"We are confronted with a scene of wiring and technology and it is impossible to understand their purpose. They are awe-inspiring, fascinating and we cannot pin them down. In other words: they look like art"

- *Kunstuur 16.12.2018*
on industrial photography by Thomas Struth

EXPLAINING THE AUTISTIC

HOW PROCESS SHAPES SPACE

STATEMENT

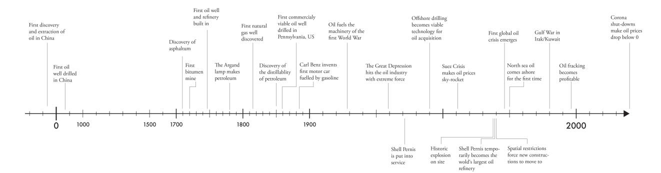
Harbor cities around the world are characterized by their strong connection between the urbanized area and the (closely or loosely) adjoining industrial port areas. This relationship is often relying on economic dependencies and spatial relations between the two as well as the cultural and demographic influence the ports exerts its' host cities. The port's function as a global infrastructural knot allows the cities range for influences to expand drastically and thus opens it up to human flows, economical driving forces in form of companies and materials and technological advances - even way before the official age of globalization started. The territorial devision between city and port recently becomes a growing problem due to population and economic growth world wide. This results in separation although close proximity of industrial and urban areas.

Though harbors themselves have been an invention of the human race, its' advancing precision, specialization and growing complexity disconnects us from each other ever since port areas were repositioned outside / have grown out of the cities. For decades the two zones have been evolving in a parallel manner without the port having strong communication to the public. This brings us to a place where our neighbor became a type of phantom or black box to most of us. Its' zones are closed of for the public and behave rather hostile to busy-bodies.

Revisiting industrial sites especially as an architect makes one thing more apparent than any other: space making is relative to its context everywhere and in a context where there is no need to serve human needs or aesthetic judgement there is a different set of rules underlying it. The strangeness of in which processing units, infrastructure and composition that are inherent to every specific industry present themselves is intriguing and confusing at the same time. They govern the space as allegedly grown structures of divergent still repetitive patterns. Due to their introversion and their channeling of energy into a limited number of tasks and processes, they can be defined autistic spaces. The following research tries to profoundly dissect these industrial spaces and make them understandable to the reader, explaining the networks they are embedded in, the workflows on site and their impact on the created spatial configurations. A strong focus is put on the act of drawing, as it strongly informs and reflects the findings.
In order to be able to come to a reasonable judgement about space making two comparable sites are picked in the harbors of Rotterdam and Marseille-Fos.

THE SITE

The petroleum industry has significantly coined world economy for the past two centuries, powering our vehicles and homes and refining base products for further processing into plastics and cosmetics for example. The Shell Refinery in the Port of Rotterdam (PoR) - close to Pernis - is mostly recognizable through it's present skyline, visible from both the city and even the distant coastline of Hoek van Holland. As Shell Pernis used to be the largest refinery world wide and still plays a significant role in the production and export of the Netherlands, it stands tall in the history and development of the PoR, making it a strong example for the implementation of petroleum refineries in the global network as well as the manifestation of the industry and its' processes on site.

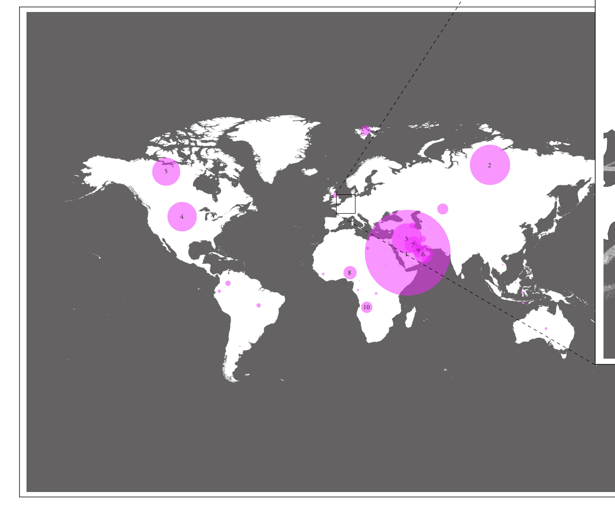


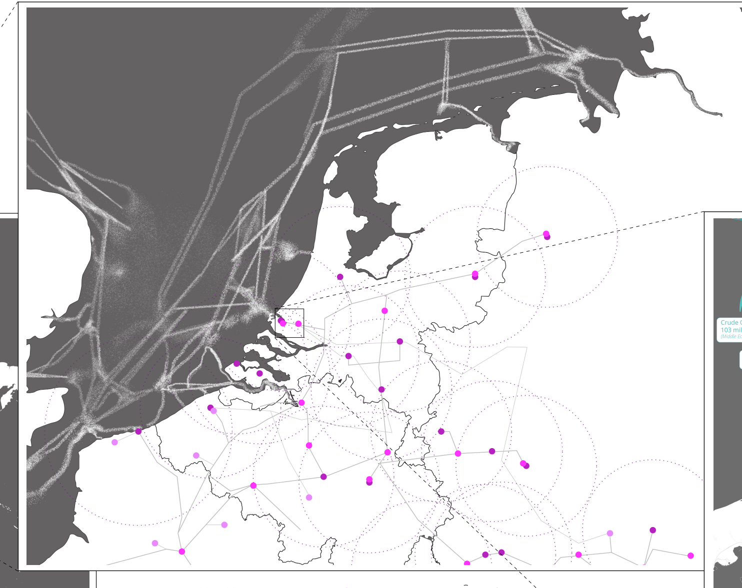
GLOBAL IMPLEMENTATION

The global crude oil export, mapped by country. Listed are the top ten producers, mainly agglomorating in the Arab region, Russia and North America.

1	Saudi-Arabia	43.986
2	Russia	21.682
3	Iraq	15.769
4	USA	15.644
5	Canada	14.925
6	Emirates	9.529
7	Kuwait	8.507
8	Nigeria	8.214
9	Qatar	6.130
10	Angola	5.894

x thousand metric tonnes per month referring to latest information available





EUROPEAN IMPLEMENTATION

Area coverage of refinery plants in the BeNeLux area. A comprehensive network of Transloading stations (intermodal) allows efficient forwarding and distribution of petroleum products aside the Central European Pipeline System (CEPS).

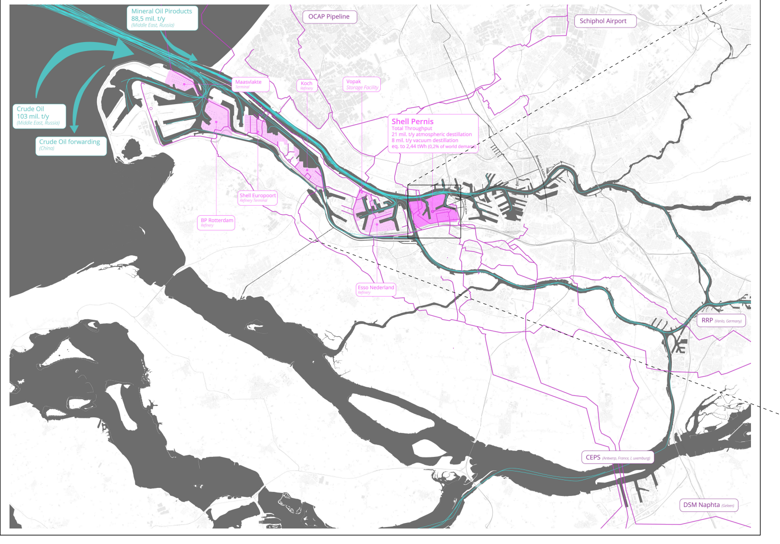
- Active Depots
- Private / State Depots
- Transloading

75 km
125 km

REGIONAL IMPLEMENTATION

The well accessible Maasvlakte terminal is where most of the large crude oil tankers deploy their load. Forwarded via a infrastructural pipeline spine along the PoR the it reaches it's destination: The Shell Pernis Refinery.

- Petroleum Sites
- Pipeline Network
- Ship Routes



THE SITE

Connected via a pipeline spine on the site, crude oil and refined products are efficiently moved on site between various kinds of processing units and types of storage tanks.

- Processing Unit
- Point of Entrance / Exit of Material

Orthogonal Grid

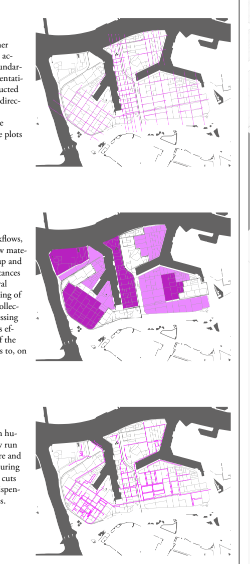
A general grid (or rather mutliple) is layed out according to the site boundaries and the desired orientation of the to be constructed processing units / the direction of the workflow.
This is the basis for the infra-structure and the plots on site.

Zoning

According to the workflows, its' accessibility for raw material delivery and pickup and given natural circumstances (wind direction, natural borders) a general zoning of the site is designed. Collecting storage and processing units into zones allows efficient maneuvering of the materials and products to, on and from the site.

Infrastructure

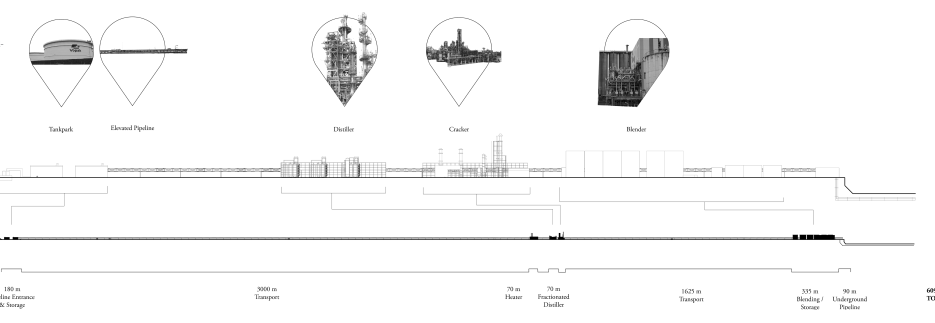
Infrastructure for both human and material flow run along the grid structure and access/supply neighbouring plots thus making the cuts between the plots indispensable spaces themselves.



PROFILE 1

Common workflow along site

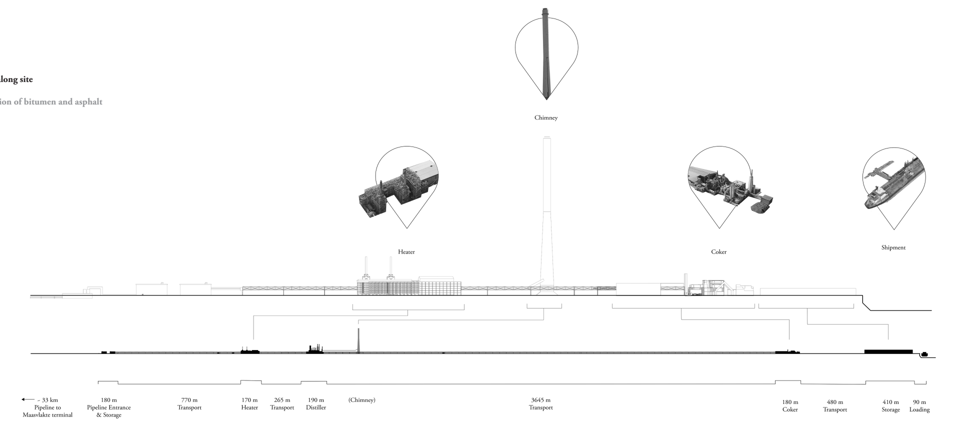
Accurate for production of oils, petrol, kerosine, and diesel



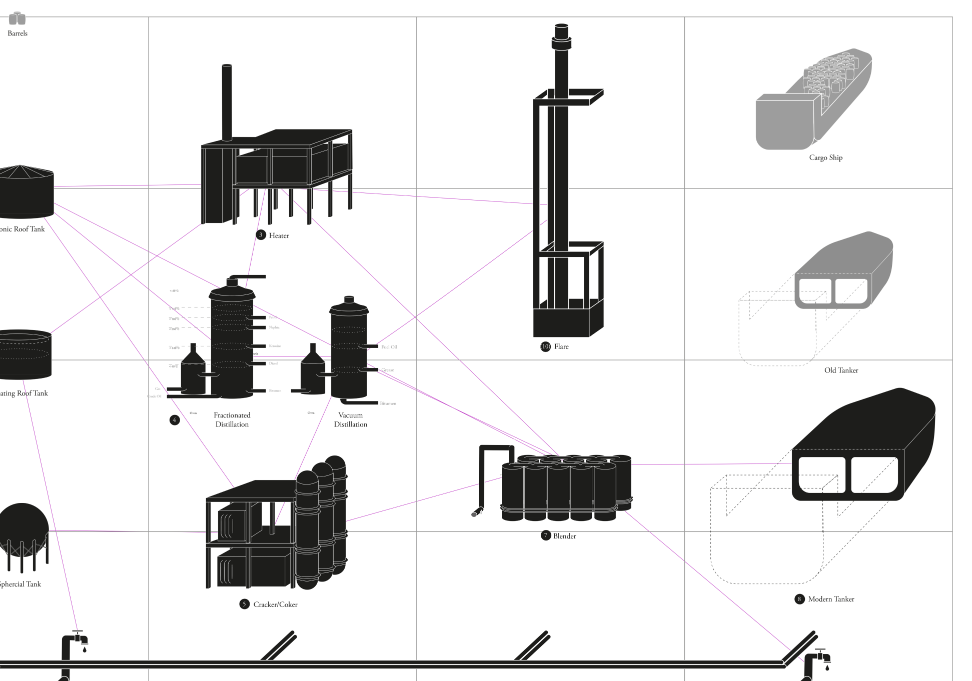
PROFILE 2

Common workflow along site

Accurate for production of bitumen and asphalt



- Characters numbered regarding the general workflow
- Characters for alternative workflow
- Expired Characters
- Noisy
- Hot
- Smelly



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CHARACTERS OF OIL REFINING

1 **Pipeline**

Underground, above ground or elevated. Means of transportation of goods to, on and away from site.

Diameter: 25 cm - 3 m
Height: ≥ 20 m (elevated), further pipes within processing unit structures.

2 **Floating Roof Tank**

Crude Oil Storage. Roof floats on top of volatile crude oil in order to keep the amount of gases inside the tank to an absolute minimum.

Diameter: 5-30 m
Height: ≤ 24 m

3 **Heater**

Processing Unit to pre-heat the crude oil for further processes. Agglomoration of tanks and pipes within (concrete) structure.

4 **Distillation Unit**

Processing Unit to separate petroleum products via heat (fractionated) or suction (vacuum). Different filters catch a variety of ligh to heavy fuels etc. in the Fractionated Distiller - residues will be forwarded to the Vacuum Distiller to be processed and minimize left overs. Situated within/attac

5 **Cracker / Coker Units**

Separate Units, though similar in appearance.
Cracking processes allow further distinction in products (light fuels). Coking processes refine gases into heavy residues f.e. for asphalt production.

Main element of tankpark zone on site. Used for storage of a large variety of products (diesel, kerosene, naphta, petrol...).

Diameter: 5-40m
Height: ≤24 m

7 **Blender**

Blending of products into usable chemical compositions.

8 **Oil Tanker**

Used for the forwarding and distribution of finalized products. Storage are is siuatated within the ship body. Modern oil tankers can carry up to 564.000 tonnes. The ship size though is limited to the minimal depth of the waters they are traveling.

9 **Spherical Tank**

Tank storage for gases. Due to spherical shape it can withstand large interior pressures. This way gases can be compressed to liquids and stored more efficiently.

10 **Flare**

Chimney-like structures that serve as ventiles for flammables. Exhausts are lit on fire and burnt immediately to avoid spreading on site. Flares are only active while processing units are maintained or malfunction. Not to be confused with exhaust chimneys on site (up to 213m)

Height: 110m

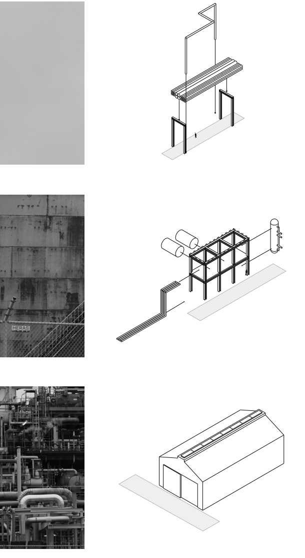
METABOLISM

A tank storage is gradually replaced by a processing unit. over a period of 13 years.

1) 2005: Tank storage connected to exhaust chimney
2) 2012: Replacement by processing unit
3) 2018: Rearrangement of piping

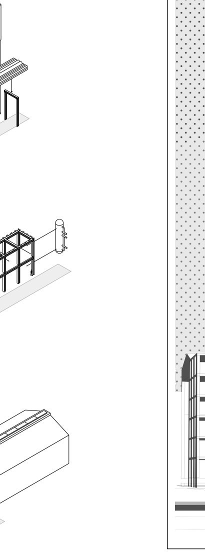
DETAILING AND MATERIALITY

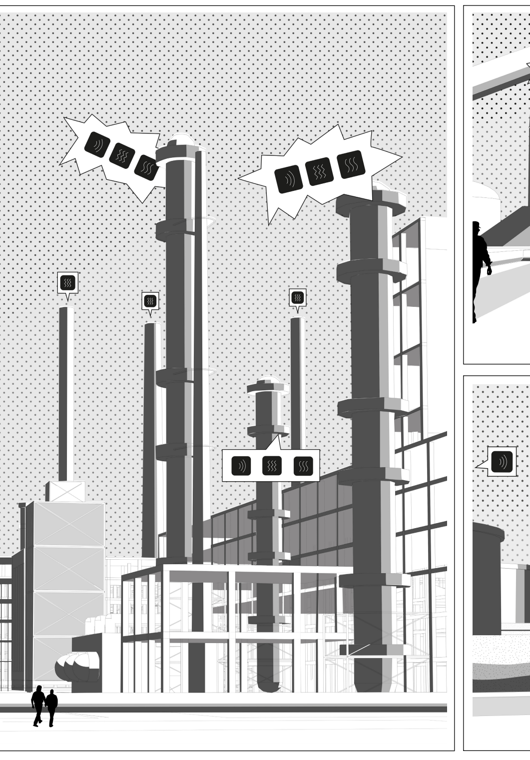
1) Light Structures: Flare chimney
2) Heavy Structures: Tank
3) Graining of façades: Processing unit

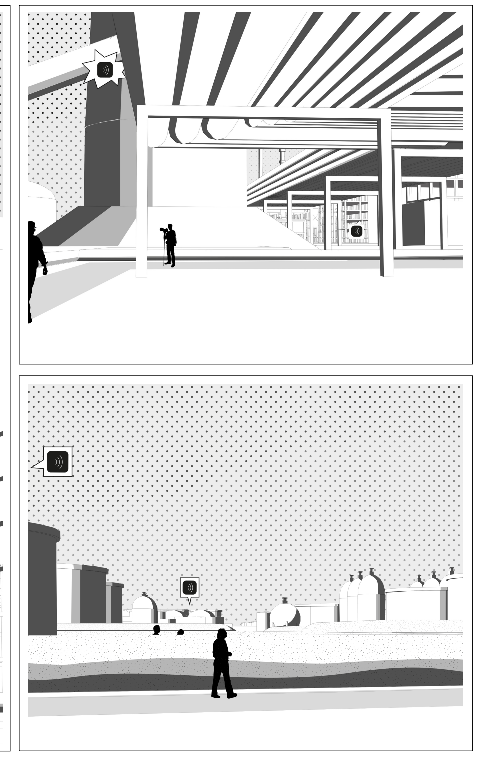


CONSTRUCTION PRINCIPLES

1) Infrastructure: Elevated Pipeline Structure
2) Workflow: Processing Units
3) Stationary: Warehouse







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Though harbors themselves have been an invention of the human race, its' advancing precision, specialization and growing complexity disconnects us from each other ever since port areas were repositioned outside / have grown out of the cities. For decades the two zones have been evolving in a parallel manner without the port having strong communication to the public. This brings us to a place where our neighbor became a type of phantom or black box to most of us. Its' zones are closed of for the public and

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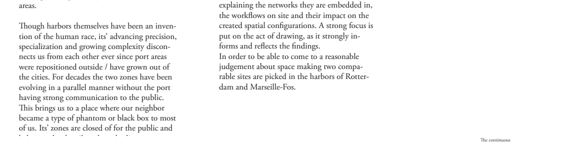


THE SITE

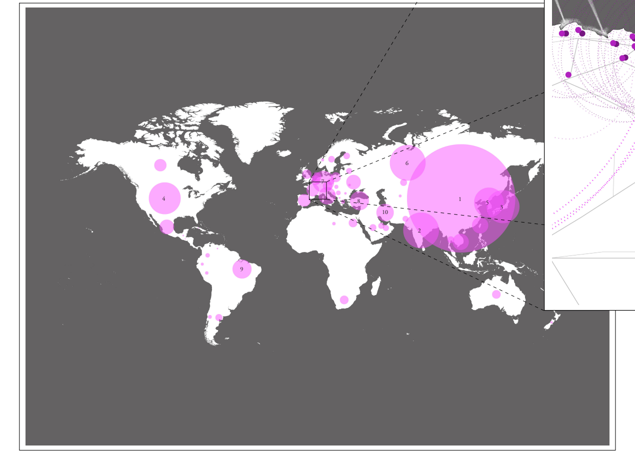
The steel industry is an essential producer for our everyday lives. Steel - as a material that is rather light, strong and resistant in certain legations - has become indispensable for transport industries (automotive, railway, nautic and aviation), construction and industrial design. The large automotive production sector in France explains the country's reliance on the product underlining the importance of the ArcelorMittal production site in the port of Marseille, Fos-sur-Mer (PoM). As ArcelorMittal - ever since the take-over of Mittal Steel by Arcelor - is one of the leading steel producers world wide the site is a strong example for the implementation of the steel plants in the global nework as well as the manifestation of the industry and its' processes on site.

GLOBAL IMPLEMENTATION

The global steel production, mapped by country. Listed are the top ten producers, mainly agglomorating in East Asia, Russia and North America.

1	China	81.520
2	India	9.089
3	Japan	8.157
4	USA	7.407
5	South Korea	5.983
6	Russia	5.950
7	Germany	3.322
8	Turkey	2.687
9	Barzil	2.597
10	Iran	2.200

x thousand metric tonnes per month referring to oct. 2019



EUROPEAN IMPLEMENTATION

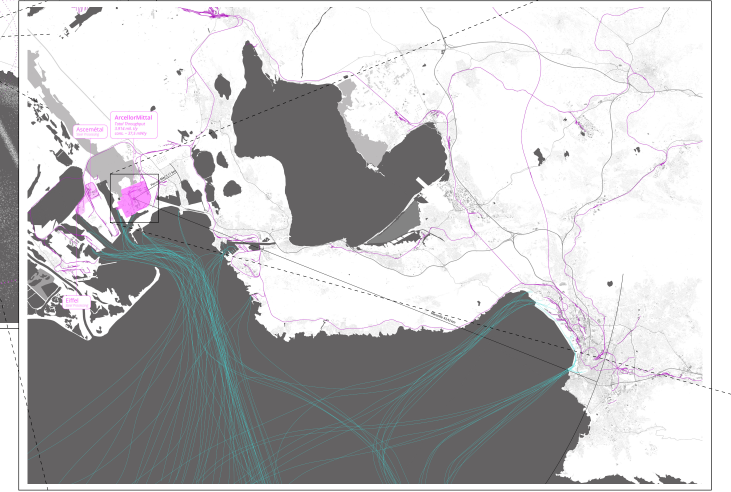
Area coverage of steel manufacturing plants in the Norther-Western Mediterranean area. The agglomoration of Secondary Steel plants reflects the concentration of f.e. car industry hot spots. ArcelorMittal is the only primary steel production plant in southern france.

- Primary Steel Production
- Secondary Steel Production
- Transloading
- 75 km
- 300 km

REGIONAL IMPLEMENTATION

Due to its' conventient positioning on the seaside, ArcelorMittal is accessible even for large dry bulk carriers. Final products are distributed either via ship or via train, making the railway network especially relevant for the plant.

- Steel Production Sites
- Railway Network
- Ship Routes



THE SITE

Raw materials and sinter intermediates are moved via conveyor belts on site whilst final products are transported via vehicles.

- Processing Unit
- Point of Entrance / Exit of Material

Orthogonal Grid

A general grid (or rather mutliple) is layed out according to the site boundaries and the desired orientation of the to be constructed processing units / the direction of the workflow.
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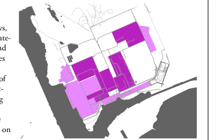

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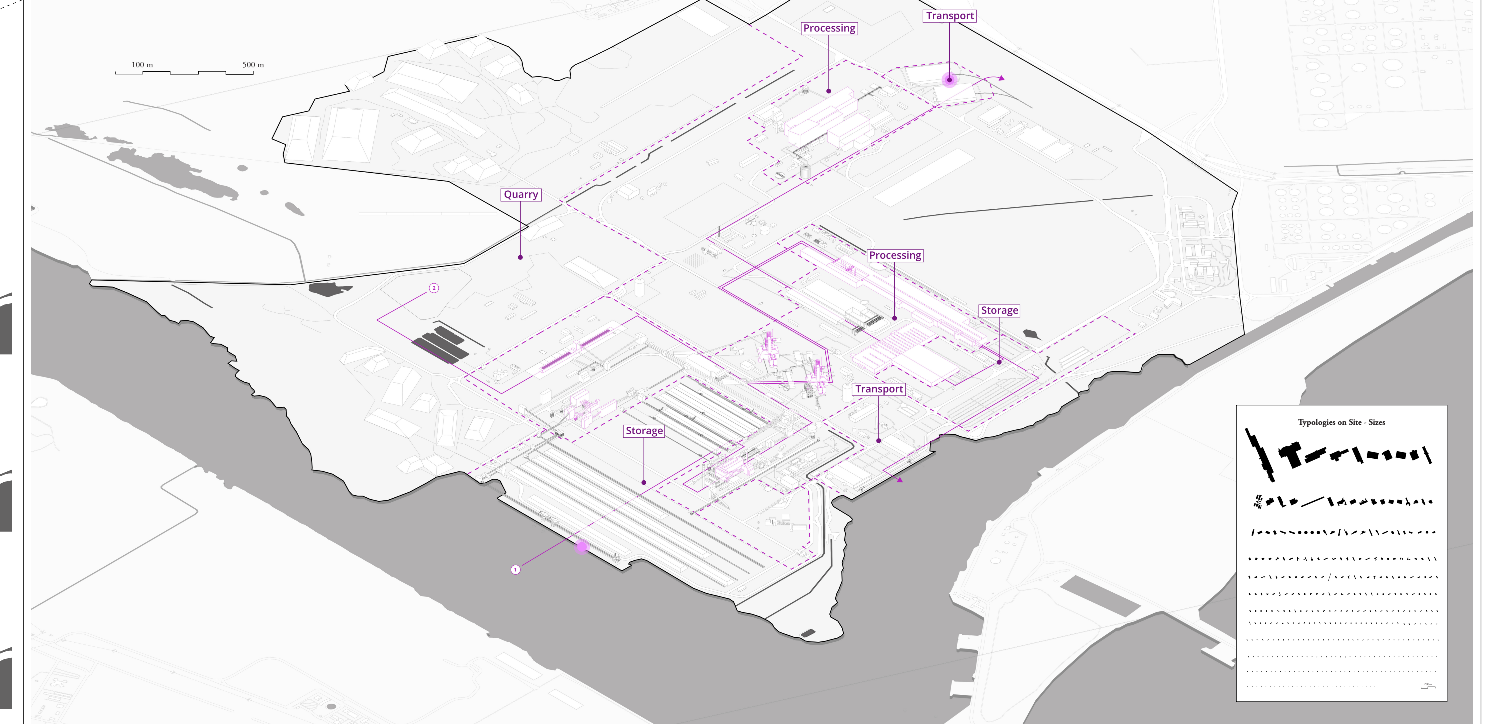
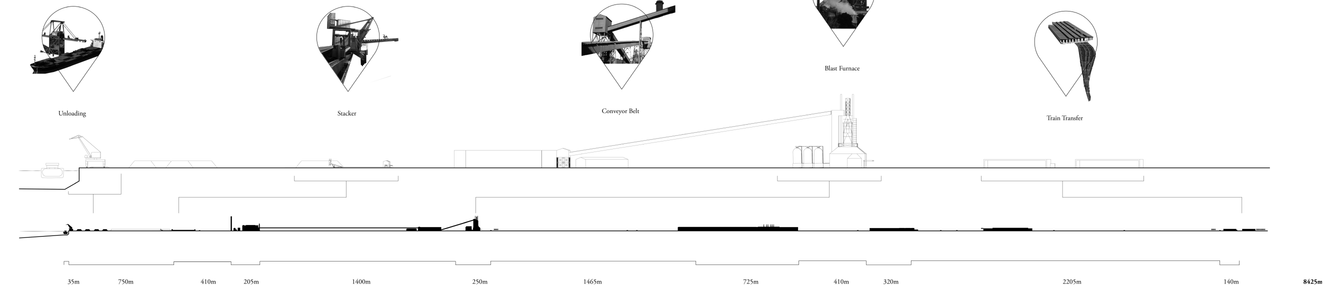


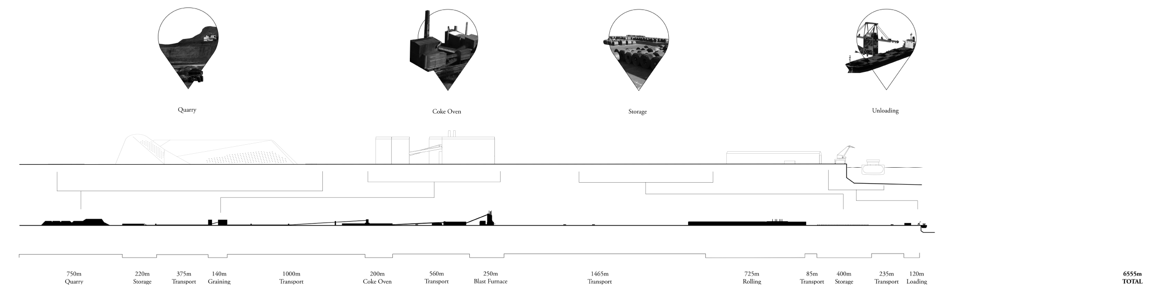
PROFILE 1

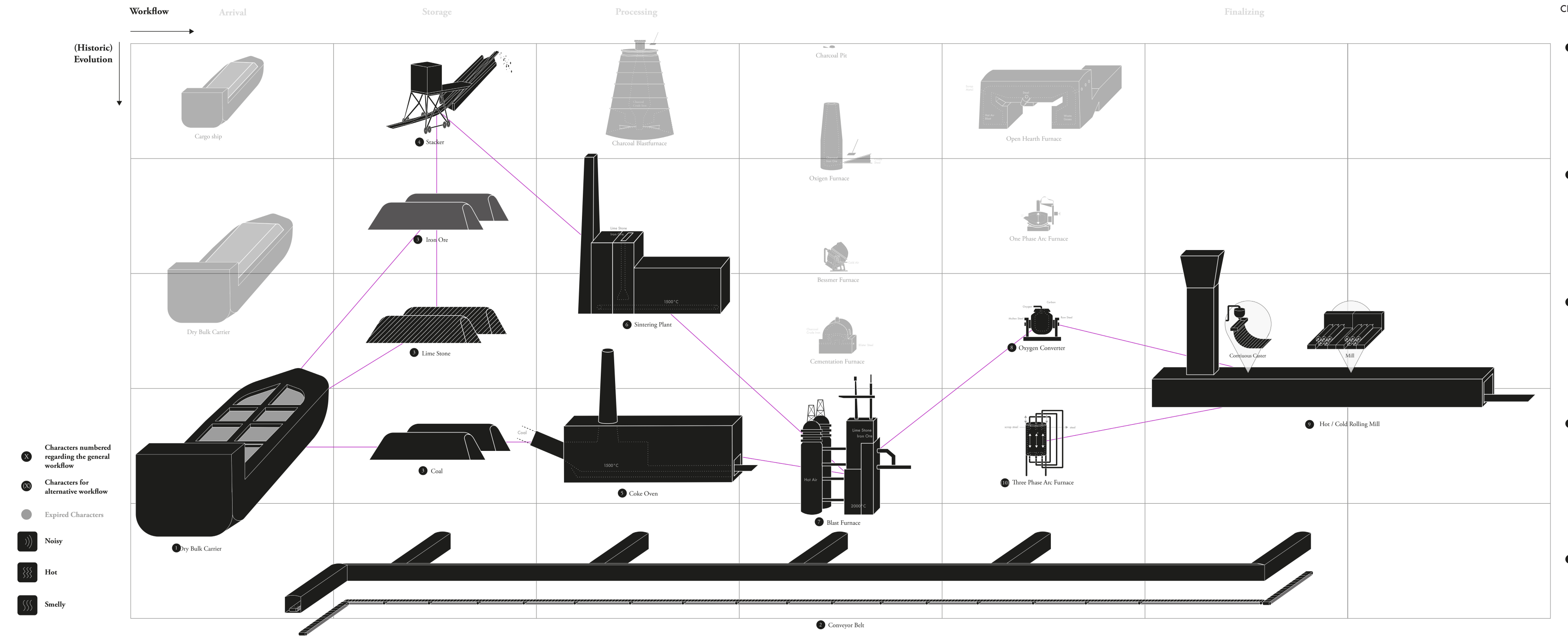
Common workflow along site
Accurate for production of steel coils and sheets



PROFILE 2

Common workflow along si
Accurate for production of





CHARACTERS OF OIL REFINING

1 Dry Bulk Carrier

Used for the shipment of raw materials such as iron ore. Storage are is siuatated within the ship body. Modern Dry Bulk Carriers can carry up to 100.000 tonnes. The ship size though is limited to the minimal depth of the waters they are traveling.

2 Conveyor Belts

Main means of transport on site. It can an be found as open or encased mechanical structures. Also used to elevate material (tilted).

Width: 3-9 m
Height: 3-5 m

3 Storage Stacks

Raw materials are stored openly on the site. The sorted stacks will then be mixed and processed.

4 Stacker

Machinery to mix the different raw materials (iron ore, lime stone and further aggregates) in large quantity (sinter mix) to acquire an even mixture for consistency of the final product.

5 Coke Oven

Coal is baked into Coke for later use in the blast furnace.
Coke is needed in order to achieve the desired chemical reachtion in the blast furnace for pig iron.

6 Sinter Plant

Unit to process sinter mix. Pre-baking it for the blast furnace allows the sinter mix to reform into larger brickettes to allow better air-flow in the blast furnace

7 Blast Furnace

Unit to melt the sinter mix into pig iron. Aggregates like lime stone support the separation process of the pig iron and the residues (slag).

8 Oxygen Converter

Unit to process pig iron. Coming from the blast furnace, pig iron has a significantly large share of carbon (as well as silicium, sulfur and phosphorus) makin the pig iron brittle.
Induced oxygen burns away unwanted shares of the iron and raw steel is created.

9 Hot / Cold Rolling Mill

Reheated raw steel can be rolled into the desired products (pipes, skelps, plates and strips)

10 3-Phase Arc Furnace

Unit used for recycling of steel.
Shooting electrons through a mixture of scrap metal smelts the old parts and creates re-usable molten steel.

METABOLISM

An unoccupied plot is gradually filled by a storage zone over a period of 14 years.

1) 2004: Unoccupied natural plot

2) 2008: Small extension of the adjoining storage zone

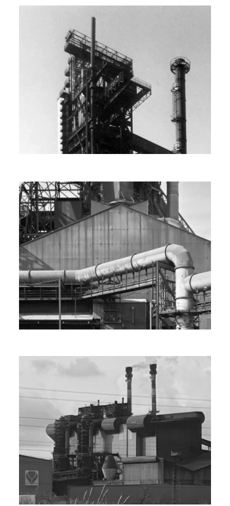
3) 2018: Full take-over of the plot as storage zone

DETAILING AND MATERIALITY

1) Light Structures: Blast furnace chimney

2) Heavy Structures: Housing of Oxygen Furnace

3) Graining of façades: Processing Unit



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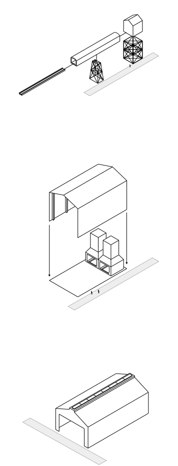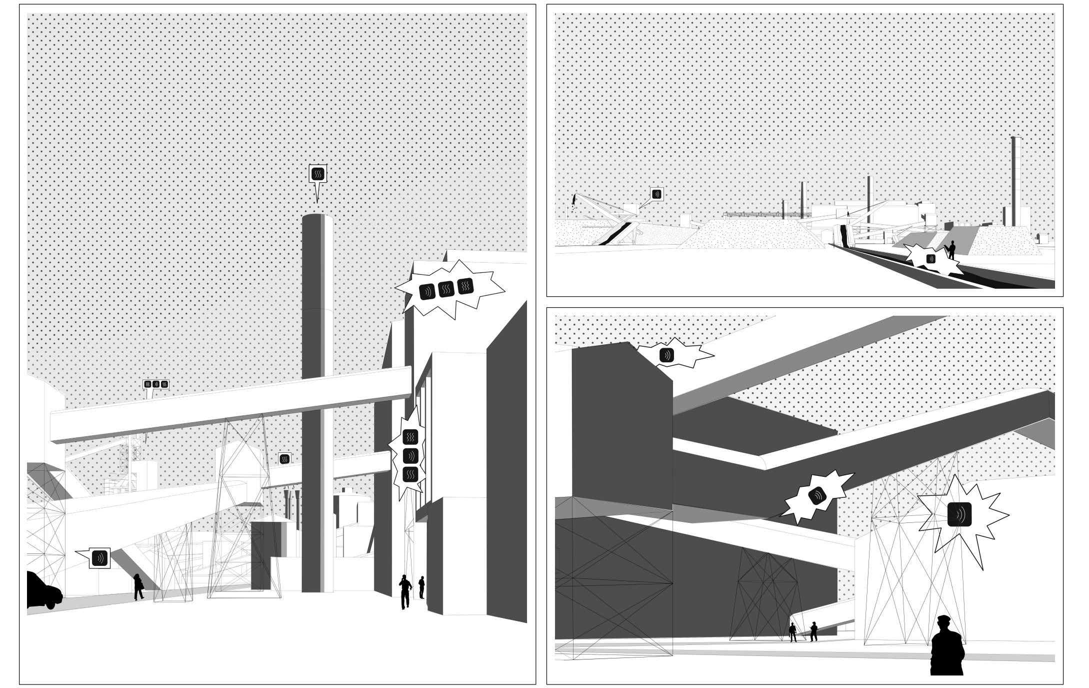
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