Renew

Towards A Closed Loop Architecture

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01.

01. *Demolition.*
Photography: Omar Marque.
Retrieved from The Guardian. 2020.

Contents

Statistics

In 2016, the world consumed and disposed of resources **1,7 times faster** than they could be renewed or sequestered

This deficit is even higher in Norway - if the rest of the world consumed at the same rate as the Norwegian society, it would require the capacity of **3,5 Earths** to sustain[1]

[1] Global Footprint Network. (2016). *Worldwide Ecological Footprint*

Between 2006 and 2010, the average per annum consumption of construction materials in the EU27 was **1,6 billion tonnes**.

Moreover, yearly waste from building activity during this period was **450 million tonnes**

The amount of energy embodied in the EU27 building stock was estimated to be **1,9 million terajoules**[2]

[2] Herczeg, M. McKinnon, D. Milios, L. Bakas, I. Klaassens, E. Svatikova, K. Widerberg, O. (2014). *Resource Efficiency in the Building Sector.*

Construction and demolition comprises the largest waste stream in Norway, accounting for **24%** of all refuse[3]

Building activity produced **1,82 million tonnes** of waste in 2018, of which **65%** was from demolition and rehabilitation[4]

It is estimated that 20 000 buildings are demolished in Norway each year[5]

[3] Statisisk sentralbyrå. (2018). *Avfallsregnskapet.*

[4] Statisisk sentralbyrå. (2018). *Avfall fra byggeaktivitet.*

[5] Kilvær, L. Sunde, O. Eid, M. Rydningen, O. Fjeldheim, H. (2019). *Forsvarlig ombruk av byggevarer.*

Recovery rates, however, are fairly high. Of those 1,82 million tonnes:

778 000 tonnes recycled

518 000 tonnes burned for energy recapture

507 000 tonnes sent to landfill[6]

[6] Statisisk sentralbyrå. (2018). *Behandling av avfall fra nybygging, rehabilitering og riving.*

02.

03.

02. *Trucks carrying sand dredged from the Sone River, Bihar, India.*
Videography: Paul Salopek
Scene from *Out of Eden*. 2020.

03. *Demolition of the old Norwegian Railway Academy at Tomtekaia, Oslo, Norway.*
Photography: Cornelius Poppe.
NTB Scanpix. 2020.

Take
Make
Dispose

The world has undergone radical change during the past 200 years. Driven relentlessly forward by industrialization and globalization, we now exist in a state of linear material flow and consistent deficit - the 'take-make-dispose' society.

Prior to the Industrial Revolution, material availability and production was constrained by labor intensity and the limitations of transport. As much of the world industrialized between the late 18th and mid-20th century, productive output shifted from handicraft to the assembly line. More effective modes of transport opened markets across the globe from which resources, labor and production could be sourced. No longer restricted by local availability or regional tradition, there was a radical change in the accessibility of materials and products.

Indeed the framework of modern life appears to have little to no room for anything other than linear consumption - a seemingly inevitable consequence of contemporary Western comforts. The 21st Century, however, has brought with it a growing awareness of the negative social and environmental impacts of a linear global economy pushing or even exceeding planetary boundaries. One reponse is the idea of circularity; in essence, minimizing the inputs of virgin resources and the outputs of waste by operating with closed-loops of material use and reuse. Although less a brand-new idea than a repackaging of older concepts (the book *Cradle to Cradle* was written in 2002, for example), circularity has been gaining traction in recent times. Already in 2015, the EU embarked on a policy initiative for making the European economy more circular[7].

Although all aspects of the economy are contributors, the data presented on the previous pages demonstrate that the building industry is one of the largest streams of material consumption and waste. Feeding this mammoth industry greatly affects both the atmosphere (emissions involved in material processing and transport) and the lithosphere (interventions from resource extraction and landfilling). Closing the loop on this industry is no small feat - challenges include overcoming economic and technical realities, traditional dogmas and methodologies, and the stigma often attached to the value of renewed versus novelty.

EU and national initiatives have already made good headway in recovering waste from construction and demolition, especially in Norway (see pg 7). Waste recovery, however, most often involves crushing a material into aggregates or burning it to recapture the embodied energy. Both methods represent a downcycling or even permanent loss of function. In many aspects, this is still a form of disposal albeit a better one. The direct reuse of local building elements, on the other hand, maintains the functional and/or aesthetic value of the object, while also requiring comparatively little energy to accomplish.

Though waste recovery by recycling and energy recapture by combustion are lower on the value pyramid than reuse, it is always better than landfilling and therefore a worthy pursuit. This thesis is not intended to be a case *against* recycling but rather a call to *rethink* how taking away can be a step towards making rather than a step towards disposal.

[7] European Commission. (2015). *First Circular Economy Action Plan.*

Rethink
Reclaim
Reuse

Considering that the building industry accounts for such a large portion of consumption and waste, architects are in a central position to enact change. This change involves a reconsideration of both the design approach and of the inherent value of the current building stock. Can we challenge take-make-dispose by looking at a building slated for demolition not as a source of waste but as a material repository?

Typically, the design methodology is top-down, starting with abstract systems, forms and compositions. Then the materials are fitted to meet these requirements. For all intents and purposes, material availability is boundless; the market is well-established and global. According to one estimate, there was, at the turn of the 20th century, roughly 50 unique building materials to choose from in Norway, a figure that had ballooned to 40 000 by the 2000s[8]. On the contrary, a market for architectural salvage does not exist, at least not nearly to the same extent, and thus the methodology must invert: the designer must first identify materials for reclamation, most preferably local, and then fit the design to those constraints.

The built environment already in existence becomes the source, a material repository for either today or future generations. Identifying materials suitable for reuse can be an arduous process, especially where as-built documentation is lacking or does not exist. Furthermore, the physical and functional properties of the salvaged element are often in question and must be recertified. This is compounded by building regulations that are ambivalent or down right hostile to reuse, having been formulated only for virgin materials[9]. Finally, capturing architectural salvage requires a careful, selective deconstruction, a far cry from standard destructive methods.

There also appears to be a kind of cultural limbo with regards to reuse. On the one hand, certain buildings and their elements are revered and painstakingly maintained or salvaged. On the other, the vast majority of the current building stock falls far short of the value threshold required for preservation, notwithstanding the actual durability of the material embodied therein. It has been said that a buildings permanence is predicated on nothing more than public opinion[10]. One of the challenges facing reuse is convincing the public and clients that what is at first glance considered garbage is worth the effort.

Despite the cultural, technical and financial hurdles, industry interest in reuse is kindling, fueled perhaps dually by ecological responsibility and growing public and political momentum. Resirqel AS is a small Oslo-based offering both reuse consultancy and resell. Across the Skagerrak in Denmark, Gamle Mursten specializes in salvaging, cleaning and reusing Denmarks most widespread building product, brick. Farther south in Belgium, Rotor operates a consultancy, thinktank, and salvage warehouse/store. Located also in Brussels, the EU Council headquarters was completed in 2016 with a glass facade fashioned from reused windows[11]. Back in Oslo, the coworking building *Spaces* is, as of November 2020, nearing completion, replete with reused elements including 80% of the load-bearing steel and 3 floors of hollow-core slabs salvaged from the dismantling of the nearby Government Quarter[12].

Reuse and recycling are the foremost goals of the circular economy, though that is not to say that new materials are rejected outright. In many cases, practicalities stipulate that an element just has to be new. In such cases, it should be durable and designed for disassembly, ensuring that future generations can more easily reuse it.

[8] Fosshaug, E. (2008). *Et enestående byggemateriale.*

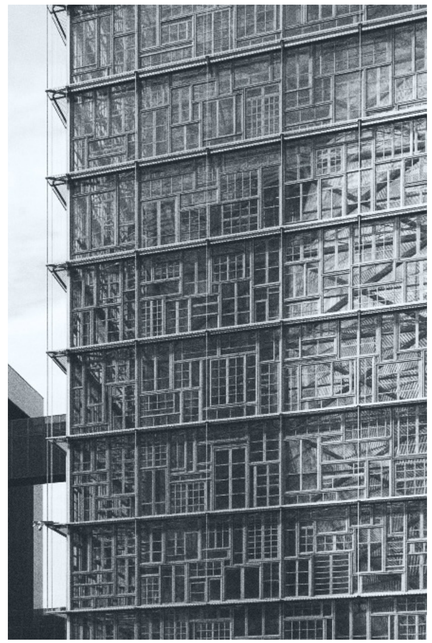
[9] Kilvær, L. Sunde, O. Eid, M. Rydningen, O. Fjeldheim, H. (2019). *Forsvarlig ombruk av byggevarer.*

[10] *Paraphrase from unknown source, possibly Louis Kahn.*

[11] *Europa.* Architect: Samyn and Partners. (2016).

[12] NRK. (2020). *Her gjenbrukes deler av regjeringskvartalet.*

05.



06.

05. *Hollow-core slab being transported for reuse, Government Quarter, Oslo, Norway.*
Photography: Truls Antonsen.
NRK. 2020.

06. *Reused window facade, EU Council HQ, Brussels, Belgium.*
Photography: Samyn and Partners
2020.

07. *In Feb 2020, the author was involved in a student-led project tasked with designing and building a sauna in Longyearbyen, Svalbard. The structure was constructed entirely from reused wooden studs and cladding. Panes of glass from reclaimed windows were removed from their frames and incorporated in (re)new floor-to-ceiling glazing.*

Photography: Moritz Groba.
2020.

08. *Residential project in Copenhagen, Denmark. Brick from local demolition was cut into panels and reinstalled to form the facade.*

Photography: Lendager Group.
2019.

09. *Processing of salvaged bricks at Gamle Mursten, Denmark. Salvaged materials are rarely ready for reuse. They often need to be processed, such as here where mortar is being removed from the individual bricks and quality checks are performed.*

Videography: Gamle Mursten.
2018.

10. *The showroom at the Rotor DC facility in Brussels, Belgium. Rotor describe the showroom as their "public front" where customers can browse the materials or meet with the company to put in an order.*

Photography: Rotor DC.
Unknown year.

11. *Resirqel warehouse in Oslo, Norway. Limited space and a temporary rental agreement make it difficult to expand or plan for the future.*

Photography: Unknown.
Unknown year.

Proposal

As discussed in the previous chapter, circularity is the key to building a sustainable and resilient economy in a world challenged by climate change, globalization and the limits of biocapacity. Reuse in the building industry creates possibilites for reducing demand for virgin resources and minimizing waste, though societal and architectural implications pose a challenge to the formation of a viable reuse infrastructure. This proposal responds to these challenges programmatically and through design.

The proposed building is a **reuse hub**, a centralized location where architectural salvage is collected, processed and stored before being redistributed to the market. Due to the start up-like and often highly specialized nature of many reuse specialists today, the reuse hub will accommodate several private actors in a kind of coworking environment where knowledge and costs can be shared. Apart from **reuse logistics**, the hub will also function as a **competency center** building knowledge within the topic, informing policy and performing the testing necessary for the recertification of materials.

In addition, the reuse hub will function as a **civic interface** through a public workshop, experiential path and shopfloor. In doing so, the proposal aims to be a community engagement effort, increasing awareness around circularity and breaking down the cultural barriers facing reuse.

Finally, the proposal will be designed, where possible, with reused materials cataloged from a real-life building facing demolition. This allows the proposal to investigate the inverted design approach touched upon in the previous chapter, as well as giving a deeper understanding of the implications of identifying and designing with reused material. Where new materials are required, the proposal will investigate methods of designing for disassembly. This part of the proposal is covered in detail in the accompanying document *Urban Mining* and should be considered essential reading for the evaluation of this project.

Spatial Estimates

	Room No.	*m2*	*Name*	*Comments*
Reuse Logistics	1101	1000+	Staging Area	Outdoor
	1102	2000	Warehouse Storage	Minimal climate requirements
	1103	500	Production Hall	
	1201	200	Workshop 1	Noisy
	1202	75	Workshop 2	Noisy; hazardous or fire-danger
	1301	216	Offices	Cohorts of 6; total 36
	1302	36	Meeting Room	
Competency Center	2101	100	Test Lab	Incl. hydraulic testing machine
	2201	36	Office	Cohort of 6
	2202	36	Meeting Room	
Civic Interface	3101	N/A	The Detour	Experiential path
	3201	120	Public Workshop	Noisy
	3202	70	Production Hall	
	3203	36	Lab	Quiet
	3301	300	Shopfloor	
Services	4101	36	Admin/Reception	
	4201	30	Kitchen	Self-serve
	4301	25	Toilets	Employees
	4302	30	Toilets	Public

Program Reflections

The spatial estimates on the previous page were put together by rehashing several kinds of buildings - reuse specialists currently in business, hardware stores, various projects adatively reusing warehouses, a material testings lab in Italy. However, this project differs from all of those by being both an operating warehouse and a public space. The architecture derives from the meeting between the public and the industrial. These two are in balance, necessarily separated at some points but always engaged in a material dialog.

On the following pages are short paragraphs expanding upon a few chosen spaces from the room schedule presented previously - reflections on use and layout, relationships and engagement. A guiding principle, however, is to be flexible enough as a designer to respond to the constraints of the materials reused. Their extents are already set, laid down at some point in the past, and the program must be able to adapt. At this point, the program is a rather diffuse thing, not yet in conversation with the material. Therefore, the reflections here are subject to change in the final realization.

1101
1102
1103
1201
1202

The ebb and flow of reused materials is variable and often uncertain. Therefore, the reuse specialists who use the building should be able to expand and contract according to their needs, and the warehouse space should be flexible enough to accommodate this. In addition, the workshops are shared, ensuring no one actor bears the responsibility for expensive equipment.

Industrial spaces are often hidden away, totally utilitarian, especially in modern day industrial buildings. Though there is a certain kind of beauty in utility, a workplace, even an industrial one, should well-lit with natural light, airy, a place where even menial labor is somehow elevated.

Interdependence
Arrive
Store
Process
Display
Exit
Insight
Control

1301
1302
2201
2202
4201

In accommodating officespace for distinct actors, there is a need to provide spaces that are amply separated. Issues of noise and privacy, at least between the cohorts, take precedent. Nonetheless, the nascent reuse industry benefits from an environment that fosters knowledge-sharing. Break-out and social zones should be designed so as to create informal meeting points between the different reuse specialists.

The method here is to aim for spaces within spaces, offices that are distinct but reside within and are dependet upon a greater whole.

Meet
Share
Within
Part
Synedoche

3101 The Detour is a public right-of-way going through the building. It should be adjacent to or an extension of an existing pathway somewhere on the surrounding site and should offer a low-threshold opportunity for the public to experience the inner workings of the hub. In this way, it should act as a response to the desire to expose and advocate for reuse not only for those who are users of the building.

The Detour holds a special role in the building, the fulcrum between the public and the occupational. It should be both an act of exposition and a control between the accessible and the off-limits.

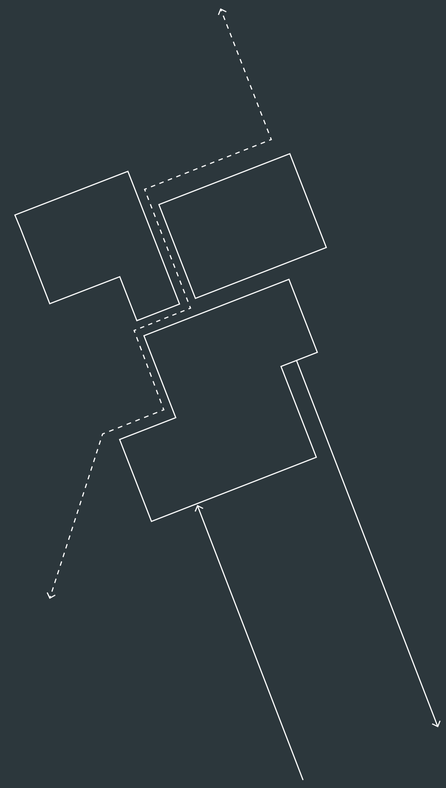
Movement
Rythym
In
Out
Balance
See
Hide

3202 DIY, self-build, and handicraft seem to be rising in popularity, evidenced in the rise of makerspaces, Etsy-culture and IKEA-hacking. Nonetheless, public access to workshops with heavier equipment remain somewhat scarce in Oslo. In offering a place to make and repair your own things, the proposal hopes to engage the public in a participatory manner, with easy access to reused material.

3202

3203

Make
Repair
Participation
Noise
Dust



The Inner City Fringe

At around 11km2, Hovinbyen is Oslo's largest redevelopment project. It is an example of an inner city fringe area: the territory between the historical city center and the outskirts[13].

Hovinbyen shares many of the same characteristics as fringe territories in other European cities - the spatial structure is fragmented, dominated by car-based infrastructure and large industrial or commercial activity with islands of older residential districts in between. This distinct lack of topological continuity creates a scattered and diffuse sense of place. Hovinbyen is analyzed in greater detail in the accompanying document *Urban Mining*.

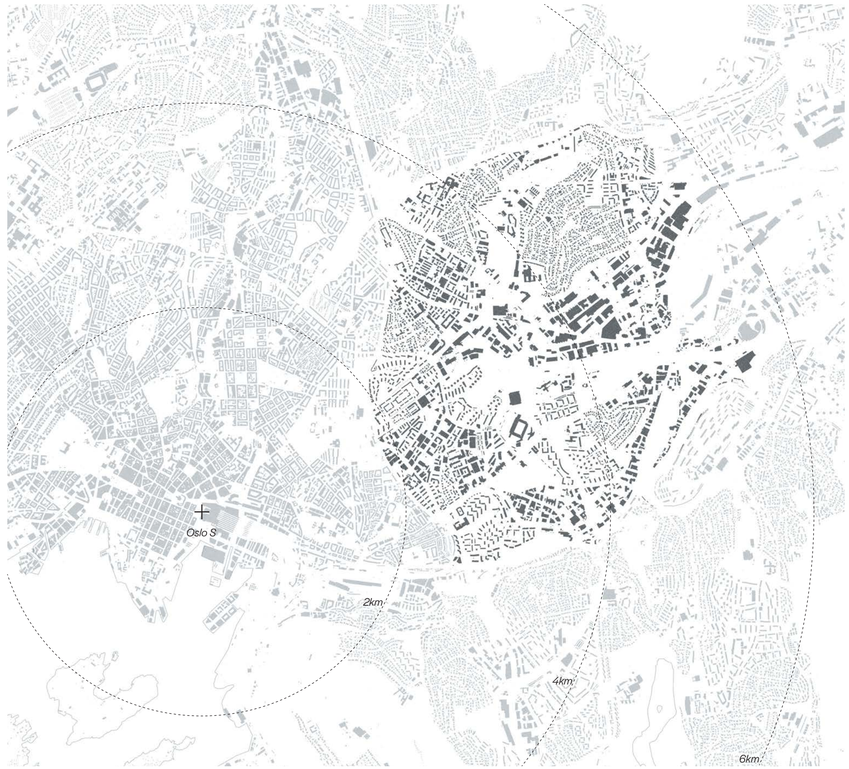
Fringe areas generally arose during the period of post-war housing development, which tended to be built on the outskirts of the city. Cheap land prices made the space in between the city center and the suburbs attractive for large industry and bulk business. In modern times, the shift away from suburbanization has made growing cities look at the potential of fringe areas for densification.

With its proximity to the city center, Hovinbyen is a clear target for fringe redevelopment. Several policy documents are written up and in force, varying in scale from a strategic masterplan to more focused public space guides and district-level possibility studies. The Oslo municipal government estimates that 80 000 residents and 100 000 workplaces can be added to the area over a 50-year timeframe[14]. Work has started in many places and at least one district is near completion.

Sourcing material is an integral part of the reuse methodology. This is also closely linked with the location of the project in relation to its material sources. As fringe territories are redeveloped, vast swathes of buildings are cleared to make way for urban renewal, releasing enormous amounts of materials. Transformation in the inner city fringe represents a great potential for reuse and siting the reuse hub within this context will allow it to function both a practical, local measure for dealing with future waste and as commentary on urban renewal practices in general.

[13] Formato, E. (2017). *Fringe Area of a City, Can You Show Me The Way?*

[14] Oslo kommune. (2018). *Strategisk plan for Hovinbyen*



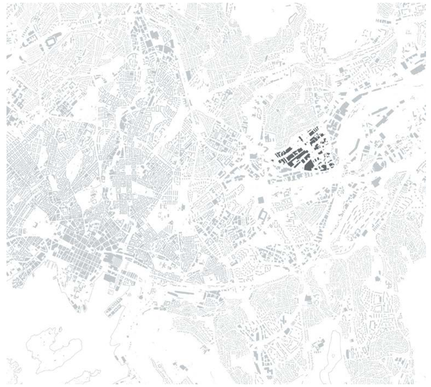
07. *Oslo, with Hovinbyen emphasized.*
Reproduced by the author with GIS-data.

Site

In the north-eastern corner of Hovinbyen lies the district of Haraldrud. The Oslo Municipality envisions, as with the rest of Hovinbyen, a dense urban fabric to arise here. It is hard, however, to imagine the Haraldrud of today fulfilling that role. Essentially, the area consists of two parts: a waste handling facility, including a waste-to-energy incinerator, surrounded by large industrial buildings and bulk goods providers. There is little sense of continuity in the spatial structure and an ambiguity between the pedestrian and the heavy traffic realm.

Nonetheless, there is potential here too. Mixed-use has already infiltrated Haraldrud in the form of a hotel and a vocational education and training center, Kuben yrkesskole, with upwards of 1400 students and 550 adult students. These lie alongside Kabelgata (Cable Street), sharing the street with the rest of the now defunct Standard Telephone and Cable Company factory. The factory complex as a whole represents an important piece of historical heritage. Built in many stages over a roughly 60-year period, it embodies the important societal and technological changes that took place during that time.

Preliminary planning has laid the groundwork for the transformation of the area, summarized over the next few pages. However, it is also clear from the planning documentation that the waste handling facility is to remain; in fact, there is, as of Autumn 2020, planning work being done on upgrading and expanding the facility. In this lies a deep sense of contradiction. However, this also brings about a set of exciting possibilites to explore and challenge the NIMBY-divide between people and waste. Can the project act as a kind of mediator, both at the urbanistic and formal level as well as the programmatic?

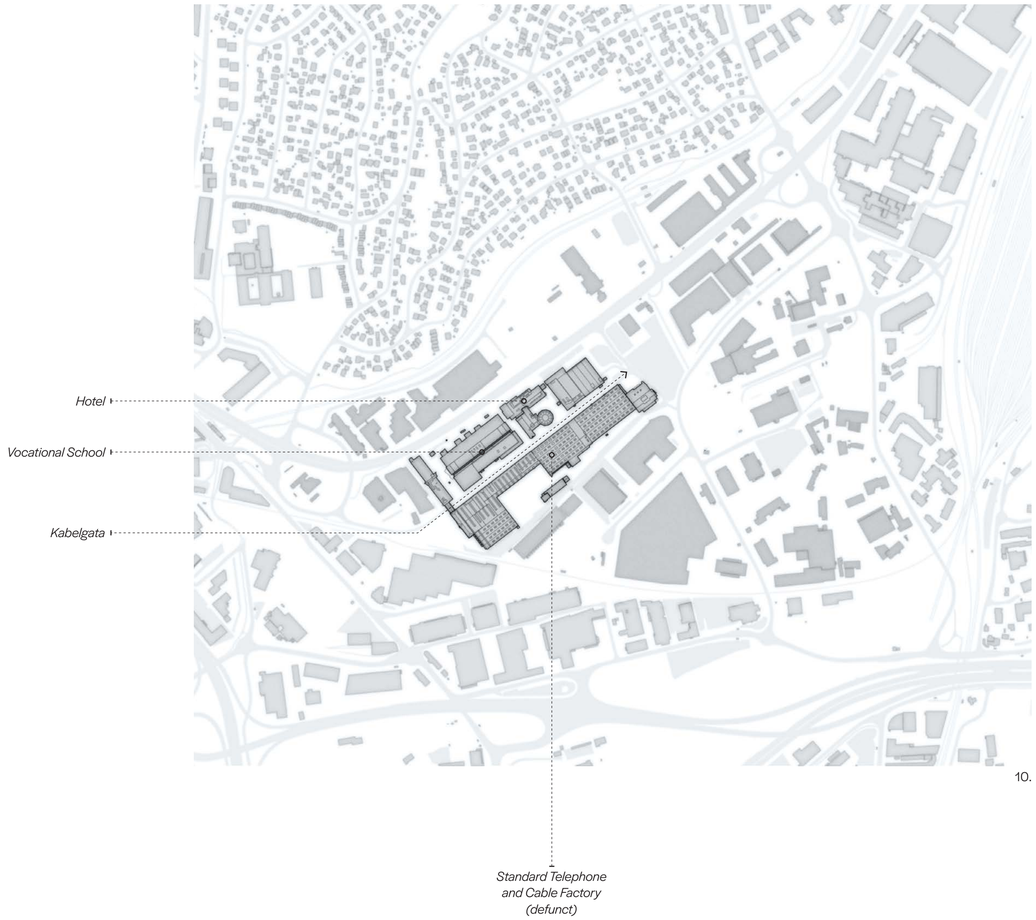


08.

09.

08. *Oslo, with Haraldrud emphasized.*
Reproduced by the author with GIS-data.

09. *Haraldrud and its immediate surroundings.*
Reproduced by the author with GIS-data.

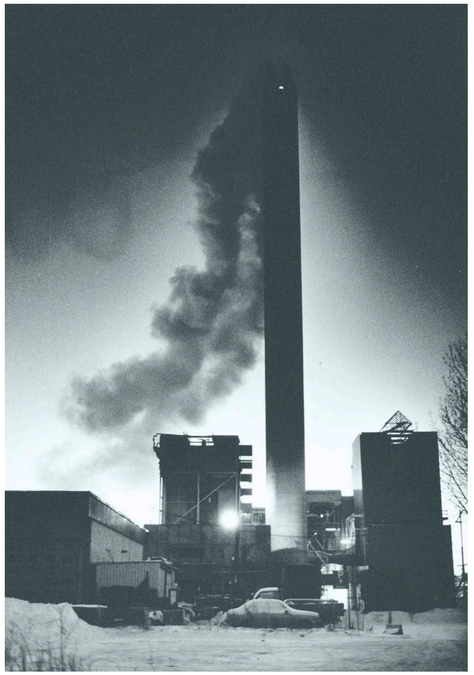


10.

10. *Haraldrud, with Kabelgata emphasized.*
Reproduced by the author with GIS-data.

11. *Kabelgata. To the left is the vocational school. The right, the defunct cable factory, now home to numerous other businesses. It is protected under historical heritage bylaws.*

Photography: Oslo kommune.
VPOR Haraldrud. 2016.



12.

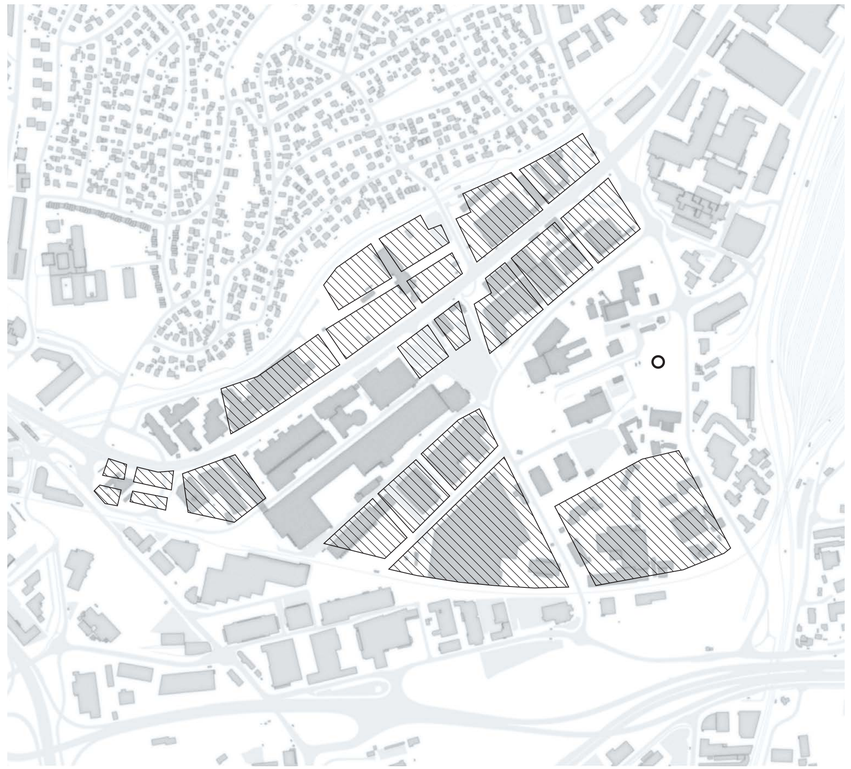
13.

12. *Incinerator at Haralrud.*
Photography: Arne Ove Bergo.
Arbeiderbladet. 1986.

13. *Haraldrud Waste Handling Facility, view from northeast.*
Aerial photography: Oslo Kommune.
VPOR Haraldrud. 2016.

14

14. *Haraldrud, with the waste handling facility emphasized.*
Reproduced by the author with GIS-data.



15. *Zones of future development. Shown here are plots targeted for redevelopment as well as the placement of a new recycling drop-off point intended to replace the existing. This diagram is a visual summary of planning proposals currently going through the application process, not proposals made by the author.*

Reproduced by the author with GIS-data and from permit applications 201701691 & 201114057.

New recyling drop-off point

Future development

16. *Future road network. The street Haraldrudveien, emphasized on the diagram, is to be straightened. On the corner of this new road, an area currently used for parking is to be turned into a city square. This diagram is a visual summary of planning proposals currently going through the application process, not proposals made by the author.*

Reproduced by the author with GIS-data and from permit applications 201701691 & 201114057.

Future square

Haraldrudveien

17. *To the north and south of Haraldrud are two planned green corridors, part of the larger proposed greenbelt network in Hovinbyen. Connecting these is a "green connection" running the north-south axis through the district, skirting the new square and street Haraldrudveien. It is intended to be a major pedestrian and cyclist thoroughfare. This diagram is a visual summary of planning proposals currently going through the application process, not proposals made by the author.*

Reproduced by the author with GIS-data and from permit applications 201701691 & 201114057.

18.

19.

18. *Haraldrud, aerial photography.*
Photography: Oslo kommune.
2020.

19 . *The street Haraldrudveien, current situation.*
Photography: Oslo Kommune.
VPOR Haraldrud. 2016.

Approaches On-Site

A corner situation arises with the straightening of Haraldrudveien and establishment of a new city square, which currently (Autumn 2020) is not utilized in any planning proposals. The proposed siting of the reuse hub is in this situation, stabilizing the corner and “completing” the square. Additionally, this is where the “green connection” runs, providing ample opportunity for the project to engage a pedestrian thoroughfare with its own internal Detour. Heavy traffic will be excluded from the new street Haraldrudveien so material logistics must use the existing infrastructure of the waste handling facility. Immediately to the south of the proposed siting, is the current recyling drop-off point. As this is to be moved in the near future, it provides the outdoor area necessary for the proposals Staging Area.

The northern facade facing the square should delineate the public space, as well as function as a visual mediator between the civic room and the waste handling facility beyond. It should be noted that the incinerator lies appoximately 6m above the level of the square and proposed siting. This, in addition to the tall chimney, introduces a vertical component to the mediation. Along Haraldrudveien and the green connection, the western facade, the reuse hub should engage the sidewalk both in having a recognizable and cohesize urban role but also in offering spaces for stopping, looking or meeting.

It is important to note that the reuse hub exists in a kind of simulated reality, responding to a future context. Many of the acts on-site answer planned renewal interventions, not those that exist today. In operating within this simulation, the reuse hub is intended to be a tool, a driver and contribution to not only the future of the district and Hovinbyen but to the future of a circular city.