

Material Cycle and Capitalist Urbanization in the Canton de Vaud



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Acknowledgment

The machine itself makes no demands and holds out no promises: it is the human spirit that makes demands and keeps promises. In order to reconquer the machine and subdue it to human purposes, one must first understand it and assimilate it¹.

1. Lewis Mumford, in Martín Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London New York: Verso, 2020), 8.

This text examines the cycle of aggregates and their function in the construction process, which is in turn influenced by economic and political factors. Although it addresses the relatively understudied topic of aggregates, the text draws extensively on the existing literature on concrete, which is receiving increasing attention from both academic and non-academic researchers. It draws extensively on the work of Armelle Choplin, Alia Bengana, Claude Baechtold, Nelo Magalhaes, and Sarah Nichols, among others. Furthermore, reflection on this material is closely associated with critical materialist interpretations of our constructed environment and its relationship with political and economic space, as discussed by Karl Marx, Pedro Arantes, Barbara Macaes e Costa, and David Harvey.

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Introduction

La Tour des Cèdres, n'est pas seulement une tour, ni simplement un édifice résidentiel haut, il est le prototype d'un nouveau mode d'habiter, sorte de landmark, pouvant être identifié depuis Lausanne, en bordure Nord du Léman. Elle porte vers le ciel un bois composé d'arbres d'arbustes, de plantes et de fleur. C'est le symbole vivant d'une nouvelle relation entre la sphère urbaine et la sphère naturelle².

2. Stefano Boeri in 'Les Terrasses Des Cèdres, Rapport Du Jury' (Chavannes-près-Renens, 26 October 2015).

This is how Stefano Boeri describes the ecological qualities of La Tour des Cèdres. This new project will soon rise from the ground. At 120 meters high, it stands as an example of contemporary architecture, designed by Stefano Boeri and commissioned by Orllati Real Estate.

Far from being an anecdote, this building is a symbol. On the one hand, for its size - it will be the tallest tower in the canton of Vaud - and, on the other, for its innovative prototype, which, according to the designer, will redefine our relationship with living species and put biodiversity back at the center of our attention. The designer even sees his buildings as a solution to global warming³. However, such a structure necessitates a particular material condition. Its existence relies on essential materials collected, mixed, and poured together; chief among them aggregates, which form the backbone of concrete production.

3. Jean-Marie Hosatte, 'L'architecte qui enrachine les villes', Information Immobilière (blog), 1 February 2021, <https://www.infoimmo.ch/articles/stefano-boeri/>.

Image of La Tour des Cèdres
© 'Une forêt verticale de 117 mètres pour la tour de Chavannes-près-Renens', infoSport, rts.ch, 3 November 2015,

infrastructure such as La Grande Dixence, which generates electricity, as well as roads and highways but also new development projects, such as the Musée des beaux arts in Lausanne. These projects share a common characteristic: they are designed and constructed in aggregate; either used as raw materials or transformed into the form of concrete. More than ever, built space is synonymous with aggregates and therefore concrete, here and elsewhere. Despite its industrialization, which only began in the 19th century, concrete has become a ubiquitous feature of the built environment. Its presence is so obvious that its disappearance seems impossible. However, in the context of global warming, with concrete accounting for 8% of global greenhouse gas emissions⁴, it is clear that there is a need to reduce its environmental impact. However, our dependence on this resource seems so unsurpassable, that the only way forward seems to be to make it greener.

Concrete is intimately connected with cement, which serves as a bonding agent. Although cement is a crucial component in the production of concrete, it constitutes only a minor element in the overall recipe. The majority of concrete, comprising over 80% of the total volume, is aggregates - sand and gravel. The extensive use of aggregates has led to it becoming the leading material in terms of quantity moved (20GT) and the most extracted material. The primary resource of the Capitalocene is, therefore, an ordinary and abundant material, characterized by its minimal cost and widespread availability⁵.

Nevertheless, it is beginning to receive ever greater attention, firstly because the ever-increasing demand for a finite resource is beginning to create a shortage of material⁶. This looming crisis creates tensions in the market, leading to confrontation and violence. Another

4. Nelo Magalhaes, *Accumuler Du Béton, Tracer Des Routes, La Fabrique* (Paris, 2024), 48.

5. Magalhaes, *Accumuler Du Béton*, 18.

6. UNEP, 'Sand Mining: The Problem with Our Dwindling Sand Reserves', 2 June 2023, <https://www.unep.org/news-and-stories/story/problem-our-dwindling-sand-reserves>.

7. Vince Beiser, 'Why the World Is Running out of Sand', accessed 28 October 2024, <https://www.bbc.com/future/article/20191108-why-the-world-is-running-out-of-sand>.

8. Bárbara Maçães e Costa, 'Conduit, Patio, Waste: Mapping Environmental Relations in Bairro Da Malagueira' (EPFL, 2021), 13.

9. Maçães e Costa, "Conduit, Patio, Waste", 14.

10. Magalhaes, *Accumuler Du Béton*, 15.

11. Magalhaes, *Accumuler Du Béton*, 92.

problem with this material is the environmental and social impact of its massive extraction. Because of the short-distance transport, the impact is very close and visible from the construction site. This proximity creates contrasting opposition, coming from the extraction site as from the construction site, from the population opposing these projects⁷.

Although vital to the manufacture of concrete, this material is often overlooked. This work seeks to put aggregates back at the center of this process, which in the long term makes it possible to create the cities and infrastructures in which we live. The objective is to uncover the processes of production that lie behind the commodity⁸. Indeed, the composition of space is shaped by the full and the empty; gravel pits and construction. This composition takes place spatially, hollowing out certain peripheral spaces to fill the center. This physical space is a product, due to a specific interplay between materiality, technology, and ideology, but also of specific power relation benefiting to certain group. This configuration and the underlying reasons for it are one of the subjects of this work^{9,10}.

The salient feature of aggregates is the considerable expense associated with their transportation, which is a consequence of the cast quantity transported compared to the relatively low cost of sale. This situation renders international extractivism unfeasible, except for some countries characterized by high GDP and no access to sand. The production and consumption of concrete is based on ordinary extractivism¹¹, as a result, the production-consumption cycle can be observed on an ultra-local scale (within a 50km radius). This specificity of this resource makes it impossible for states and enterprises to externalize production, as well as to displace negative impacts to third countries. This particularity enables a very close observation of this cycle inside a very small territory, covering the entire line of production and consumption.

This study will attempt to trace the role of aggregates in this process of spatial production. To this end, the initial chapter will provide a comprehensive overview of the utilization of aggregates and concrete, incorporating historical and theoretical insights.

More especially, this study will concentrate on a particular geographical area, namely the canton of Vaud, to examine the regional management, requirements, and movements of aggregate supply, as well as the interaction between the state and the private sector in the context of gravel management and exploitation. The rationale for focusing on this region is twofold. Firstly, the canton demonstrates a high degree of autonomy in aggregate production, with 70% of aggregate produced within the canton. Secondly, the gravel pits and quarries in this region have been the subject of considerable public and media attention since the Mormont ZAD (Zone To Defend), in 2020-2021 and other local protests (Vufflens La Ville, Ballens, Aubonne)^{12,13}. Conversely, the canton has a dynamic economy, particularly in the vicinity of the Geneva Lake, which has resulted in substantial urbanization of which La Tour des Cèdres stands as an example. This has led to a paradoxical situation where, despite the region's growing demand for aggregates and concrete, there is mounting opposition to gravel mining and its associated issues, including loss, noise pollution, and environmental degradation.

The final section will concentrate on the physical spaces that are generated through the extraction and utilization of aggregates. This section will seek to understand the materiality of these production relationships and their concrete impact on the spaces to which they are attached. This section will continue to examine this case study in the Vaud region, with a particular focus on the Lausanne area, the capital of the region, and the surrounding region of Pied du

12. Erwann Le Bec and Sylvain Muller, 'Les zadistes expriment ce que beaucoup de monde pense tout bas', 24 heures, 21 March 2023, <https://www.24heures.ch/les-zadistes-expriment-ce-que-beaucoup-de-monde-pense-tout-bas-860075650175>.

13. Camille Krafft, 'A Ballens, le bras de fer autour du projet de super-gravière ne fait que commencer', Le Temps, 7 September 2024, <https://www.letemps.ch/suisse/val-de-a-ballens-le-bras-de-fer-autour-du-projet-de-super-graviere-ne-fait-que-commencer>.

Jura, which is a significant supplier of aggregates to the region. The construction of La Tour des Cèdres in Chavannes-près-Renens serves as an illustrative example of how architecture serves real estate developers to create value through the utilization of iconic, greenwashed buildings. This chapter seeks to foster a more critical approach to our utilization of aggregates, moving beyond the conventional rhetoric of necessity to which construction has responded.



Gravière de Bière

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Aggregates of Capital: Concrete in Economic Growth

La façon dont les hommes produisent leurs moyens d'existence dépend, en premier lieu, de la nature (...). Ainsi ce que sont les individus dépend des conditions matérielles de leur production¹⁴.

14. Karl Marx, Philosophie (Paris: Gallimard, 2019), 306.

Before delving into the politics of aggregate management, this chapter aims to provide a broader perspective by outlining historical and theoretical elements of the relatively short period during which concrete industrialized and spread, first in Western societies and then globally. The objective is not to provide an exhaustive account of the complex history of concrete; rather, it is to present an overview of its dissemination and its interconnections with economic and political structure. This chapter is mainly focusing on the subject of concrete. While the paper concentrates on aggregates, the industrial extraction of aggregates as we know it today is inextricably linked to the increasing use of concrete in construction. To comprehend the trajectory of concrete is also to understand that of aggregates.

The history of concrete use is a complex and multifaceted subject, and as such, it is beyond the scope of this chapter. Other authors, including A.Forty, N.Magalhaes, S.Nichols and others, have addressed the increasing utilization and public acceptance of concrete. It is pertinent to note that the first appearance of concrete in its modern form

15. Magalhaes, Accumuler Du Béton, 52.

16. Anselm Jappe, Béton. Arme de Construction Massive Du Capitalisme (Paris: Editions L'échappée, 2020), 85.

17. Alia Bengana, Claude Baechtold, and Antoine Harari, Béton - la fin d'une ère? (Chêne-Bourg: Heidi.News, 2021), 129.

18. Michel Folliet, 'Cementing the Foundations of Growth | Proparco - Groupe Agence Française de Développement', accessed 14 October 2024, <https://www.proparco.fr/en/article/cementing-foundations-growth>.

19. Sarah Nichols, 'Opération Béton: Constructing Concrete in Switzerland' (Zurich, ETHZ, 2021), 73.

20. Philippe Genestier and Pierre Gras, Sacré béton ! fabrique et légende d'un matériau du futur (Lyon: Libel, 2015), 95.

21. Genestier and Gras, Sacré béton, 96.

22. Magalhaes, Accumuler Du Béton, 47.

occurred during the Industrial Revolution. However, its widespread utilization commenced following the Second World War and the subsequent period of reconstruction and economic expansion¹⁵. Initially employed for infrastructure purposes, its utilization has subsequently been extended to encompass all levels, including roads, housing, bridges, educational establishments, universities and so forth. Global cement production increased exponentially between 1950 and 2019, rising from 200 million tons to 4.4 billion tons, representing a 22-fold increase in consumption¹⁶. From a material initially regarded as inferior, it has become a defining feature of contemporary architecture. Currently, concrete represents over 80% of the global market for building materials¹⁷. While concrete consists of 80% aggregates, this material occupies a particularly significant position in this market. Since the early 20th century, there has been a steady increase in concrete consumption, and this trend is expected to continue, particularly in rapidly developing economies such as India and Nigeria¹⁸. The recent history of concrete is therefore characterized by a significant expansion in its use, with developments across all construction sectors in the majority of countries worldwide.

Unlike other construction materials, concrete has the specificity of being a regional product. While the raw material needed for concrete - cement¹⁹ and aggregates - is available almost in all regions, specifically in Europe, and can therefore be extracted more widely throughout the country, the creation of cement necessitates the use of large-scale kilns, which favors the concentration of its manufacture in large units owned by major industries²⁰. The significance of cement production is therefore determined in particular by the kiln and the technological innovations that improve it. This system, which encouraged the concentration of production, created the large cement groups that are currently in existence^{21,22}.

The increasing utilization of concrete is inextricably linked to the development of the capitalist economy from the advent of the 20th century to the present day. Concrete, like aggregate, is often used as a means of creating space²³. Space is always a product, which implies an activity using raw resources (like aggregate), as well as the economic, legal and political systems that accompany its production. Consequently, the design and fabrication of space are embedded in a social process, thereby defining a specific mode of existence within that space²⁴. The relationship between concrete and economic development is particularly evident in so-called “emerging countries.” In countries with a low GDP, there is a positive correlation between GDP growth and increased cement consumption²⁵.

To comprehend the part played by this material in capitalized economic growth, it is possible to distinguish between two functions. The first of these is the construction of roads and highways, where concrete, or more specifically, gravel and asphalt, plays a pivotal role in facilitating the exchange of goods. For this function, aggregate is also particularly important when used as raw materials to stabilize the soil. The second function takes place in the built environment, which is currently predominantly composed of concrete. Here, it fulfills the role of city builders, increasing capital value through the commodification of built space.

The fabrication of roads and highways represents a significant aspect of capitalist acceleration of flow, as developed by N. Malaghesse in *Accumuler du béton, tracer des routes*. This evolution in mobility infrastructures began with the development of the train in the second half of the 19th century. This construction venture created the first major demand for gravel, as well as the systematization of earthworks for infrastructure work, and thus a first step in the business of soil abstraction²⁶.

23. Henri Lefebvre, *La production de l'espace*, 4e éd, Ethno-sociologie (Paris: Anthropos, 2000), 102.

24. Magalhaes, *Accumuler Du Béton, Tracer Des Routes*, 25.

25. Folliet, 'Cementing the Foundations of Growth | Proparco - Groupe Agence Française de Développement'.

26. Magalhaes, *Accumuler Du Béton*, 57, 86.

27. David Harvey, *Spaces of Capital. Towards a Critical Geography* (Copyright, 2002), 100.

28. Martín Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London New York: Verso, 2020), 105.

29,30. Magalhaes, *Accumuler Du Béton, Tracer Des Routes*, 58,76.

31. Magalhaes, *Accumuler Du Béton*, 124.

The construction of railways represents the first step in the process of making freight transportation more fluid. The highway represents this second step, allowing traffic to flow freely, free from the various constraints of the normal road. Their construction received a significant boost in the 1960s. Highway design is geared toward speed and volume, with optimization of curve radius, grade, width and other factors for speed and high loads. This new infrastructure aligns with what David Harvey calls “the annihilation of space through time”, facilitating greater ease and speed of exchange²⁷. This fluidification of flux is one of the key elements of the acceleration of capital valorization and reproduction²⁸.

This abstraction of the land required extensive earthwork and pavement thickening by the addition of concrete layers that can withstand the weight of trucks^{29,30}. Building these enormous infrastructures is not a straightforward process. If the project is to gain acceptance from the state and the population, it must demonstrate a clear economic benefit, particularly in accelerating the flow of traffic. In particular, they will utilize the media to construct a framework for ideological debate, within which the issues raised can be addressed by reinforcing existing infrastructure³¹. The emergence of highways is not an obvious phenomenon, rather the result of a historical process designed to facilitate the flow of goods and promoted by the business community. These same groups are responsible for framing the ideological debate around these infrastructures, making their use self-evident

Highway between Morge and Lausanne

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and their expansion the only solution to the problems they create. The co-dependence between aggregate and highways is significant, as this material enables the construction of such infrastructure. Additionally, the heavy process of transporting aggregate over distance is made possible by the construction of infrastructure, specifically highway that facilitate the transportation process.

Aggregates have thus played a significant role in the construction of highways, and thus easing the transportation of goods, which is essential for capitalist growth based on ever-increasing long-distance trade. However, their importance extends beyond road infrastructure. Aggregates are also a crucial component of concrete, which has been used in the construction of cities for over 80 years.

Aggregates are driven by the making of concrete in the construction industry. It's caused by a number of factors, including population growth and urbanization, as well as economic growth and the resolution of crisis³². As developed by Harvey, in particular in *Abstract from the Concrete*, the expansion of the Chinese construction sector and concrete use, which has been defined by significant investment, particularly from the state, has been identified as a means of addressing the 2008 crisis through the stimulation of the construction industry^{33,34}. This dynamic is also pointed out by Pollux, who highlights how the cement industry links concrete production to real estate by investing in infrastructure and creating demand for its product, driven by the constant need for new markets and resources³⁵.

This interconnection between concrete, urbanization, and the advancement of the capitalist economy is also evident in west-central Africa, as illustrated in Armelle Choplin's book *Matière grise de l'urbain*.

32. Folliet, 'Cementing the Foundations of Growth | Proparco - Groupe Agence Française de Développement'.

33. David Harvey, *Abstract from the Concrete* (Berlin: Sternberg Press, 2016), 27.

34. Charlotte Malterre-Barthes, 'Architecture's Good Intentions, or the Political Economy of Space', in *On Architecture and Greenwashing*, Hatje Cantz Verlag, vol. 1, *The Political Economy of Space*, 2024, 8.

35. Sarah Nichols, 'Pollux's Spears', *Grey Room* 71 (June 2018): 141–55, https://doi.org/10.1162/grey_a_00246.

36. Armelle Choplin, *Matière grise de l'urbain: la vie du ciment en Afrique*, vuesDense-bleEssais (Genève: MetisPresses, 2020), 80.

37. Choplin, *Matière grise de l'urbain*, 89.

38. Pedro Fiori Arantes, Reinhold Martin, and Pedro Fiori Arantes, *The Rent of Form: Architecture and Labor in the Digital Age*, trans. Adriana Kauffmann, Buell Center Books in the History and Theory of American Architecture (Minneapolis, MN: University of Minnesota Press, 2019), 2.

39. Sergio Ferro, *Concrete as Weapon*, n.d., 5.

The city is thus a decisive factor in globalization and competitiveness. Urban and economic growth are strongly correlated. To this end, the World Bank is making cement a decisive element in this development. Cement is not just a profitable commodity for cement manufacturers but is also seen as a key element in the development of a country's economy³⁶. Thus, capitalism in African Cities could be generated by the action of building, destroying, and concreting³⁷. The link between concrete and capitalist economic growth is then quite exemplified and widespread as a worldwide phenomenon.

The advent of a new form of capitalism, which is more finance and rental-oriented, has led to a transformation in the role of construction and how it can be made profitable. Instead of focusing on the intrinsic value of buildings, there has been a shift towards optimizing surplus production by promoting the image of buildings as a means of attracting capital. This has resulted in buildings becoming objects whose value is detached from the value of labor and material. This is achieved through a fictitious value derived from the process of rent of form, which is heavily related to new materials enabling them to take on special forms, such as *concre*³⁸.

The role of concrete in the construction industry is also defined in relation to the fluidification of the building process. As emphasized by Ferro, the process of planning and building with concrete has been accompanied by a long history of the dispossession of builders' knowledge, a strategy employed by capitalists to prevent strikes, reduce wages, and centralize power³⁹.



The increased use of aggregate and concrete in infrastructure and buildings is therefore linked with the growth of the capitalist economy, in which, in search of surplus production, aggregates meet several goals such as easing the flow of materials and accelerating the construction process, but also the commodification of form. This chapter adopts a global perspective and employs a theoretical approach to examine the rapid and extensive utilization of concrete in a relatively short period of history. The subsequent chapter will investigate the exploitation of aggregate resources in a specific region, examining the diverse legal and actor-based arrangements that facilitate this process.

West-Lausanne under
urbanisation process

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Managing Aggregates: Policy and Industry in the Canton de Vaud

Regional Consumption

Aujourd'hui de toute façon on a besoin de béton, on a besoin de ciment, ainsi que de décharge et gravière⁴⁰.

40. Avni Orllati in *L'empire Orllati*, accessed 14 October 2024, <https://latele.ch/emissions/entrepreneurs/entrepreneurs-s-2021-e-33>.

In these words, Avni Orllati, the founder of the Orllati Group, a prominent entity in the construction and deconstruction sector within the canton of Vaud, elucidates the subject of concrete consumption and the criticisms levied against it in the region. These words are not limited to Mr. Orllati but reflect the canton's policy on gravel management in construction. The latter assesses a stable need for aggregates, notably due to demographic growth, which is resulting in the densification of urban areas and the construction of ever larger, taller, and deeper buildings⁴¹. The canton uses a stable quantity of concrete each year, requiring approximately 2.2 million m³ of gravel and sand per year⁴². The primary function of aggregate is its use in the production of concrete. As previously stated, aggregate is mixed with up to 80% cement and water to form concrete, which is then alloyed with reinforcement to create reinforced concrete. This is the primary purpose for which aggregate is extracted. It is also occasionally utilized in its unmixed state, predominantly for the construction of roadways, where it serves as a foundation for the application of asphalt (which also necessitates the use of gravel), but also as a stabilizer in the construction sector. The proportion of domestic gravel production remains relatively consistent, representing approximately 70-80% of the canton's consumption, while 20-30% is imported from France⁴³.

41. Etat de Vaud – DGE-DTE, 'Plan de Gestion des Carrières', 2014, 17.

42. Etat de Vaud – DGE-GEODE, 'Carrières, gravières, décharges et recyclage des déchets minéraux', 2022, 1, https://www.vd.ch/fileadmin/user_upload/themes/territoire/construction/carrieres_gravieres/fichiers_pdf/Rapport_2021.pdf.

43. Etat de Vaud – DGE-GEODE, 'Carrières, gravières, décharges et recyclage des déchets minéraux', 2022, 1, https://www.vd.ch/fileadmin/user_upload/themes/territoire/construction/carrieres_gravieres/fichiers_pdf/Rapport_2021.pdf.

In Switzerland, concrete has a particularly dominant position in the construction industry, being the primary raw material used in the majority of structures. Aggregate is therefore a material with a high degree of usage and a near monopoly in all types of construction. This is evident in the construction of buildings, where concrete is the primary material used. Furthermore, aggregates are employed extensively in constructing infrastructure, particularly in developing road networks. The diagram above provides a detailed overview of the utilization of gravel in the built heritage of Switzerland. Given that concrete is composed of 80% gravel, it can be seen that its use is distributed equally between the real estate and infrastructure sectors. It is also noteworthy that this graphic assesses the entirety of Switzerland's built capital. The 50/50 split between infrastructure and buildings is therefore a long-term one, particularly following the substantial construction of roads and freeways in the latter half of the 20th century. It should be noted that in the current era, and since the 2000s, there has been a notable increase in investment in the

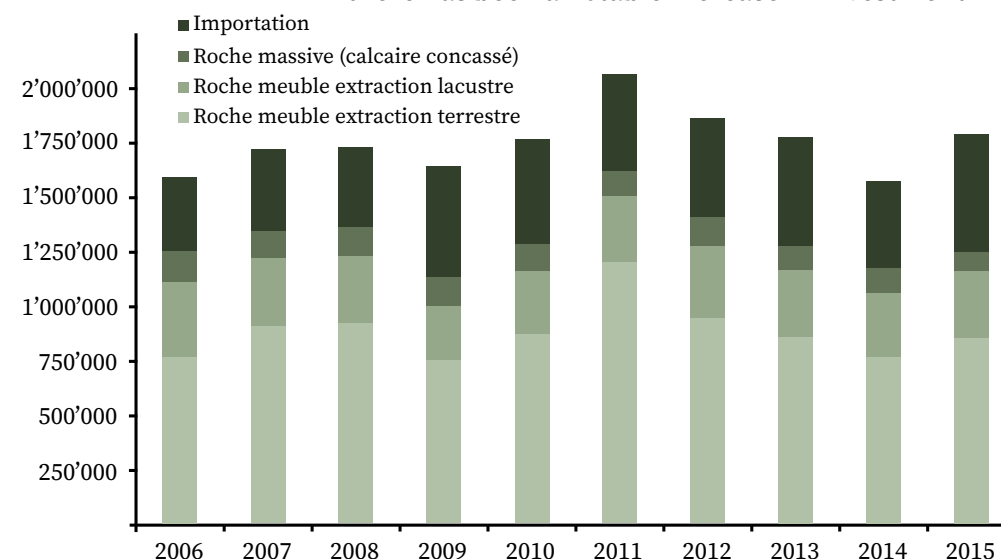


Figure 1: Evolution of the production and import of natural aggregates during the last deceny

Etat de Vaud – DGE-DTE, 'Plan de Gestion des Carrières', 11.

private building sector. Consequently, the distribution of raw materials is shifting towards this sector to a greater extent than that of infrastructure⁴⁵.

The unquestionable prevalence of concrete is even endorsed by the state. The objective of guaranteeing a consistent supply of mineral resources (gravel, limestone, marl) is enshrined in law, thereby ensuring the availability of essential materials for construction companies coming from the canton. This necessity is enshrined in the canton’s legislation, which mandates a continuous supply of gravel to the canton⁴¹. This legislation establishes a land use management tool, known as a quarry plan (PDCAR, Plan Directeur des Carrières), which is utilized to identify areas with rich soils that can be exploited for quarrying activities⁴⁶.

44. swisstopo, ‘Matières premières nécessaires à la fabrication du ciment – Besoins et état de l’approvisionnement en Suisse’, 2020, 13.

45. ‘Loi Sur Les Carrières’, Pub. L. No. 931.15 (2013), Art. 4.

46.Loi sur les Carrières, art.4.

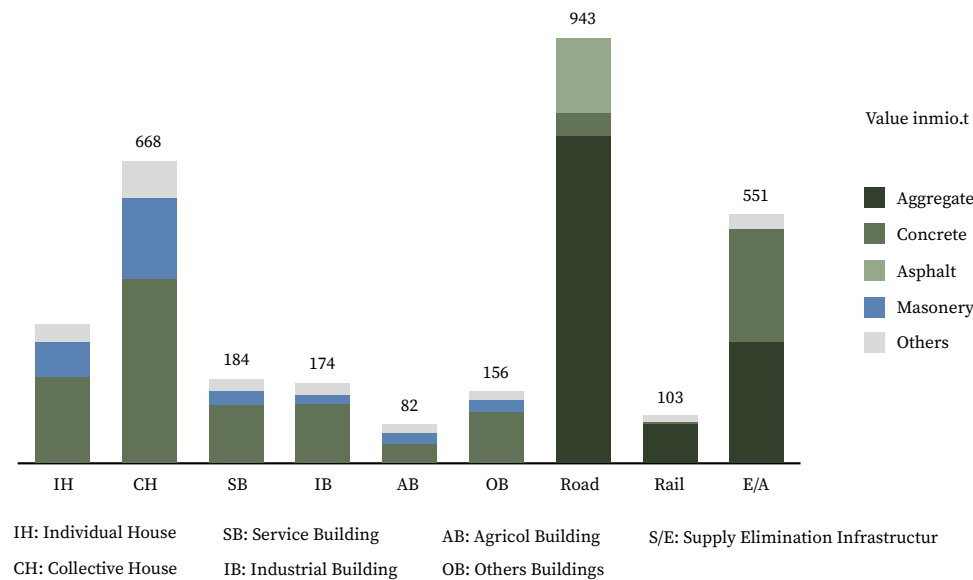


Figure 2: Part of the different construction material by cate-gory in switzerland in 2015
swisstopo, ‘Matières premières nécessaires à la fabrication du ciment’, 13.

In the canton of Vaud, the greatest demand for aggregates is concentrated in the region of Lausanne-Morges, representing over 50% of the total demand within the canton. This percentage is calculated by a ratio between the population and the number of jobs. Consequently, the necessity for aggregates is significantly correlated with urban and economic growth, as previously outlined by Choplin.



Figure 3: Spacialisation of nat-ural aggregates need in Canton de Vaud
Etat de Vaud – DGE-DTE, ‘Plan de Gestion des Carrières’, 9.



The construction industry is responsible for the generation of a considerable quantity of waste. Primarily, this is due to the earthworks that are necessary for the construction of the building. This displaced earth is considered waste (generally Type A) and must be stored somewhere.

Secondly, the lifespan of concrete buildings is relatively short, and the material is not directly recyclable. Each time a building is demolished, a significant amount of waste is created, particularly type B waste. The management of this waste is supervised by the State of Vaud, and its export is not normally authorized, so it must be disposed of within the canton. Type A waste is generally excavated soil, which can be used to fill in former extraction sites, particularly gravel pits. In the canton, this represents 40% of the total waste stream, with the remainder being directed to Type A landfill sites⁴⁷. The canton defines landfills through the sectoral landfill plan, which functions in a manner analogous to the PDCAR⁴⁸. Type B waste encompasses construction waste, including concrete and other mineral materials. Concrete waste is sometimes recycled into recycled concrete by the process of crushing it, whereby the remaining concrete is transformed into aggregates. The remainder of the concrete is landfilled in a type B landfill, which is also defined by the landfill management plan.

47. Etat de Vaud - DGE-GEODE, 'Carrières, gravières, décharges et recyclage des déchets minéraux', 4.

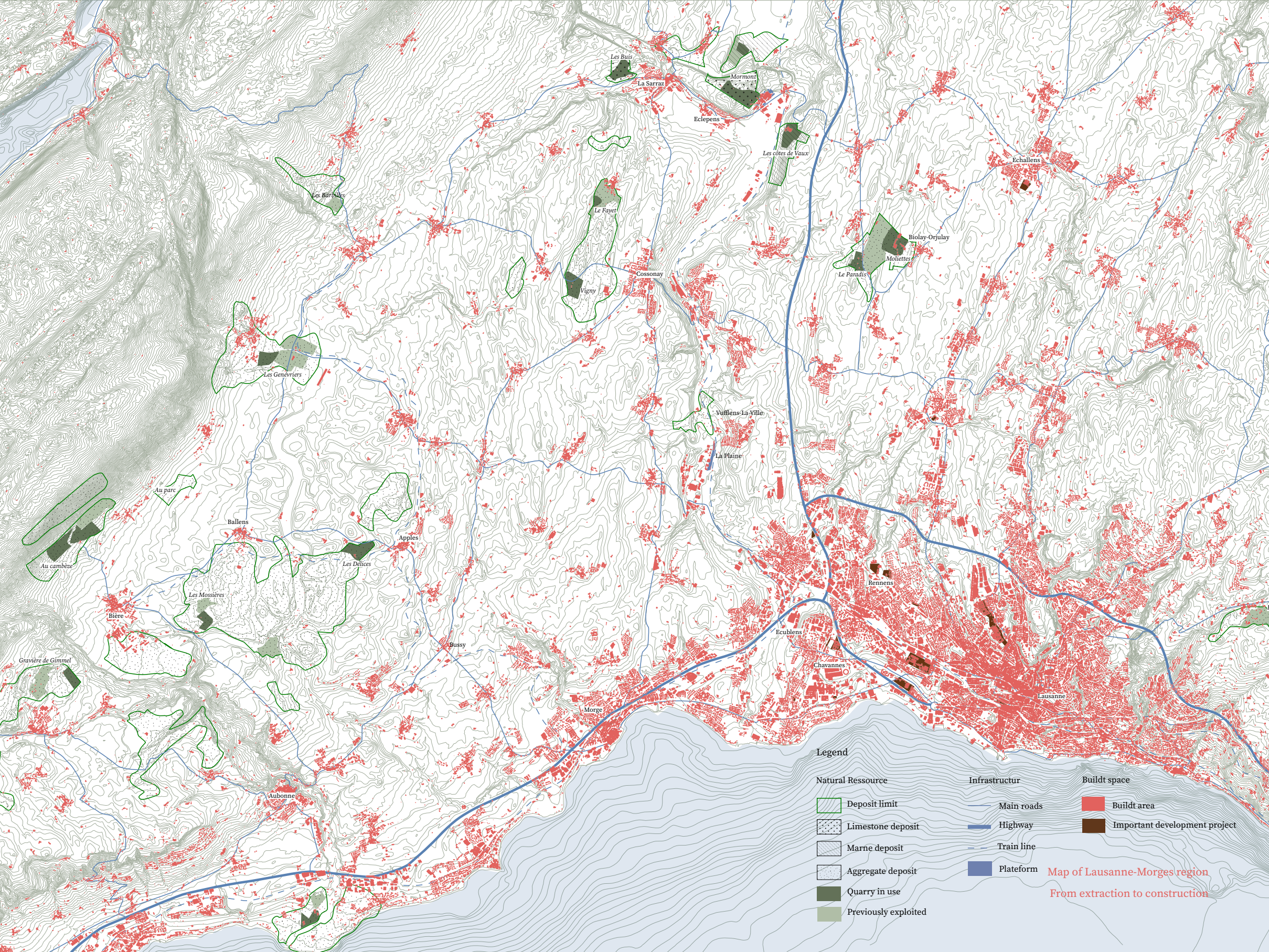
48. DGE-GEODES Etat de Vaud, 'Plan Sectoriel Des Décharges 2024', June 2024, 99.

Landfill

© "Politique environnementale: la terre issue de la construction peine à se trouver une place." 24 Heures,

Thus, the Canton de Vaud has a stable and legally enshrined need for aggregates and concrete, which form the foundation of its construction activities. This demand is not subject to question; rather, it is integrated into the region's legislative framework to ensure consistent availability. Moreover, the canton implements a robust control policy that not only guarantees the steady provision of aggregates but also landfill management.

Having gained a deeper understanding of the canton's supply and waste management requirements, we will now examine the relationship between the state and the private sector that enables the extraction and supply of gravel for construction sites in the canton.



Legend

Natural Ressource

- Deposit limit
- Limestone deposit
- Marne deposit
- Aggregate deposit
- Quarry in use
- Previously exploited

Infrastructur

- Main roads
- Highway
- Train line
- Platform

Buildt space

- Buildt area
- Important development project

Map of Lausanne-Morges region
From extraction to construction

The Quarry, the State and the Private

*Décidement, dans le monde
des gravières, si le sable est
d'argent, le silence est d'or⁴⁹.*

49. Alia Bengana, Claude Baechtold, and Antoine Harari, *Béton - la fin d'une ère?* (Chêne-Bourg: Heidi.News, 2021), 106

In order to gain a better understanding of the complex interrelationship between the public and private sectors, and of the situation regarding the extraction and use of aggregates in the canton of Vaud, this chapter will focus on a specific region. This region is defined in the Gravel Pit Management Plan (PGCAR) as the region that consumes the most gravel - more than 50% - the Lausanne-Morge region. The region is characterized by high consumption levels due to its large population and robust economic growth, a phenomenon that is particularly evident in the dynamic Lake Geneva region. The region also includes a specific area known as “Pied du Jura”, which is characterized by an abundance of loose rock and is a strategic place for gravel extraction in the canton. Having gained a more comprehensive understanding of the canton’s supply and waste management needs, the following analysis focuses on the interplay between the state and the private sector that facilitates the extraction and supply of gravel to construction sites within the canton.

The diagram illustrates the canton’s strategy for managing its gravel deposits in the Jura region,

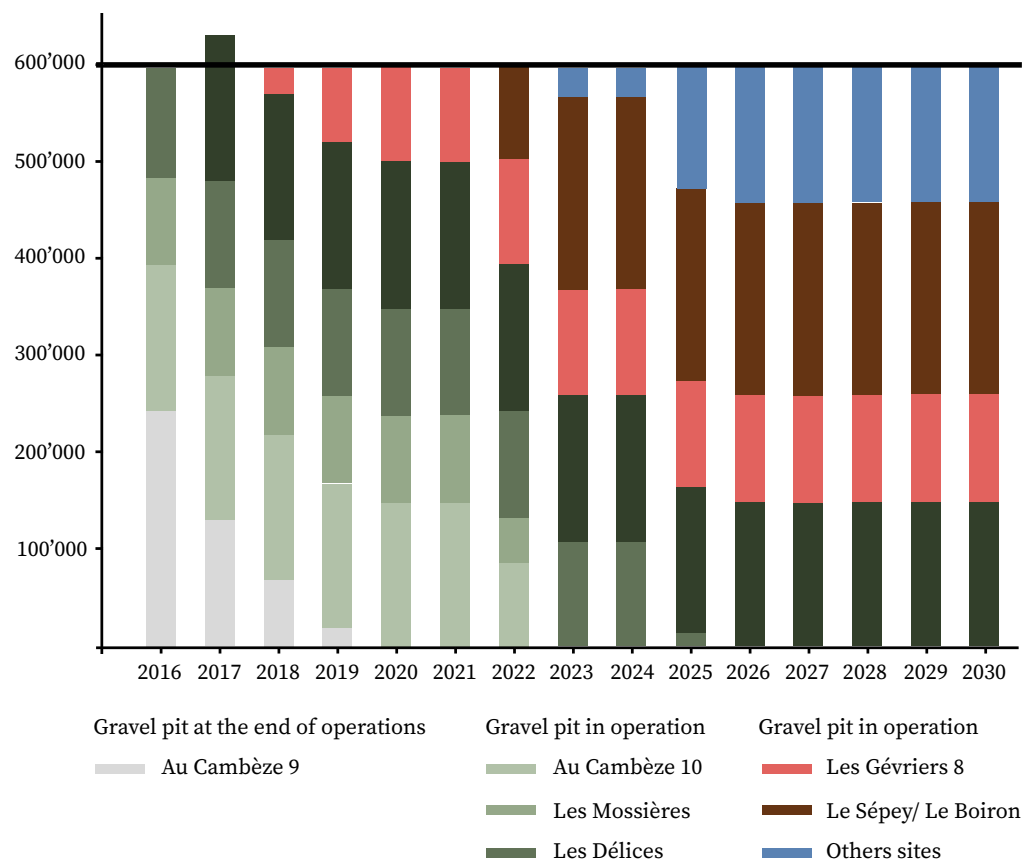


Figure 4: Succession of exploitation of gravel pit in Pied du Jura region

Etat de Vaud – DGE-DTE, 'Plan de Gestion des Carrières', 20.

which focuses on prioritizing specific gravel pits for exploitation over a given period. The canton's focus on this region is due to its abundance of raw materials. Extraction of other elements, governed by cantonal laws, is also undertaken, including limestone and marl, which are found in smaller quantities and used to a lesser extent in cement production. The cantonal reserves are located at the Eclepens site, operated by Holcim. These reserves, which are mined and directly processed into cement by the cement industry, located adjacent to the quarries, supply the entire canton with cement. The canton's unique source of raw materials for cement comes from a single site, which is owned by a single company - Holcim.

This circumstance results in the entity's possession of a monopoly on this strategic resource in the canton. This arrangement ensures a reliable and consistent supply of the material for the canton, eliminating the need to rely on external sources.

The canton is responsible for defining its aggregate requirements, for which it utilizes a tool known as the Quarry Master Plan (PDcar). This is a canton-wide inventory of available deposits that incorporates geological data and any limitations (built-up areas, protected sites, etc.)⁵⁰. The inventory results in a map delineating specific areas suitable for gravel pits, depending on the canton. The canton also has a second tool, the Quarry Management Program (PGCar), which contains a prioritization of the various deposits. This enables the state to regulate gravel extraction according to its needs, facilitating the issuance of permits following the canton's priorities. Furthermore, the canton can establish a program to open new gravel pits when older sites are depleted. The operation of gravel pits is conducted on a zone-by-zone basis, with the canton granting permission for the operation of each new zone of a gravel pit, taking into account the constraints imposed, such as the need to fill in previously operated zones to operate the new zones. The state's control over gravel ends with the issuance of the operating permit, after which the operation is managed by private companies. To extract the soil, it is first necessary for them to gain control over it, either by purchasing it or by signing an exploitation agreement with its owner. The next step is to obtain the operating permit from the state, a process that is subject to a lengthy procedure. This permit also imposes certain constraints, such as the protection of designated areas or the maximum depth at which the extraction can take place. The permit enables the temporary change in use of the area into a gravel pit for the duration of the extraction. The responsibility for restoring the area to its previous state lies with the

50. Etat de Vaud – DGE-DTE, 7.

enterprise once the period of exploitation has come to an end⁵¹.

The extraction of aggregate constitutes merely one facet of the management of a gravel pit. Consequently, for the majority of enterprises, a more lucrative aspect is the subsequent waste landfill of type A, following the exploitation period. It is the responsibility of companies to restore the land to its original state, a process which necessitates the filling of holes. The utilization of type A waste enables companies to offer a service, a process that requires less manpower and sorting work. Consequently, this aspect of operations is often viewed as a more lucrative undertaking in comparison to the extraction phase, thereby rendering it a potentially more appealing prospect for companies engaged in the management of gravel pits⁵². The extraction of gravel, on its own, does not represent the core component of the industry under consideration in terms of economic interest. However, its extraction holds strategic importance for controlling the production chain, with profits becoming geographically embedded within the construction sector. The primary advantage of gravel mining lies in its role in vertical integration for construction companies—enabling them to control various stages of the supply chain and reduce dependence on external suppliers. Moreover, it allows them to control vacant spaces, which can later be monetized as landfill sites.

The target area (Lausanne-Morges) is distinguished by a distinctive geology, containing more than 80% of the canton's natural aggregate reserves⁵³. This particular situation gives rise to a concentration of resources in one area, which then supplies a significant proportion of the region with aggregates. These characteristics render it a prime location for entrepreneurs wishing to exploit this resource. Aggregates are exported over relatively short distances⁵⁴, with export distances in the canton of Vaud amounting to around 30 km. This

51. Based on field discussions with chief of the Geology Section, 7.10.24.

52. Based on field discussions with anonymous gravel pit manager, 25.11.24.

53. Etat de Vaud – DGE-DTE, 19.

54. Magalhaes, Accumuler Du Béton, 90.

55. Magalhaes, Accumuler Du Béton, 90.

56. Bengana, Baechtold, and Harari, Béton - la fin d'une ère?, 27.

57. Bengana, Baechtold, and Harari, Béton - la fin d'une ère?, 24.

feature facilitates local production despite higher operating costs compared to France, resulting in the absence of any protectionist measures and the sale of gravel at market price. The current situation in the canton of Vaud (30% of aggregate is imported) reflects a balance between local and French extractivism, the latter being more profitable but expensive to bring into the canton. This dynamic renders the mining areas at “Le Pied du Jura” particularly intriguing, as they possess a near monopoly on supplying the region with gravel due to their proximity to the center.

Due to the substantial investment in machinery, the low production costs, and the restrictions imposed by transport costs and state land regulations, a quarry naturally functions as a monopoly⁵⁵. Heidi.News, an investigative newspaper in French-speaking Switzerland, has conducted a comprehensive investigation into aggregate extraction in the canton of Vaud, with a particular focus on the Pied du Jura region and the various issues involved. The investigation, titled *Béton La fin d'une ère*, written by A.Bengana, C.Baechtold and A.Harari, explores the implications of these issues. The results demonstrate that the extraction of granulates is a highly lucrative enterprise, characterised by reduced risk-taking on the part of companies, and revenues that are, at worst, stable, and, at best, constantly growing⁵⁶.

The revenue of a gravel pit is derived from two sources. Firstly, the sale of aggregate, which is approximately 30 Swiss francs per square meter. Notably, this stable price has only increased in the last 20 years, and this trend is predicted to continue as the canton faces challenges in opening new quarries. These challenges include growing opposition from the population, lengthy procedures, and depletion of gravel sources in the canton⁵⁷. Secondly, the gravel pit can be utilized as a landfill site for type A waste. Following the conclusion of the extraction process, the operator is remunerated

to dispose of the waste. The revenue generated from selling landfill space is approximately 30 Swiss francs per cubic meter, and this figure is anticipated to rise further due to the imminent exhaustion of the canton's landfill reserves and the legal prohibition on the export of waste beyond the canton's boundaries⁵⁸. Moreover, the costs associated with the second phase—landfilling—are significantly lower, as this process demands less machinery, reduced manpower, and minimal supervision. These factors render quarries attractive investment prospects. This dynamic has given rise to tensions between the various groups operating within these areas, as evidenced by the case of the gravel pit of *Le Sepey* in Ballens. Here, two prominent local entities, Holcim and Orllati, are engaged in a competitive struggle for control of the gravel pit and its substantial yield⁵⁹.

58. Martignier Loraine, 'Plan de gestion des déchets 2016 - révision 2020', 2016, 21.

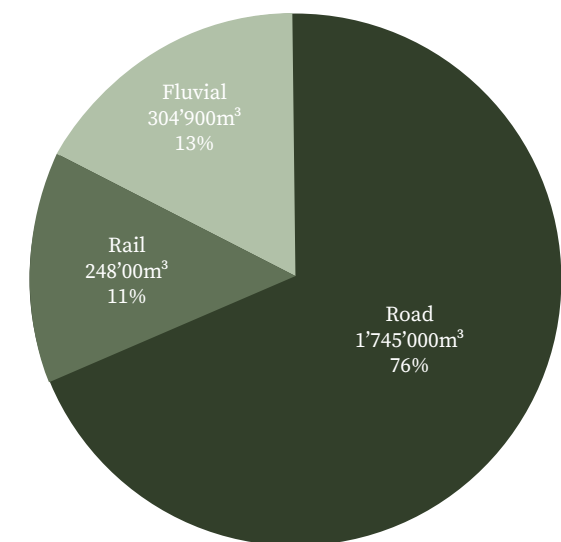
59. Bengana, Baechtold, and Harari, *Béton - la fin d'une ère?*, 32.

Site Concrete-mixer, in Chavanne

© Porteret-Lalé in *The Pace of Space*, Critical reading of the Labour Process from the Swiss Construction Site

Following the extraction of the material, it is then either sold to a resale platform, such as La Plaine in Vufflens-la-Ville, or – and this is the most common occurrence – sold directly on-site and transformed into concrete. The aggregates market thus operates on a just-in-time basis, with gravel mined in the morning being poured on a construction site within a 30 km radius in the afternoon. In the canton, the majority of this material is transported by truck; however, rail transport is another option, albeit with the necessity for significantly more infrastructure and an intermediate location (such as the Plateform de la Plaine) for material storage, which consequently renders it less economically and temporally attractive. In terms of time, train transport takes over six hours to deliver aggregates to La Plaine, followed by truck transport to construction sites. As a result, the overall duration is more than tripled compared to using truck transport alone. State incentives to reduce transport-related pollution and opposition from the population make its continued existence possible⁶⁰.

60. Based on field discussions with anonymous gravel pit manager, 25.11.24.



Repartition of different transport modes of materials in the Canton in 2015

Etat de Vaud – DGE-DTE, 'Plan de Gestion des Carrières', 13.

The regulatory framework established by the state to extract aggregate resources favors large groups across various levels. Primarily, the limited areas designated by the canton for this purpose restrict the number of companies with the opportunity to exploit these resources. The process of lobbying with local authorities or private individuals to obtain the right to exploit the land favors groups with substantial financial and legal resources, enabling them to gain the trust or fear of the various landowners⁶¹, who are often farmers with a strategic position within the village council. Their land ownership gives them a vested interest in either selling or leasing their property to industry, thus making them valuable contacts for industrial actors seeking to expand their operations. However, the personal interests of these farmers often conflict with the broader interests of the village. Yet, due to their influential position in the village hierarchy, they can prioritize personal interests over the public's⁶². Secondly, the economic rationale for gravel mining is further enhanced when the company owns the subsequent production lines, enabling it to adopt a vertical integration strategy. For instance, Orllati, a company with a portfolio encompassing gravel pits and urban development sites, can offer its gravel at preferential prices for utilization in its development projects. This strategy enhances the profitability of the various stages within the production chain⁶³. The extraction process itself requires a minimal workforce. For a gravel pit such as *Les Délices* or *Cambèze*, the extraction process is conducted by a team of 3-5 individuals working on the various machinery. The cost of production is thus partly attributed to the labor force, but primarily to the infrastructure and machinery necessary for material extraction, necessitating substantial capital investment at the project's inception⁶⁴.

61. Bengana, Baechtold, and Harari, *Béton - la fin d'une ère?*, 48.

62. Based on field discussions with anonymous Montricher resident, 21.11.24

63. Based on field discussions with anonymous senior position in Orllati SA, 13.10.24.

64. Arboleda, *Planetary Mine*, 155.

65. Sarah Nichols, 'Pollux's Spears', *Grey Room* 71 (June 2018): 141-55, https://doi.org/10.1162/grey_a_00246.

This state of affairs has resulted in a major group monopoly on the various gravel pits, particularly in the Pied du Jura region. Most of the major deposits are owned by three groups: Léman Grannulat (*Les Délices*, *Les Genévrier*), Holcim (*Cambèze*, *Le Sépey*) and Orllati (*Le Sépey*). The links established by Pollux between the cement industry and real estate development⁶⁵ therefore appear to extend beyond the confines of the cement industry, encompassing other components of concrete, particularly gravel. Orllati, which has never owned a cement production unit, seems to be attempting to master all the other stages of production, tending towards a verticalised industry model.

The canton of Vaud illustrates the pivotal role of the state as both a facilitator and promoter of the aggregate industry. Through comprehensive tools like the Quarry Master Plan (PDCar) and the Quarry Management Program (PGCar), the state actively manages resources, delineates exploitation zones, and prioritizes deposits to ensure a steady supply of aggregates for construction needs. By issuing operating permits and setting regulations, the state establishes a framework that enables private enterprises to operate efficiently while addressing environmental and logistical constraints. This regulatory oversight not only ensures the sustainable exploitation of resources but also fosters an environment where large, well-capitalized companies dominate the sector, benefiting from the state's structured approach to aggregate extraction and land restoration. Ultimately, the state's dual role as regulator and enabler underscores its critical importance in shaping the economic and logistical foundations of the canton's aggregate industry.

Physical space of Aggregates

Physicalites through cycle

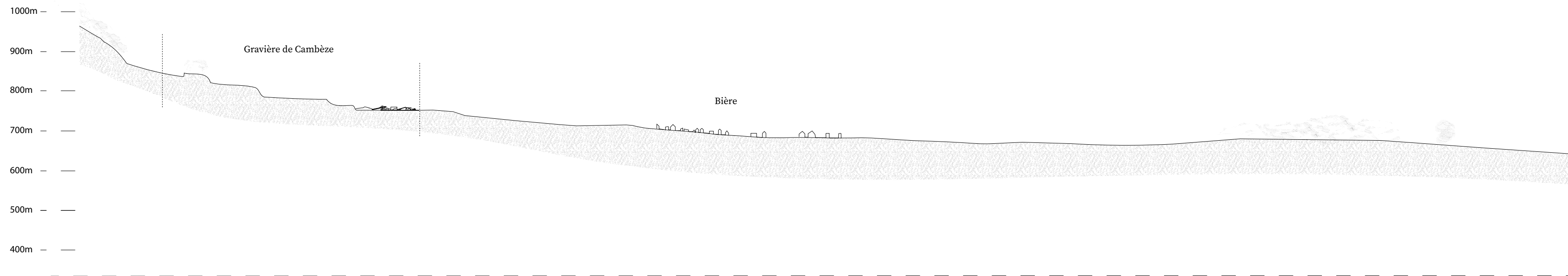
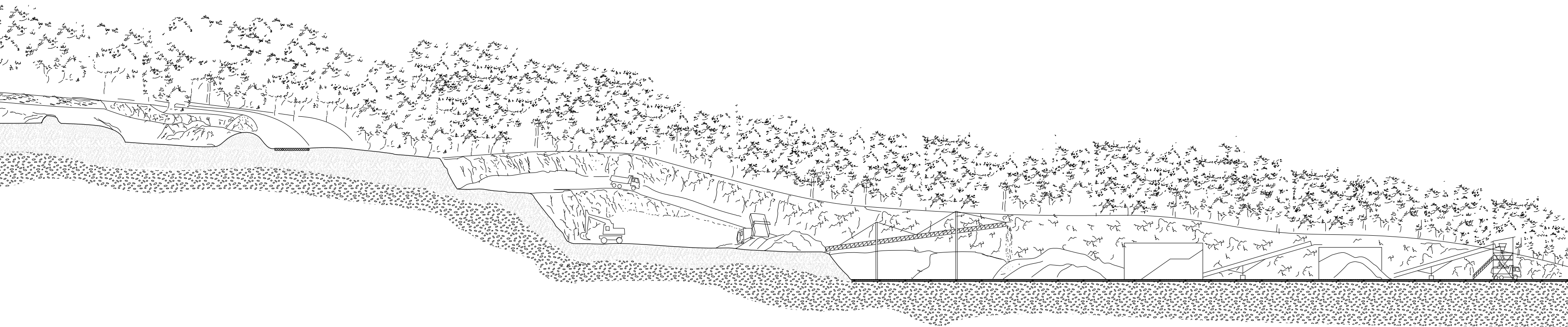
The form of social space is encounter, assembly, simultaneity. But what assembles, or what is assembled? The answer is: everything that there is in space, everything that is produced either by nature or by society, either -through their co-operation or through their conflicts⁶⁶.

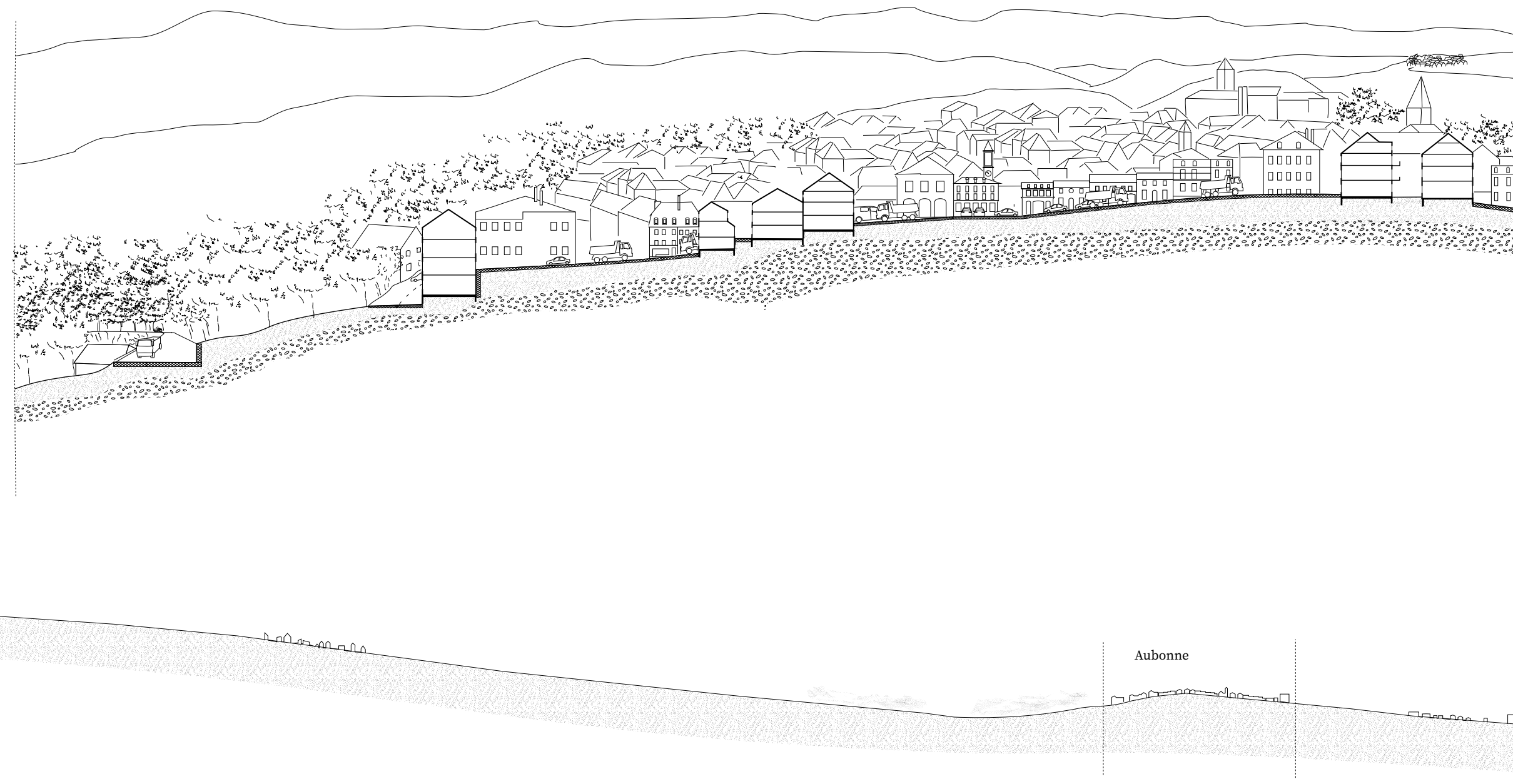
66. Henri Lefebvre et al., *The Production of Space*, Reprinted (Oxford: Blackwell, 1997), 103.

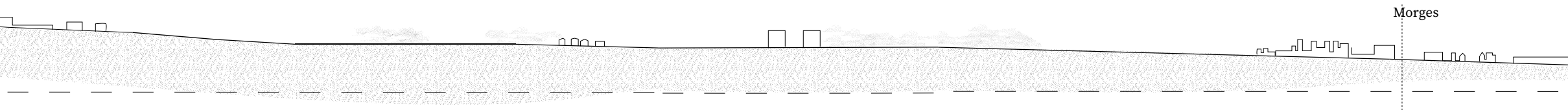
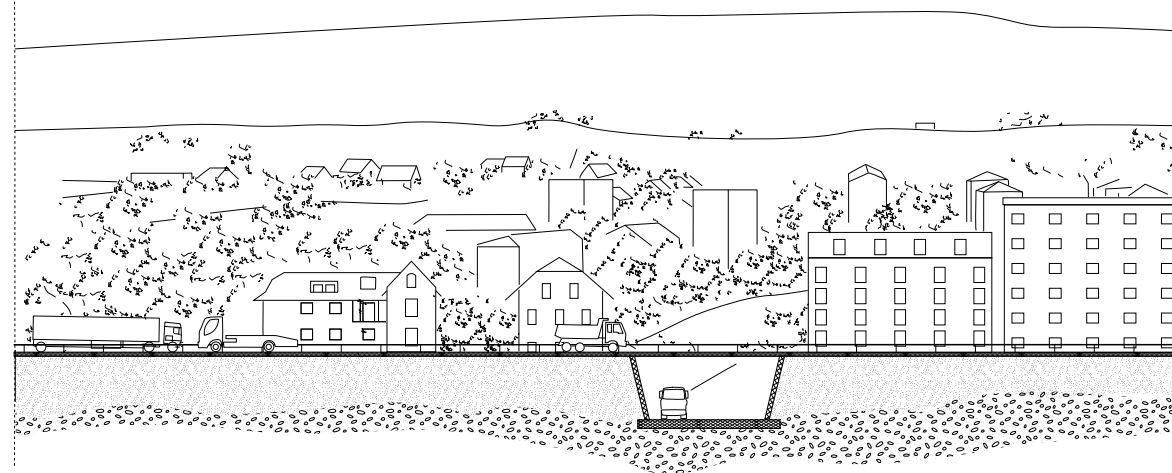
The focus will now return to La Tour des Cèdres which was mentioned at the beginning of this article. This tower, like other major constructions, is made possible by a raw material - aggregates. To understand this building, this section aims to go back through the material cycle and retrace from the extraction to the object. Through this cycle, it will attempt to understand the space constructed by this process, its significance, who plans it, and who benefits from it.

The present chapter is divided into two sections. The first segment will meticulously trace this material cycle, employing drawing as a medium to illustrate the physical characteristics of the spaces, through the 30km of the cycle. The second part will relate this cycle to critical literature and attempt to understand the issues that this tower traces, within an enterprise of urbanization in the capitalist economy. This reading is not, of course, exhaustive, but it does allow us to draw a different line from that taken by the state and private enterprise, where construction is driven primarily by the demand-supply dynamics of the economy.

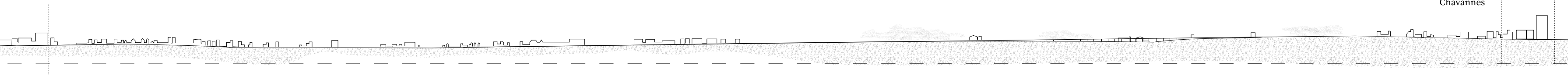
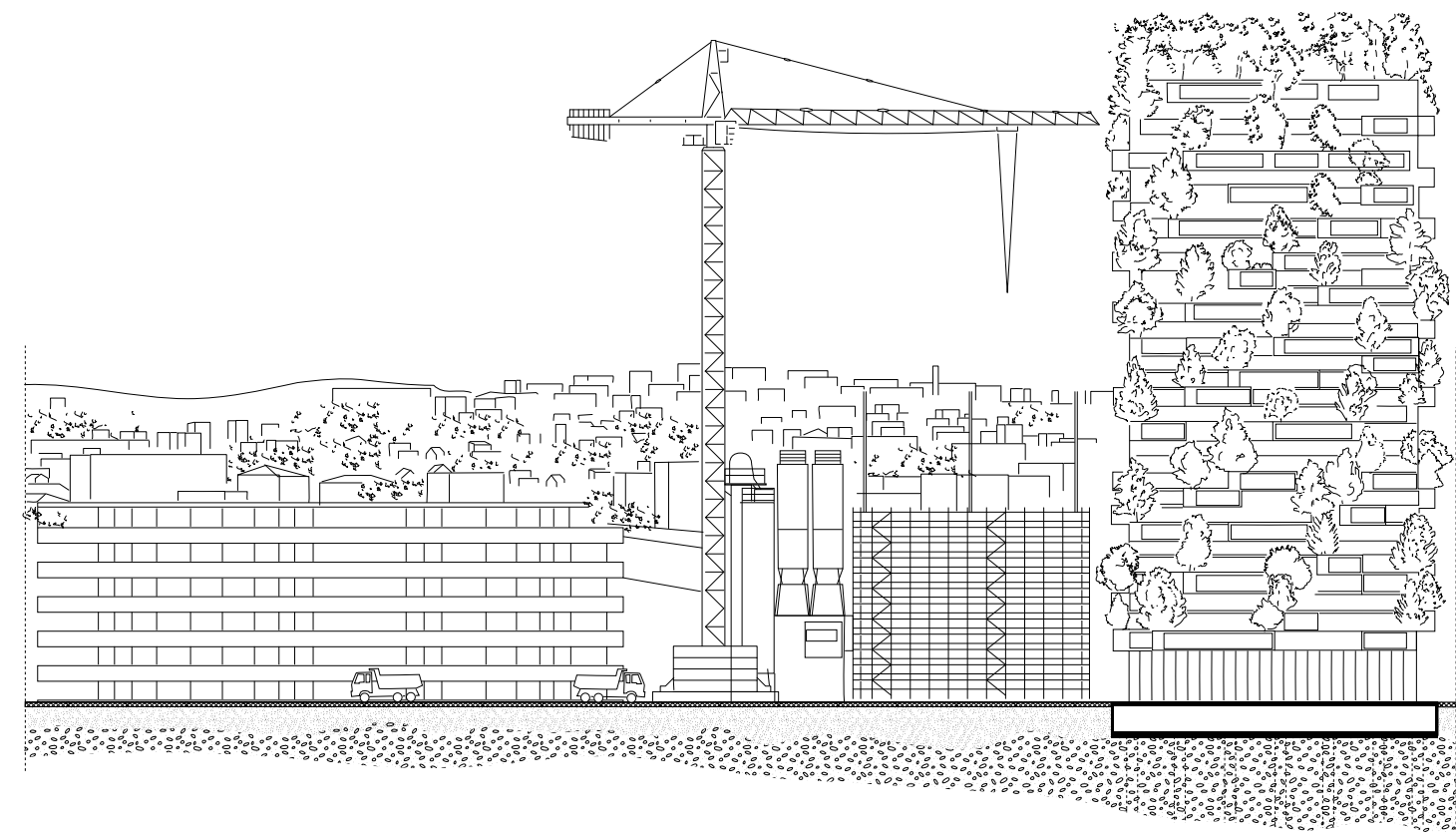
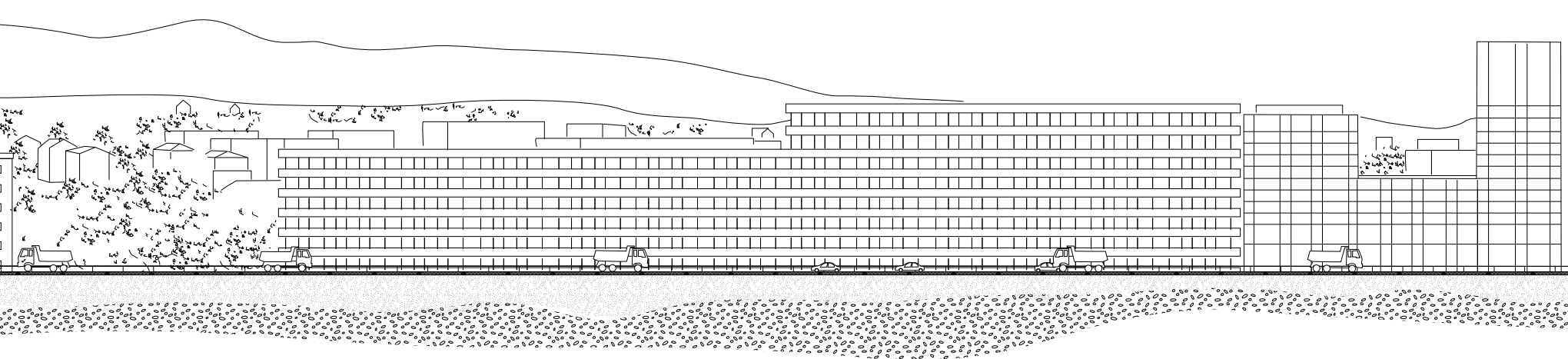








Morges



1.1500

Chavannes

1.25000

Consuming Nature, Capitalising Form

Is this really necessary? Why does it seem so inevitable? Why is it that it seems so impossible to say, “no, no, we don’t want that”? Why can’t we make something different? If capital is about freedom of choice, why is it that this future is foretold⁶⁷?

At a time when the issue of climate change is becoming increasingly important in civil society, concrete has become one of the targeted causes of this problem, responsible for more than 8% of CO₂ emissions worldwide. This has given rise to rhetoric calling for a drastic reduction in our consumption of concrete, in favor of other materials that emit less CO₂ and are less destructive to the environment. Yet concrete consumption has not fallen. On the contrary, just as much concrete is still being built, governments are taking particular care to guarantee the supply of this material. La Tour des Cèdres is just one example of this use of concrete. And yet, in its form, in its use, in the fantasies it projects, it is the symbol of a certain use of this material, benefiting certain social groups and making its use so essential.

This chapter will therefore attempt to draw a critical line through the economy of gravel, starting with the Tour des Cèdres as a symbol of a certain power relationship, in an attempt to sketch out our wider relationship with the environment. This research draws on a critical, mainly materialist reading.

67. Harvey, Abstract from the Concrete, 77.



Advertisement for the Bosco Verticale, Milano

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<https://www.stefano boeri architetti.net/en/publications/bosco-verticale-stefano-boeri-architetti/>

To expand upon this reading, the following question must first be asked: what, precisely, is la Tour des Cèdres? It is, without question, a structure of notable distinction. Its height, which surpasses that of any other building in the canton, is a factor in this distinction, but it is more than this. The fact that it is covered in trees, a feature which cannot be ignored, is the reason for its distinction. The question must therefore be posed: what was the motivation behind the decision to make this a feature of such prominence? Why this design won the competition over other propositions?

The property on which the tower is erected is owned by Orllati Real Estate, a member of Orllati SA previously mentioned in this article. Given the significance of the project, the municipality organized an architectural competition to determine the design of the intended construction⁶⁸.

The design chosen is by Stefano Boeri Architetti, a firm led by Stefano Boeri, renowned for its tree-covered towers. The firm is particularly famous for creating the Bosco Verticale in Milan, as well as several other similar projects worldwide. The tower is promulgated by the architect as a response to the problems of global warming and biodiversity in the city. However, it has been comprehensively demonstrated that such a structure necessitates a significantly greater allocation of resources⁶⁹, particularly aggregates, during its construction. Consequently, The building requires significant grey energy, while the trees incorporated into the structure are not particularly efficient in terms of cooling or CO₂ absorption⁷⁰. The building is not, therefore, a viable solution to climate change, as claimed by the architect, and his branding effort can be seen as a form of greenwashing.

68. Commune de Chavannes-près-Renens, 'Concours d'architecture- Procédure sur invitation', 22 October 2015.

69. Julien Pathé, 'Impact Environnemental, Installation d'arbres Sur Les Balcons, Tour Des Cèdres', 9 August 2023.

70. Louis Hissette, 'Les forêts verticales sont-elles capables d'apporter une réponse aux problèmes en milieu urbain ?' (Mémoire fin d'étude, Liège, Liège, 2020), 73, <http://hdl.handle.net/2268.2/9830>.

71. Arantes, *The Rent of Form*, 12.

72. Arantes, *The Rent of Form*, 16.

73. Stefano Boeri Architetti, accessed 1 December 2024, <https://www.stefanoboeriar-chitetti.net/en/>.

74. Arantes and Martin, *The Rent of Form*, 33.

This phenomenon is not exclusive to the field of architecture; it is a pervasive aspect of the capitalist economy. In this context, buildings aspire to convince the property market of their unique qualities. These qualities are achieved by creating a complex, plastic and seductive form that is abstracted from its context. Through this process, the form becomes capital through an image phenomenon in which it is remunerated as symbolic capital, what Arentes calls 'The rent of form'⁷¹. In this form, capital no longer seems to be linked to a notion of work. Architecture is reduced to the image it projects, and its value is based on the properties of this image, its uniqueness, its 'values' etc. The building then becomes fictitious capital, valued on the image market⁷².

The edifice subsequently follows the process of luxury objects and becomes a brand in its own right. The Tour des Cèdres, a luxury tower designed by Stefano Boeri Architetti, is distinguished by its 'vertical forest' concept and its commitment to "sustainability" and 'green obsession'⁷³. Like other brands, it has a design - the tree tower- as well as a "vision", carrying through the design. This results in a product that is easily identifiable and replicable across various locations. This strategic approach strengthens the connection between the building and the brand, making the building immediately associated with the brand's message. Standing as a testament to the values and vision of the brand, the building fosters recognition and amplifies the brand's presence, becoming a key element in the company's broader marketing strategy. The brand's reputation becomes a valuable asset, and it is precisely this reputation that drives the building's income, attracting clients, investors, and attention.

The value itself is determined by the image of the building, and particularly its facade⁷⁴. La Tour des Cèdres, in contrast to other 'futuristic' buildings that prioritise lightness and transparency, has adopted

an eco-friendly approach. The incorporation of trees symbolises the commitment to technological solutions in the fight against global warming. Consequently, when acquiring a residential unit within the tower, one does not merely procure a swimming pool on the uppermost floor and a deluxe apartment with a vista of the lake; rather, as a conscientious consumer, one is investing in prospective initiatives that will facilitate eco-friendly development. The act of purchasing an apartment signifies an investment in an image that one wishes to project to the public. This image is even written on the competition document for the tower: Tour végétale - modèle écologique - voir et être vu⁷⁶, but *être vu* comes at a considerable cost. The cost of housing is high and rising rapidly; in Milan, prices have more than doubled in the last decade⁷⁷.

Ce projet est un petit miracle, un trésor d'ingéniosité, qui permet de faire entrer la nature dans des appartements situés plus près du ciel que de la terre⁷⁸.

The design of the project also enhances the architectural quality of the apartments. A key feature is the ample natural light, made possible by the extensive use of glass in the façades. The building's height ensures privacy by preventing overlooking, while simultaneously providing expansive views and allowing daylight to permeate the living spaces, creating a bright and open atmosphere. Another important element is the integration of vegetation in each apartment, which contributes both to the visual appeal and a sense of freshness. Consequently, the tower incorporates several features that are likely to drive up housing costs, thus catering predominantly to privileged classes. However, these advantages come at the expense of a significant amount of grey energy consumption.

76. 'Les Terrasses Des Cèdres, Rapport Du Jury'. Chavannes-près-Rennens, 26 October 2015.

77. Chloé Din, 'La tour des Cèdres sera proche du Bosco Verticale de Milan', 24 heures, no. 87 (15 April 2024): 8.

78. Bernard Nicod in 'Les Terrasses Des Cèdres, Rapport Du Jury'. Chavannes-près-Rennens, 26 October 2015.

79. Avni Orllati in 'Les Terrasses Des Cèdres, Rapport Du Jury'. Chavannes-près-Rennens, 26 October 2015.

80. commune de Chavannes-près-Renens, 'CONCOURS D'ARCHITECTURE - PROCEDURE SUR INVITATION', 22 October 2015.

81. Arantes, The Rent of Form, 69.

82. Arantes, The Rent of Form, x.

83. Julien Pathé, 'Impact Enrionnemental, Installation d'arbres Sur Les Balcons, Tour Des Cèdres', 9 August 2023.

84. Arantes, The Rent of Form, 29.

Est-il utile d'ajouter qu'un projet de cette ampleur permettra en outre d'importantes retombées économiques dans la région, ainsi que sur l'arc lémanique ?⁷⁹

But that's not the only value behind this building and its construction. The competition was organized by the commune of Chavanne, where the project is located, although the plot itself is owned by Orllati Real Estate⁸⁰. The municipality of Chavanne, located in western Lausanne, is a fast-developing city that is not currently a major attraction zone, apart from the fact that it has land available for building. The construction of a building of this nature enables the city to establish an iconic structure, which in turn attracts further investment and initiates urban renewal, notably by replacing the existing population with an increase in the price of living around the object⁸¹.

What is the correlation between this edifice and the aggregates? As previously stated, significant cultural capital is predicated on a building's ability to stand out from the crowd, primarily through its form, which must be Instagrammable, tit-tokable, and easily disseminated in newspapers and specialist magazines. This flexibility of form, which abstracts itself from the conditions of production and the notion of construction, is rendered possible by concrete, a material that enables design to be abstracted from construction⁸². For the Tour des Cèdres, its green tree habit requires more than 60% more material than for a conventional project⁸³.

The example of la Tour des Cèdres is one of the most radical in the region, yet it is but one element of a broader phenomenon wherein architecture aligns with the prevailing economic sectors, in this instance, rentier capital⁸⁴. The overarching objective of this



A day in the street of Aubonne

© Personal Picture

85. Maçaes e Costa, 'Conduit, Patio, Waste: Mapping Environmental Relations in Bairro Da Malagueira', 14, 33.

86. Bengana, Baechtold, and Harari, *Béton - la fin d'une ère?*, 50

87. Pollux, 'The Cement Trust in Switzerland', *Grey Room* 71 (June 2018): 138–40, https://doi.org/10.1162/grey_a_00245.

88. Bengana, Baechtold, and Harari, *Béton - la fin d'une ère?*

alliance is to minimize production costs by utilizing the most economical materials to satisfy construction requirements. Consequently, Real Estate Architecture is dependent on the utilization of concrete, and by extension, aggregates, to develop buildings at a production cost that is significantly lower than the capital created by the object's image. This process entails the modification of natural resources, extracted from their environment, which are then commodified. The industry's exploitation of land that is not subject to market forces is therefore evident. The extraction of gravel is a process characterized by exploitation and the avoidance of full compensation for the commodification of the material⁸⁵.

The process creates negative externalities that are locally visible, not only deleterious to the soil but also harmful to the surrounding population, who endure various detrimental effects from this extraction. Firstly, by the privatization and disappearance of a previously public area, mostly a communal forest, but also by the significant noise and visual pollution caused by the extraction and the trucks that bring it in. Furthermore, the extraction company does not generate many jobs, and the municipality only receives a small percentage of the profit generated⁸⁶. So, overall, the population loses out. This creates tensions, resulting in citizens mobilizing to oppose the privatization of their common resources. This has resulted in a situation where the local population is disadvantaged, leading to the mobilization of citizens in opposition to the privatization of their communal resources. A notable example of this mobilization is seen in Ballens, where residents have been protesting since May 2024 against the canton's largest gravel pit project. However, despite these efforts, the battle is being waged in an imbalanced manner, with companies like Holcim and Orllati holding privileged connections to the state and financial circles^{87,88}.

To establish a connection between the extraction site and the construction site, as well as between negative and positive spaces, it is necessary to transport the material over a certain distance – in this case, 30 kilometers. Given the significant quantity of material required, the transportation of this material by truck represents a substantial flow. To transport the material, the truck must traverse two types of terrain: one designed for the transportation of materials and the acceleration of the flow, and one that is not. The highway is the type of terrain designed for the transportation of materials and the acceleration of the flow. The material is located in a specific region, not chosen by the operator, and therefore the transport also has to pass through rural areas, not designed for such a significant flow of material.

The preponderance of freight vehicles on the roads has had a detrimental effect on the quality of life for the inhabitants of Aubonne, who have seen their local amenities suffer as a result of the noise and environmental pollution caused by the trucks. Indeed, the size of the freight vehicles is such that it is beginning to damage the road and endanger the safety of the children returning to school. The inhabitants of Aubonne are heavily suffering from the influx of freight vehicles without at any moment benefiting from them. Aubonne serves as a prime example of an area that has been shaped by a particular practice, which benefits certain interests while causing harm to others⁸⁹. This dynamic has given rise to significant public discontent, as evidenced by major public protests. In the village of Aubonne, for instance, a group of residents has formed the Zero Camion association, to put out the trucks from the village⁹⁰. After passing through a small rural region, the trucks join the highway, where they are accelerated to construction sites. The political aspect of highways in their acceleration of capital was already the subject of the first chapter and will not be repeated here.



91. Harvey, Abstract from the Concrete, 11.

92. Jérôme Ducret, 'Chavannes est devenue une commune touristique', 24 heures, 12 April 2015, <https://www.24heures.ch/chavannes-est-devenue-une-commune-touristique-125049056000>.

93. '24_HQU_36 - Question orale Mathilde Marendaz - Tour des Cèdres : comment assurer une réponse à la pénurie de logement dans les sites classés en zone touristique ? | État de Vaud', accessed 18 December 2024, <https://www.vd.ch/gc/seances-du-grand-conseil/point-seance/point/bf9d7896-779e-4705-9b91-25280c72d465/meeting/1019566>.

94. Based on field discussions with Yves Golay, Opponent of La Tour des Cèdres, 18.10.24

95. Nichols, 'Pollux's Spears', 144.

89. Magalhaes, Accumuler Du Béton, Tracer Des Routes, 21.

90. Based on field discussions with Christine et Jean Maurer, member of Zerocamion, 2 December 2024.

The example of La Tour des Cèdres developed here is chosen to be radical and to illustrate, in particular, the different interests that appeared in the cycle of the aggregate. This example is not exclusive, as the lecture developed here, but aims, through a materialist analysis of the different spaces created by the cycle, to attempt to answer the “why” question⁹¹. By first immersing ourselves in the project of “La Tour des Cèdres”, we pass through a new phase of capitalism, called financial capitalism. This new phase is embodied, in the construction industry, by projects that aim to absorb the accumulation of capital by their particular form, thus creating value around them. The tower is located in a tourist area⁹², which makes it possible for foreigners to buy apartments for vacation. This situation encourages the purchase of apartments for speculative purposes⁹³. The tower is owned by a private actor and due to the price of the apartments and the zoning, will be sold to upper-class people⁹⁴. The aggregate, exploited from the environment, by the private actor (who is sometimes the same as the one building), is then brought by trucks, through small villages and highways to feed the construction process. The cycle of material, in this example, enriches the private actor who creates surplus value through natural exploitation, state support, and rent speculation. In this apparatus, the state plays the role of mediator⁹⁵, facilitating the exploitation by localizing the various resources and creating conditions of exploitation that allow the largest group to take control of them.

Gravel pit, Les Délices

© Personal Picture

Conclusion

Under late capitalism (...) studies of the sociospatial ramifications of financial and monetary systems need to be reinstated as a key priority. Every historical cycle of accumulation (...) has coevolved with its own modalities of high finance. Shedding light into the transnational monetary configurations that underlie the present phase of capitalist development, therefore, is a task of substantial relevance⁹⁶.

96. Martín Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London New York: Verso, 2020), 155.

The objective of this study was to deepen our understanding of the constructed environment by examining the material elements—specifically aggregates—that facilitate its existence. The research focuses on the Canton de Vaud as a case study to explore the dynamics of this material cycle and the physical spaces it generates. While these dynamics could apply to other regions with similar characteristics, the Canton de Vaud offers a distinct example that enables a more in-depth examination of the positions held by various actors within the cycle. By addressing the questions of who and where, this work uses a materialist approach to reveal the underlying drivers of the processes involved. Spaces, as both subject and object, are shaped by power relations, with dominant groups leveraging their position to influence others.

The aggregates cycle, encompassing its extraction, commodification, and transformation, is a key component of this spatial phenomenon. The spaces created, such as La Tour des Cèdres in Chavannes, are designed to serve the interests

of specific groups who seek to maximize profit while minimizing costs. In the context of finance capitalism, the built environment is treated as an abstract product, where value is derived from its image, design, and branding, rather than from the material or labor invested in its construction.

This study illustrates how this process unfolds spatially, unpacking the tools and legislation that support this cycle. Key elements that articulate the system include. **Aggregates as Means**, gravel mining is not the main source of surplus creation but serves rather as a tool for vertical integration, allowing companies to control the supply chain and monetize voids created by extraction, such as landfill sites. **The Gravel Pit as a Strategic Asset**, the limited number of gravel extraction sites in the canton, which function as natural monopolies, makes them valuable assets, fueling competition among companies. **The State as Facilitator**, the state plays a pivotal role in identifying gravel sources and enacting regulations that favor large companies in the sector. **Locality and Public Scrutiny**, the gravel industry is inherently local and cannot be outsourced to countries with lower environmental or social standards, leading to significant public opposition and scrutiny of mining and construction practices. **Uneven Geographic Development**, the cycle perpetuates inequalities by concentrating negative externalities in poorer, agricultural areas, while the benefits of aggregate extraction primarily serve large companies. This dynamic contributes to the construction of housing for wealthier classes along Lake Geneva's shores, deepening existing socio-economic disparities. **Attracting Form, Attracting Capital**, As described by Arantes in "The Rent of Form," real estate projects such as La Tour des Cèdres generate value not only through the buildings themselves but also by elevating

the value of the surrounding area through design and branding. These elements serve as tools to attract capital by enhancing the neighborhood's desirability. **Grey Energy and Green Privilege**, while the grey energy required for projects like the tower is higher due to features such as trees, the spatial qualities created—such as abundant natural light and a connection to nature—benefit only a privileged minority, reinforcing social divides.

While aggregates are a critical component of this process, they are not the primary cause of the phenomenon. Rather, they facilitate the commodification of space due to their low cost, ease of exploitation, and controlled availability at construction sites. The process itself is driven by factors such as state policies that support exploitation, the organization of private sector actors to secure cheap materials, and the infrastructure enabling the constant flow of resources from rural regions to urban centers. The convergence of these elements results in substantial profits for the building industry, further accelerating the commodification of form, detached from raw materials and labor value.

In addressing the “why” question, this study suggests that gravel mining is not an end in itself but a strategic activity whose value is realized when integrated into real estate investment ventures. In the context of finance capitalism, real estate development becomes an *instrument of extraction*⁹⁷, with the state facilitating the flow of gravel to support both the canton's GDP and real estate growth. This process situates the extractivism of aggregates within a broader economic logic that transcends traditional primary-commodity production.

98. Martín Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London New York: Verso, 2020), 212.

Thus, the issue of aggregate extraction should be approached through an “expanded conception of extractivism,”⁹⁸ one that considers not only the physical extraction of raw materials but also its role in urban development and the perpetuation of economic inequalities. While this work does not offer conclusive solutions to the challenges posed by the local gravel economy, it provides a conceptual framework for understanding the systemic nature of capital accumulation. The answers to these challenges are rooted in deeper questions about property, land, housing, socio-economic organization, and the distribution of surplus wealth. The specificity of this production chain lies in its locality, which could also serve as a potential vector for radical change, as it is governed from start to finish by the same legislative system. By expanding the lens through which we view aggregate economies, we gain insight into the complex interrelations between natural resources, urbanization, and capitalist structures, opening pathways for addressing the profound inequalities and environmental damage that define this system.

97. Martín Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London New York: Verso, 2020), 212.

Terms

The purpose of this supplementary chapter is to elucidate the terminology employed in this work, thereby facilitating comprehension for the reader. Aggregates, cement, concrete, sand, and other terms denote disparate materials, yet they are intricately intertwined, which can result in ambiguity in their application. For instance, an increase in the usage of concrete implies an increase in the usage of gravel and cement. However, this approach obscures the subtleties involved in distinguishing these materials and their mutual relationship, which is the subject of this investigation.

Aggregates is a family of granular minerals. The division between

Sand and

Gravel is then made by the size of the aggregate. The term sand refers to a finer grain of 0.2 to 5 mm. The term gravel defines a larger size, from 5mm to 9cm.

Limestone and

Marl are different types of sedimentary rock, which will be used to create

Clinker. This is a chemical mixture composed mainly of **limestone** (80%) and **marl** (15%), with a few adjustments. This mixture is heated to 1450° to produce a powder called clinker. The mixture is then reground with a few additives (notably gypsum) to produce **cement**.

Cement is the element that is often blamed for CO₂ emissions, which come from two points in the process. On the one hand, heating to 1450°C accounts for 40% of emissions, and on the other, the chemical process of 'clinkerisation', which releases carbon dioxide, accounts for 60 % of emissions.

Concrete is used as a building material, mainly made up of **cement**, which acts as a binder. **Cement**, which accounts for only 12% of the mix, is then mixed with **aggregates**, **sand** and **gravel** in proportions that vary according to the quality of concrete required. The **aggregate** mixture accounts for most of the material in the concrete, more than 80%. The remainder is water added to the mix.

Reinforced concrete, which is the most commonly used concrete today, is **concrete** with iron reinforcement inside, to improve the static qualities of the concrete, particularly in tension.

The different raw resources are extracted in specific sites. There are two main terms in this category:

Quarry is a general term, defining a material extraction site. It therefore covers both limestone and gravel extraction.

Gravel pit is more precise, limiting the extraction site to that of gravel.

This work focuses mainly on gravel extraction and its economics. However, the use of gravel can only be understood in the wider context of the use of concrete. This paper will therefore sometimes dwell on moments that go beyond the economics of gravel, from the limestone quarries of Eclepens to the site concrete mixer.

Interviews

Pascal Blunier, Chief of the Geology Section, Département de la jeunesse, de l'environnement et de la sécurité, Etat de Vaud, Lausanne, 01.10.24

Aeby, Didier, Director, Orllati Granulats & Béton SA, Biolay-Orjulaz, 04.10.24

Golay, Yves, Architect EPFL, opponent to the projet “la Tour des Cèdres”, Chavannes-près-Renens, 01.11.24

Alexis, Director of the Gravel Pit “Cambèze”, Holcim Granulat, Bière, 25.11.24

Asfaux, Antoine, Director of the Gravel Pit “Les Délices”, Léman Grannulat SA, Apples, 28.10.24

Jean et Christine Maurer, Residents of Aubonne, member of zerocamion, Aubonne, 02.12.24

Claude Baechtold, Journalist, author of ‘Béton la fin d'une ère’, Ballens, 09.10.24

Cédric, Resident of Ballens, member of the “Association Pour la Sauvegarde du Bois de Ballens et environs”, Ballens, 02.12.24

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