



Delta intervention in Embarcadero

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My focuses

1. The sea-level rise in 2100
(1.5m)
2. The renovation of coastal cities
(CBD)

Content

Urban design

Embarcadero

Architectural design

Terminal site

Building technology

Seawall

Floating fragment

Part 1

Urban design
Embarcadero



History

Embarcadero



1850

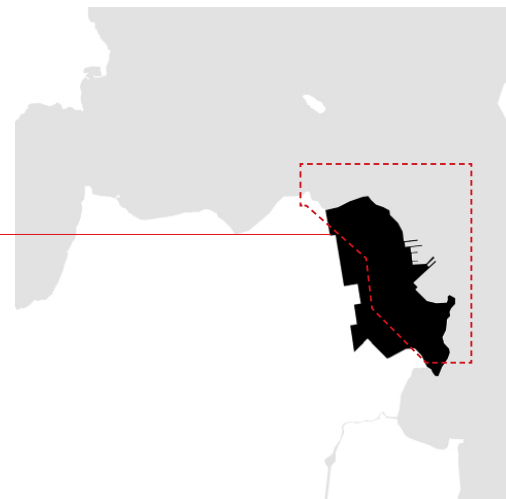


1920



2000

Embarcadero



1850



1920



2000



1850-1920
Gold rush: new settlement, small port



1920-1940
Development: cargo port

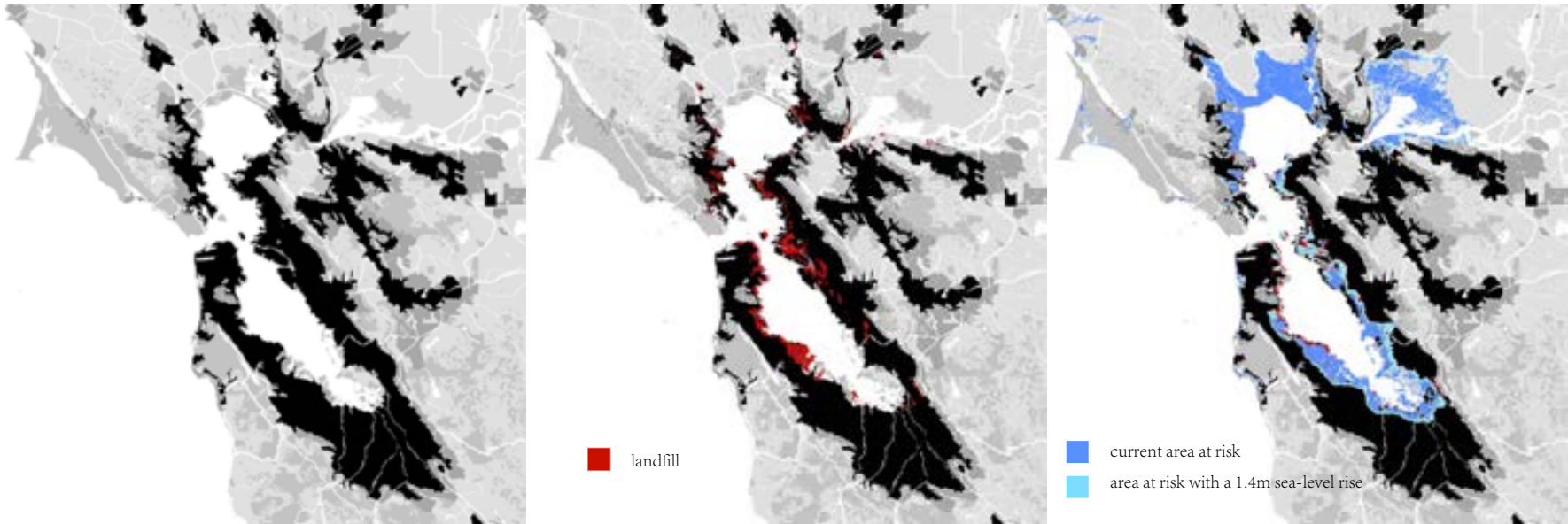
1940-1950
World war II: military port

1950-1980
After war: abandoned port



1980-now
CBD: redevelopment, tourism & recreation port

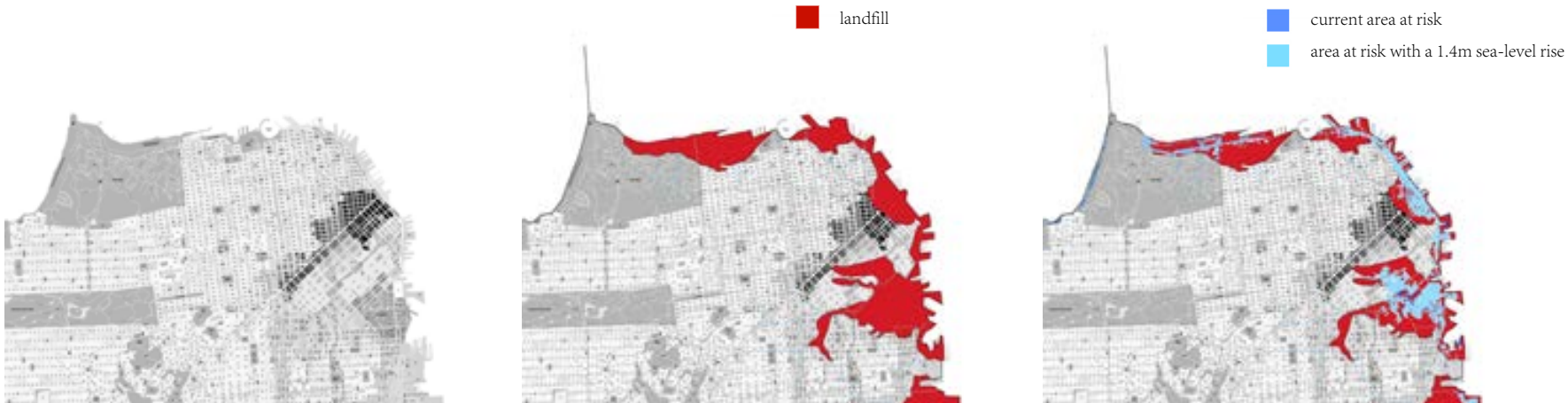
Inundation 2100



Occupation

Landfill

Inundation 2100



Occupation

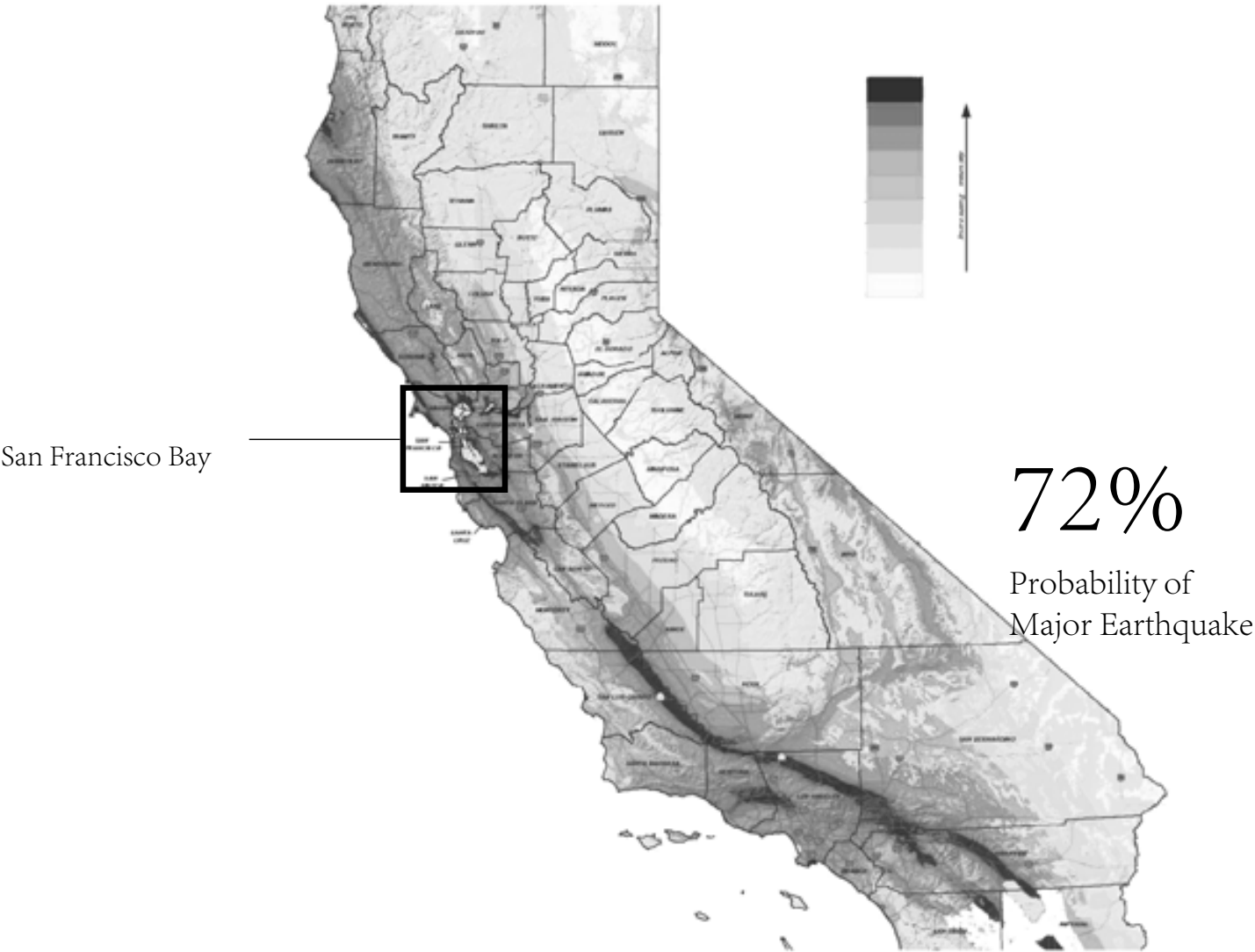
Landfill

Inundation 2100



December 2016, Embarcadero

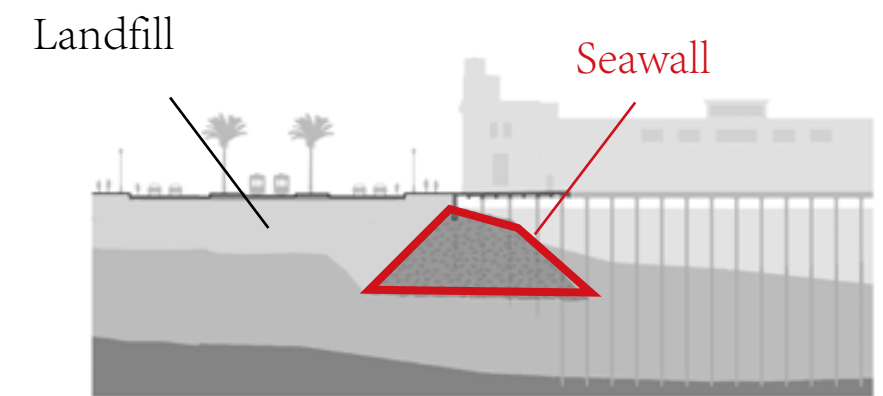
Major Earthquake by 2044



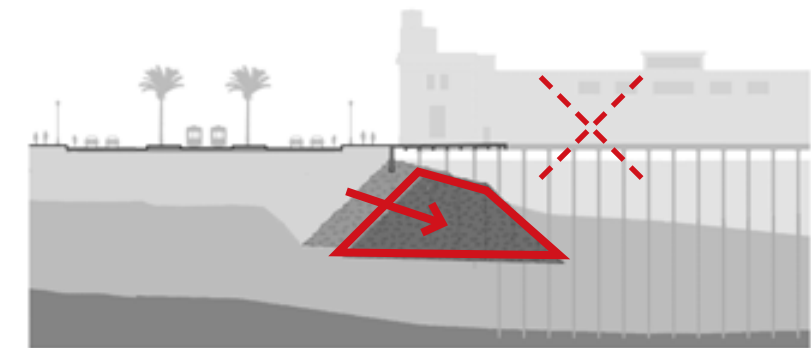
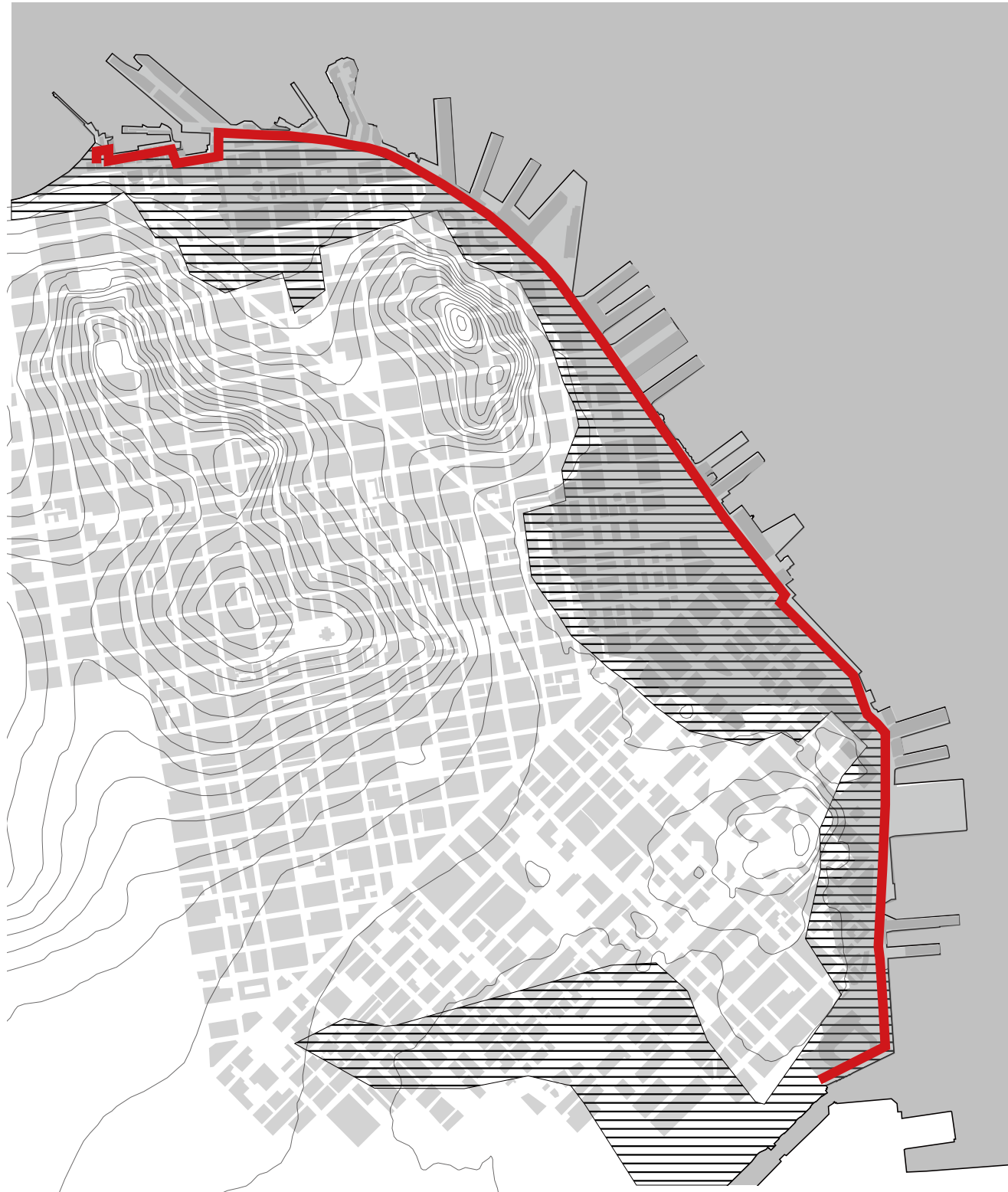


1906 Embarcadero

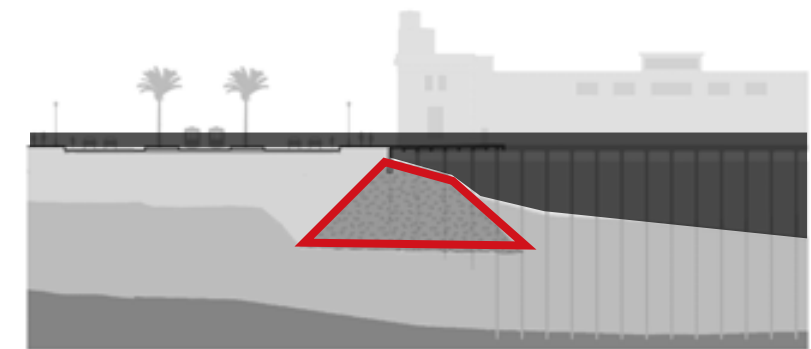
Existed situation: Landfill + seawall
1910-now



Situations in disasters

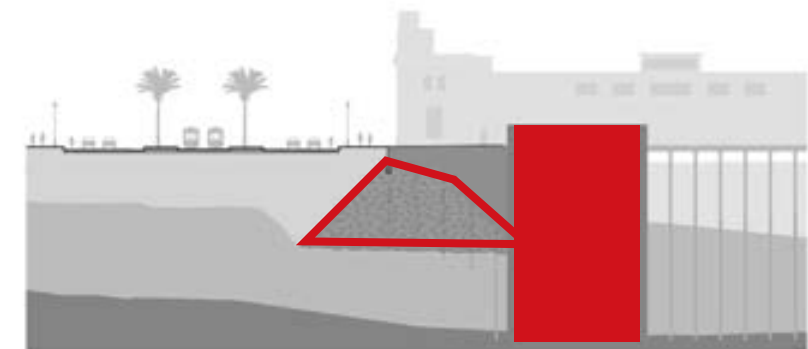


Earthquake 2044



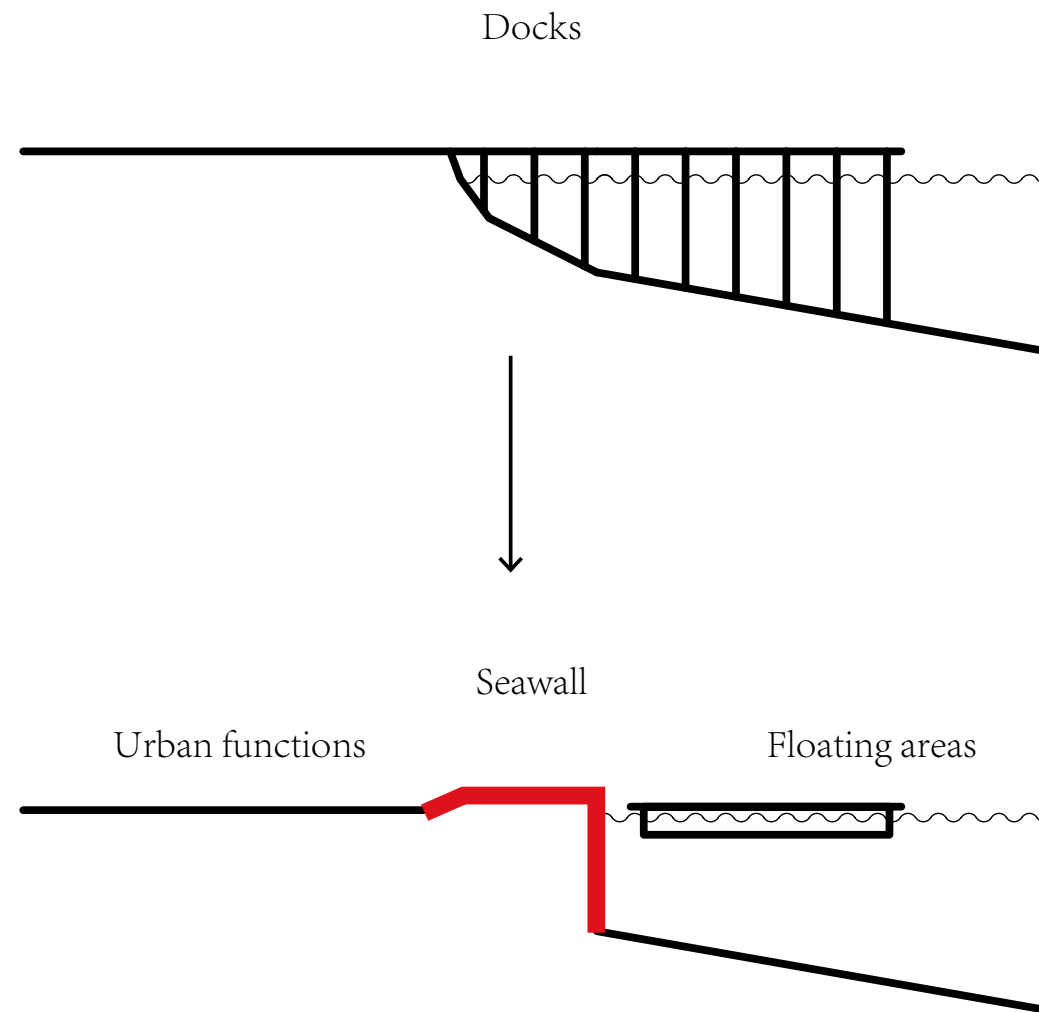
Inundation 2100

Solution

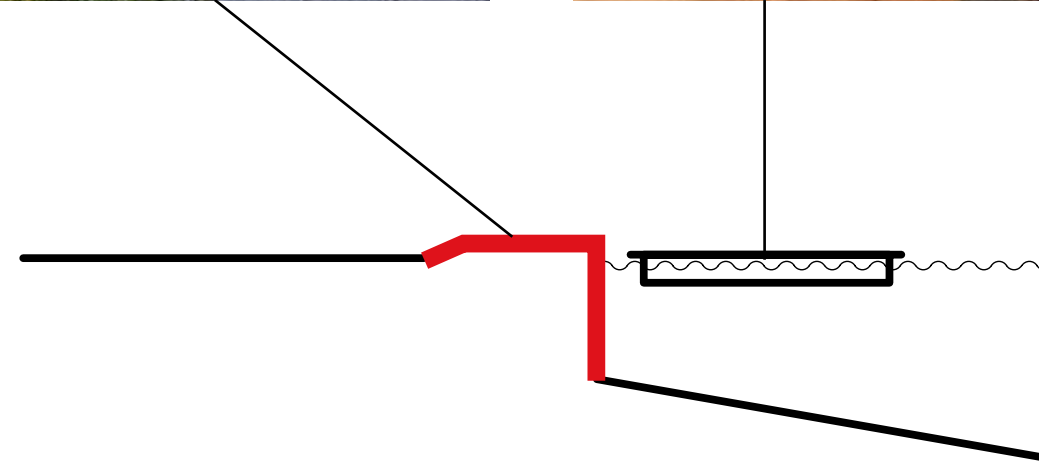


Combined with new seawall

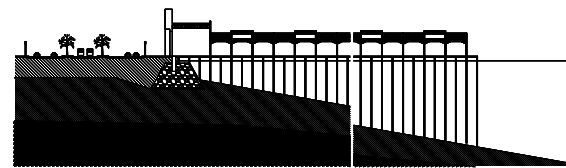
Conceptual diagram



Potentials



Situation 1: old piers



Old piers

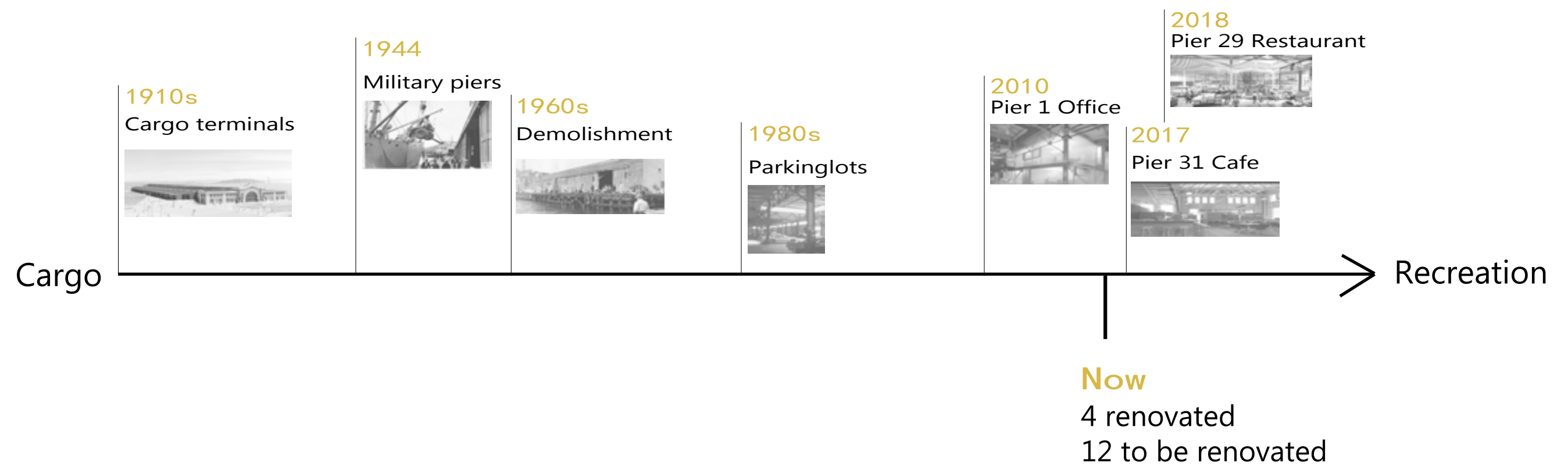


1930s

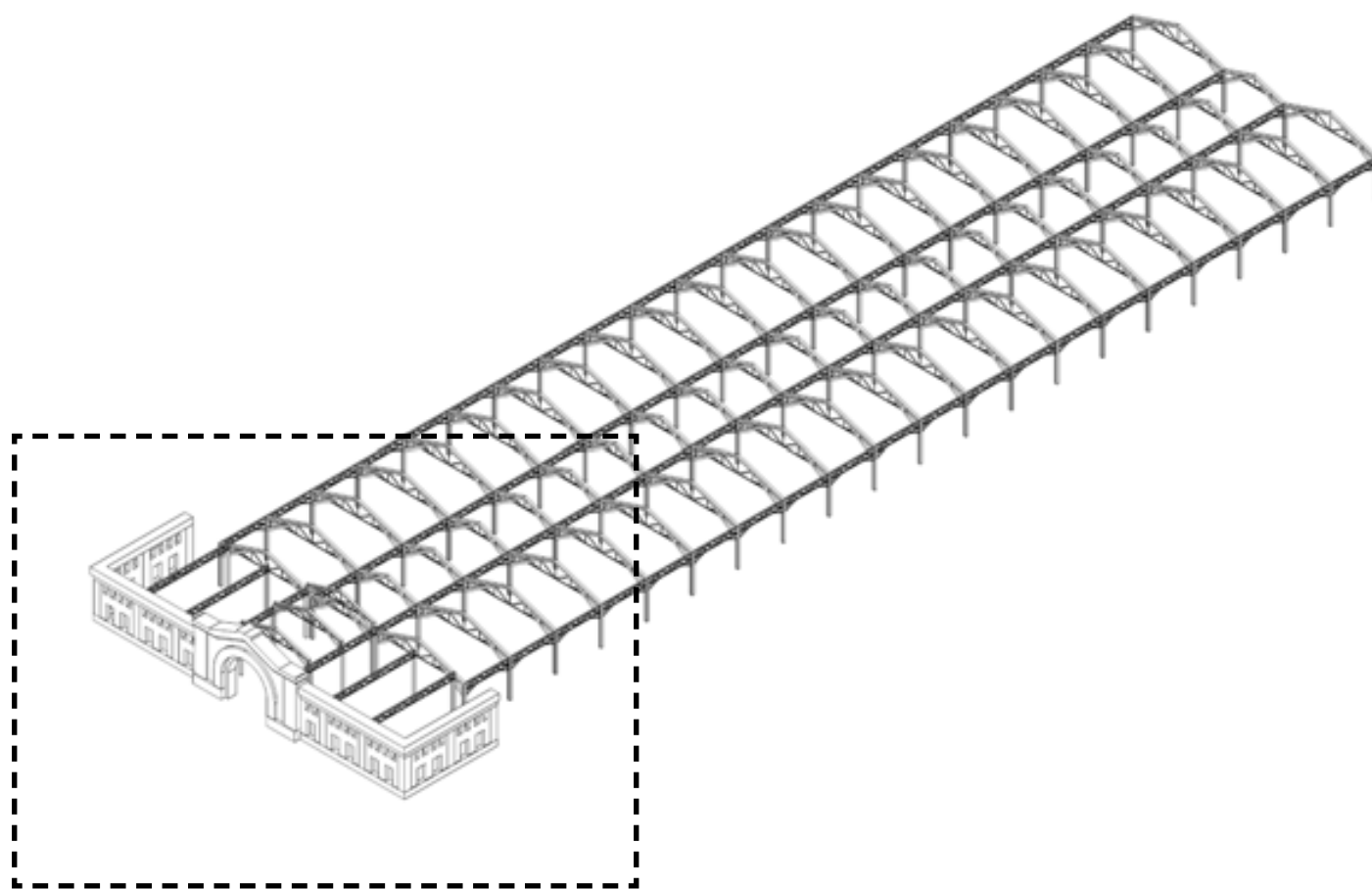


2010s

Feature 1: Important urban structure



Feature 2: Great historic value

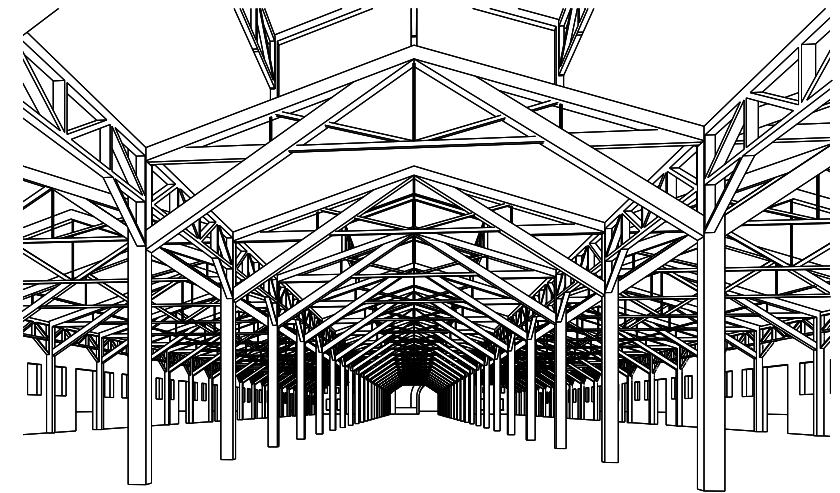
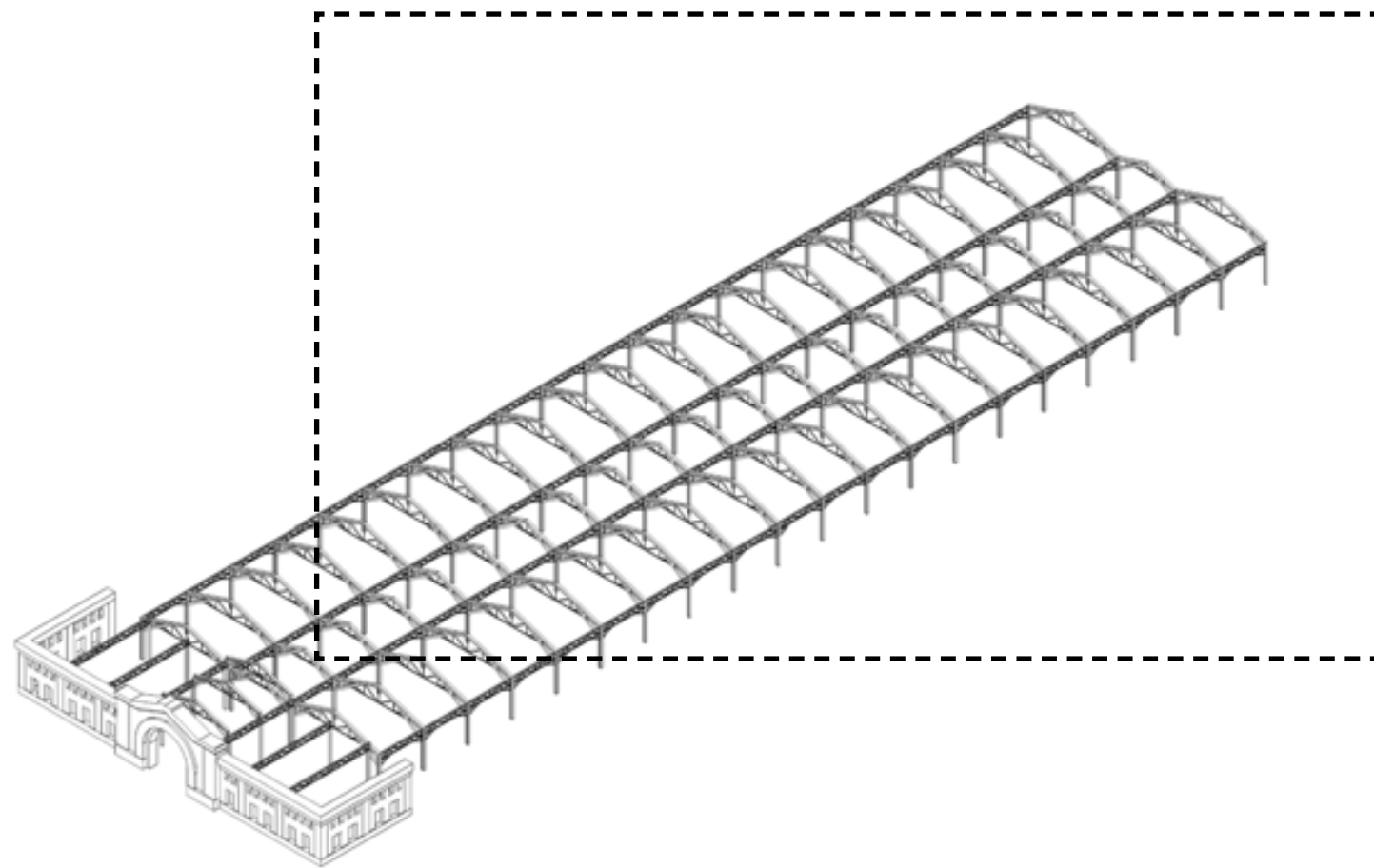


1930s



Present

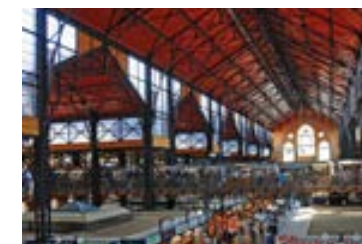
Feature 3: Iconic facades



Pier



Museum



Markethall



Shopping mall



Office

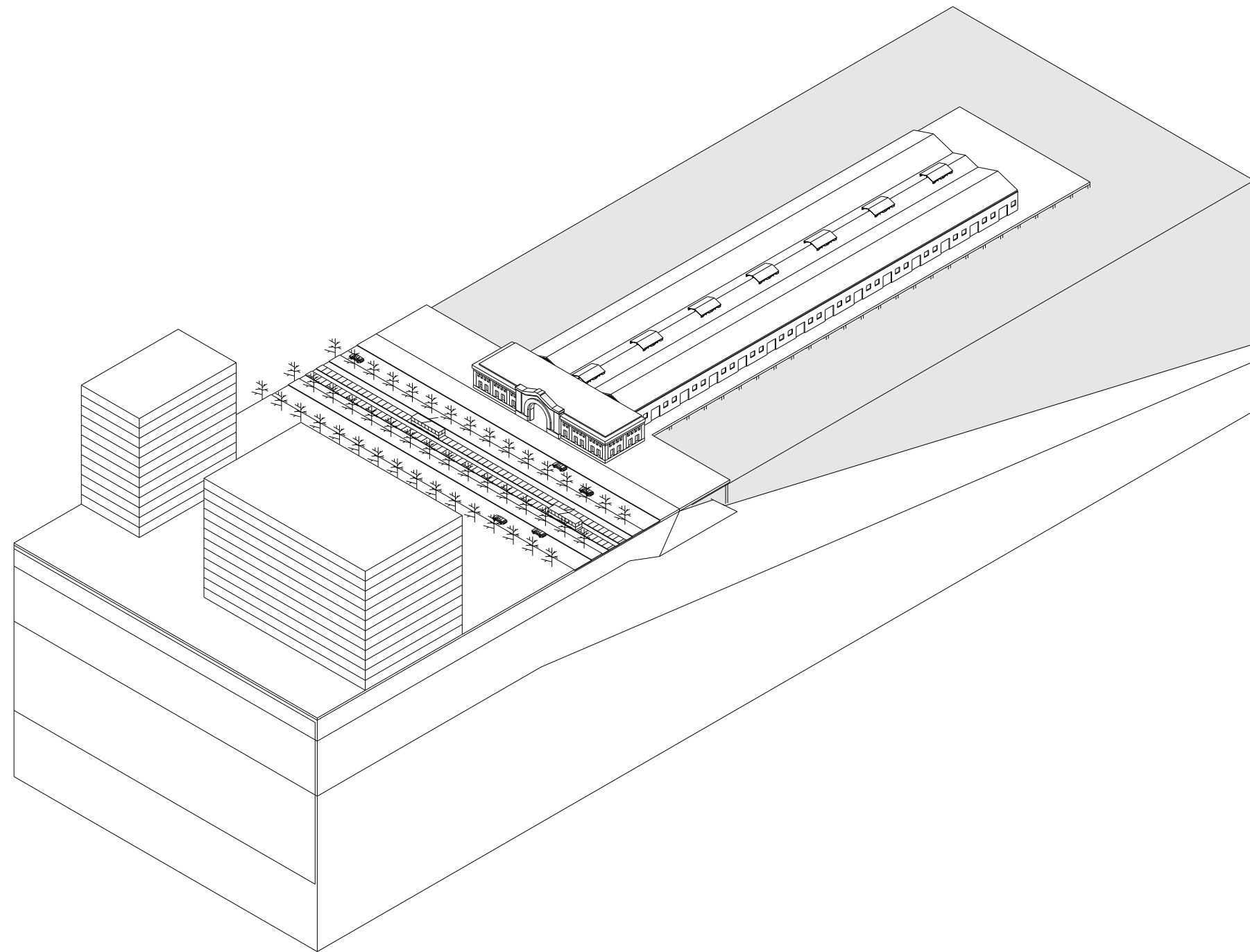


Sports

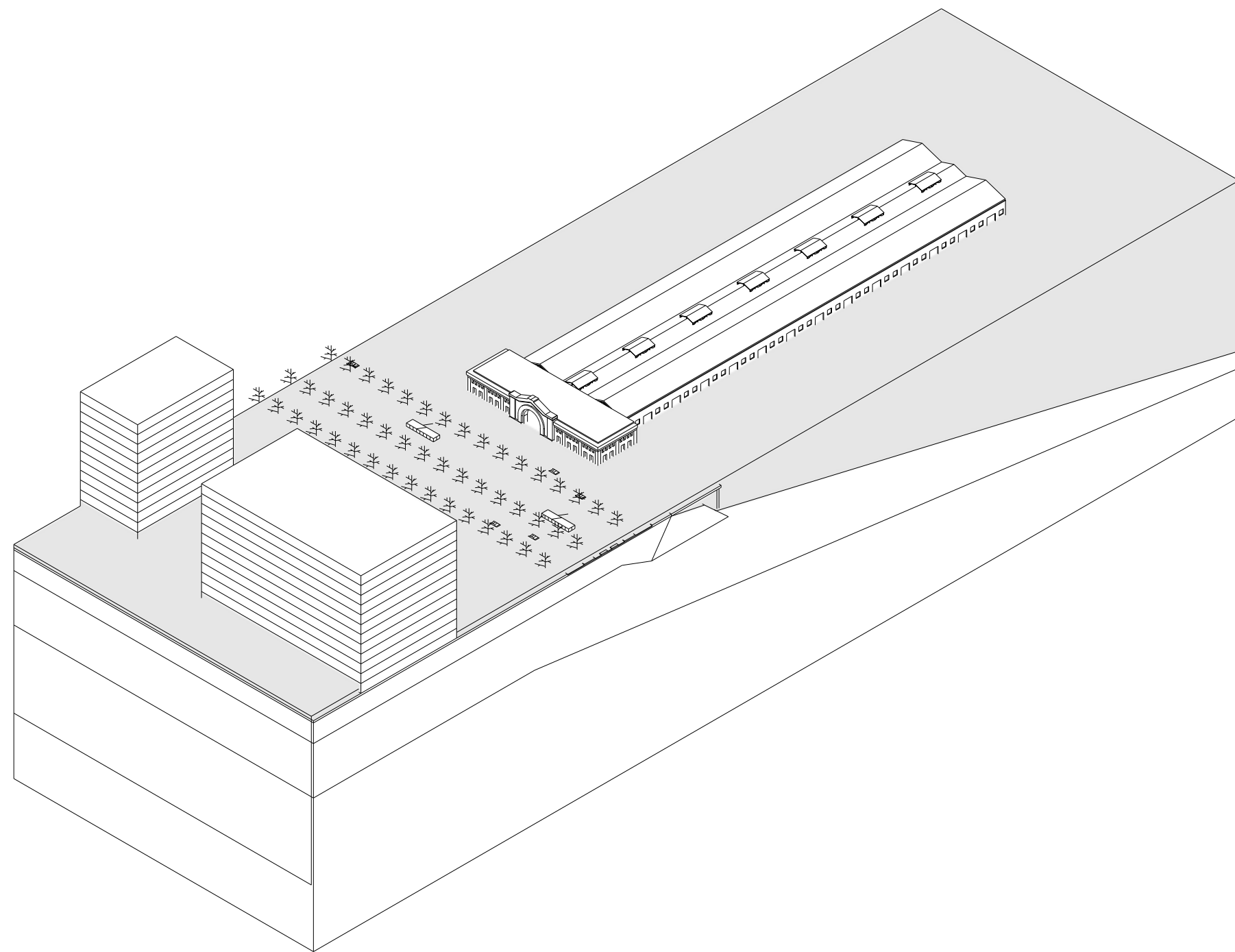
Feature 4: Large-span structures are good for public programs



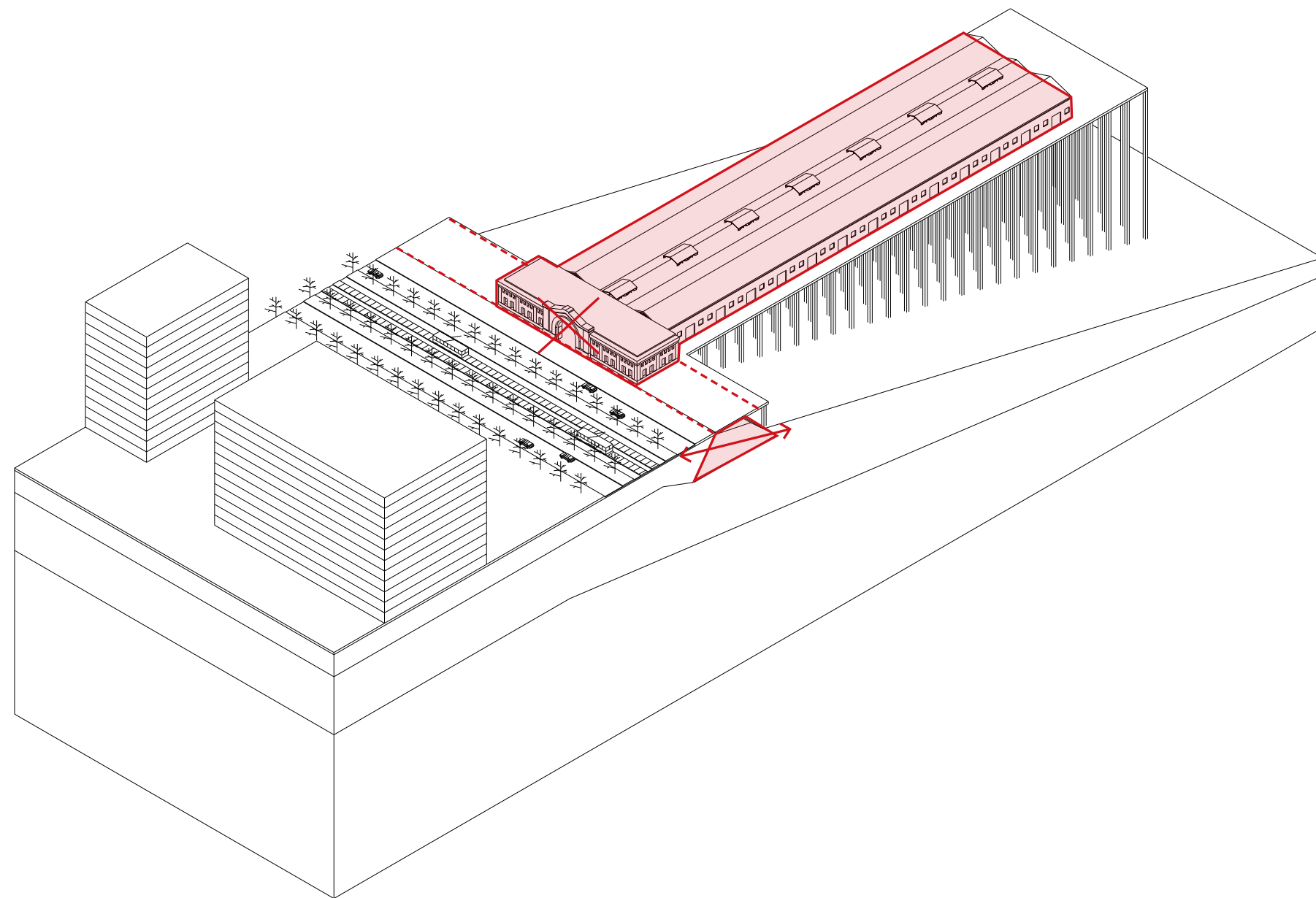
Future plannings of the old piers



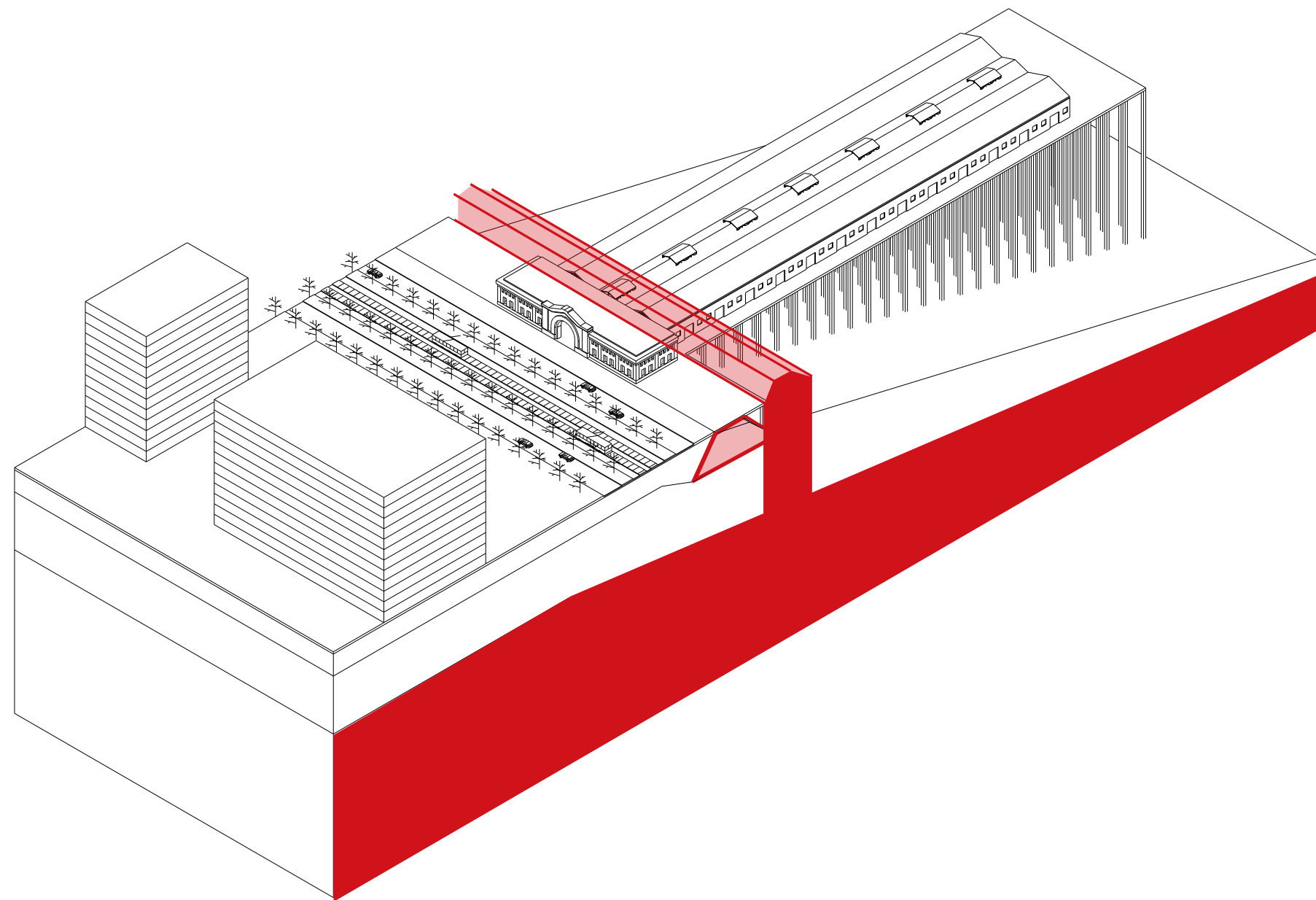
Existed situation



Inundation

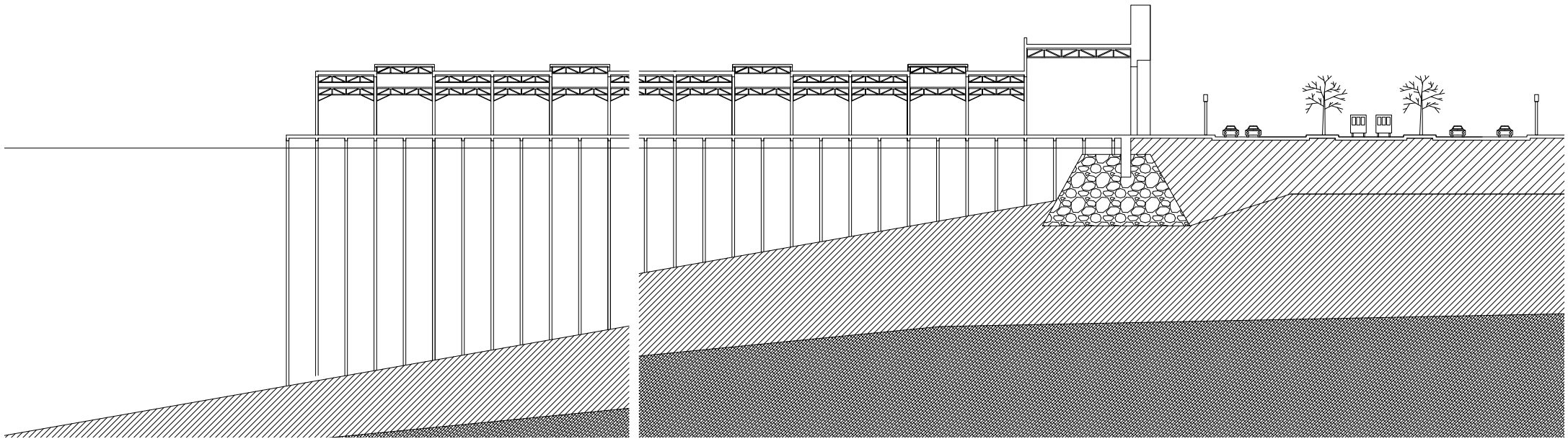


Earthquake

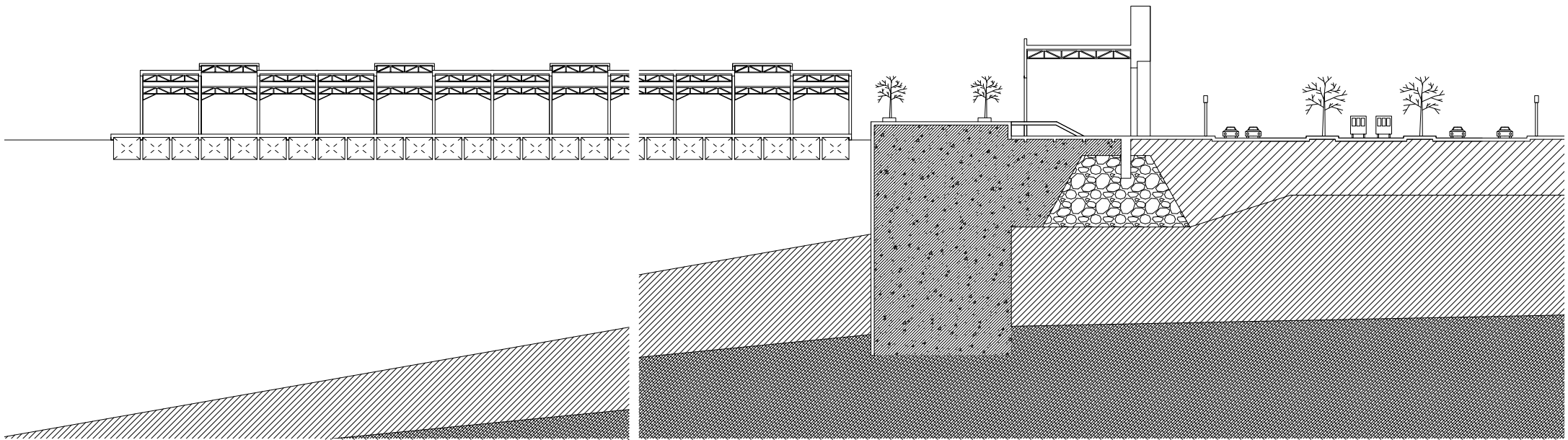


New seawall

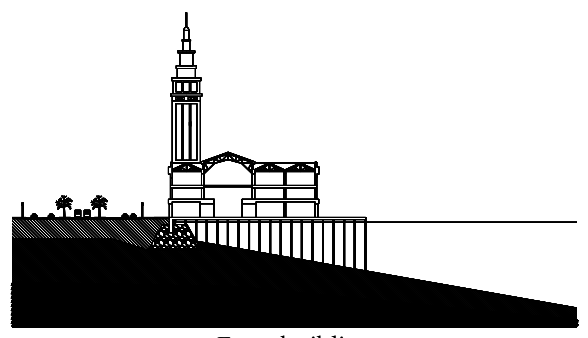
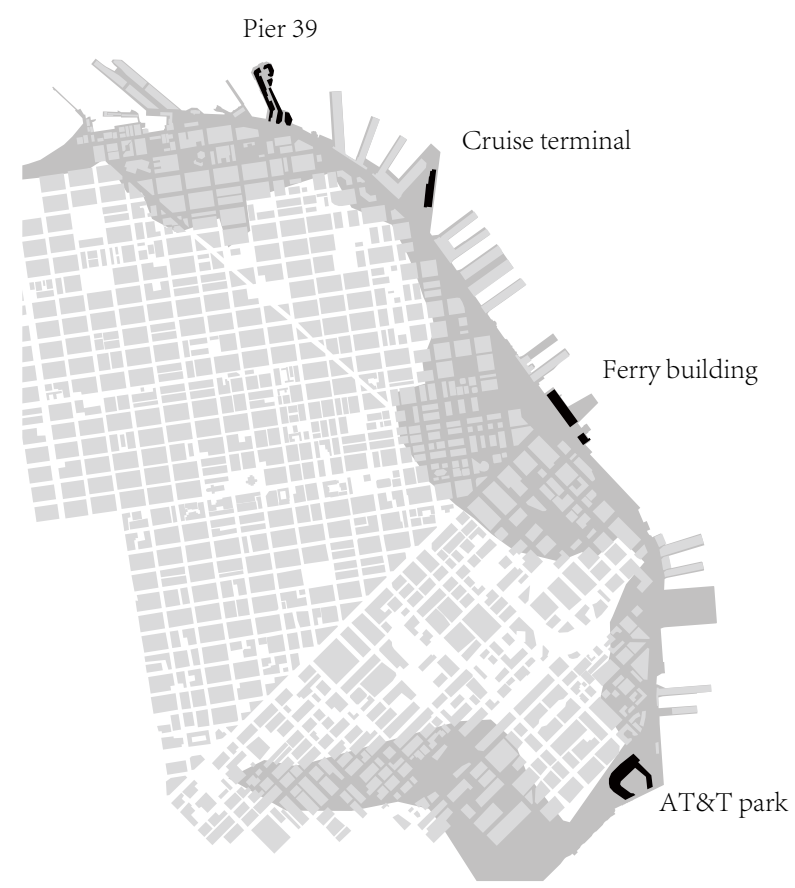
Present



Future



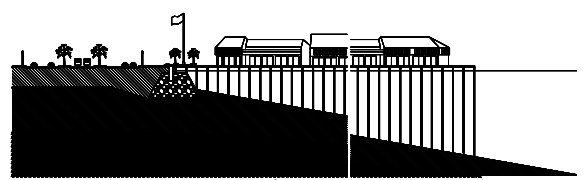
Situation 2: particular sites



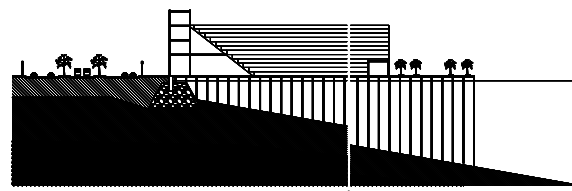
Ferry building



Cruise terminal

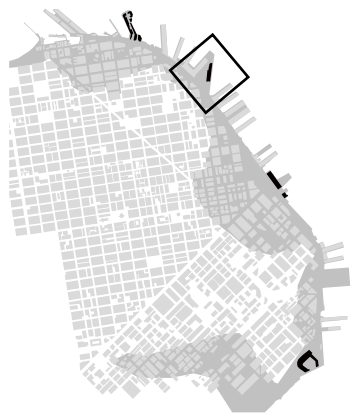


Pier 39



AT&T park

Cruise
terminal



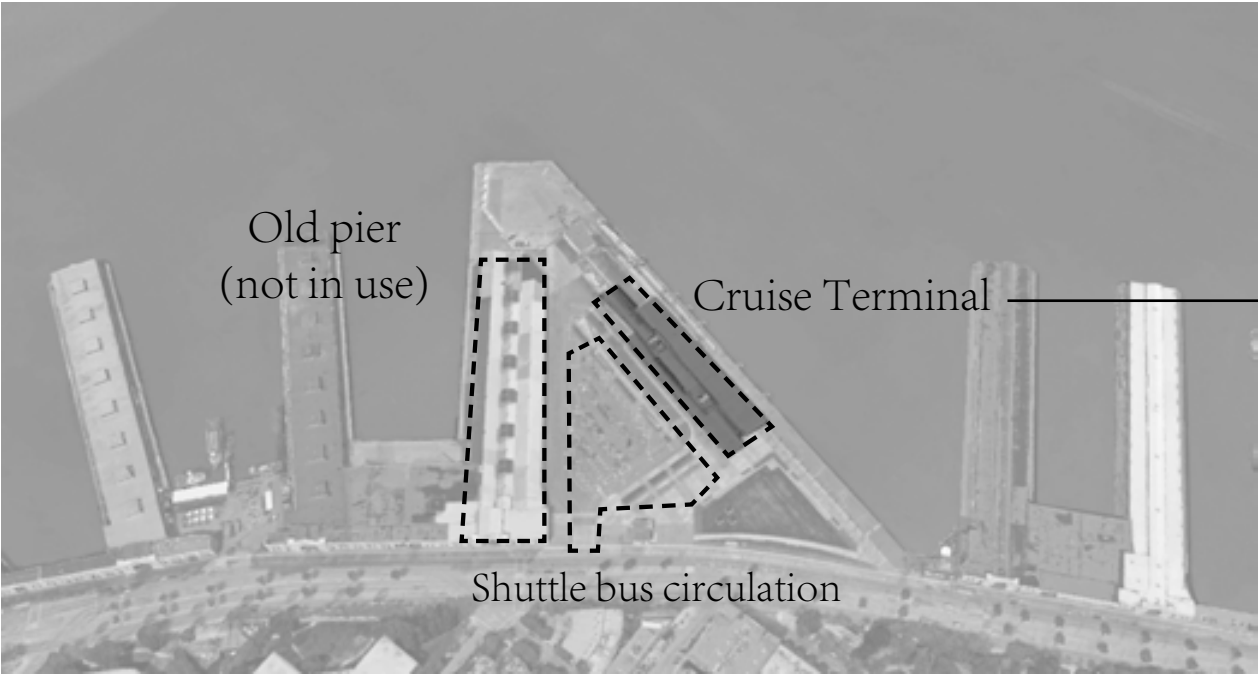
2013

The starting point of San Francisco's cruise industry



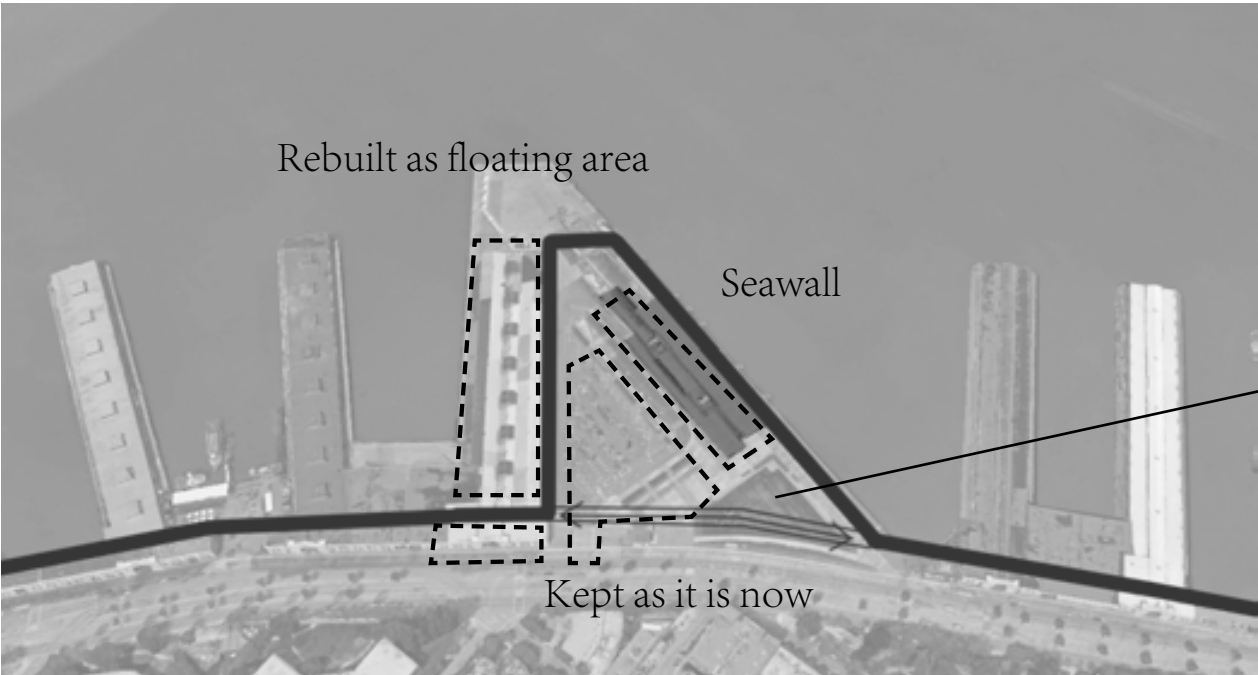
One of the only two places that deep enough for a cruise ship
The only place for shuttle buses

Present



Cost \$92 million

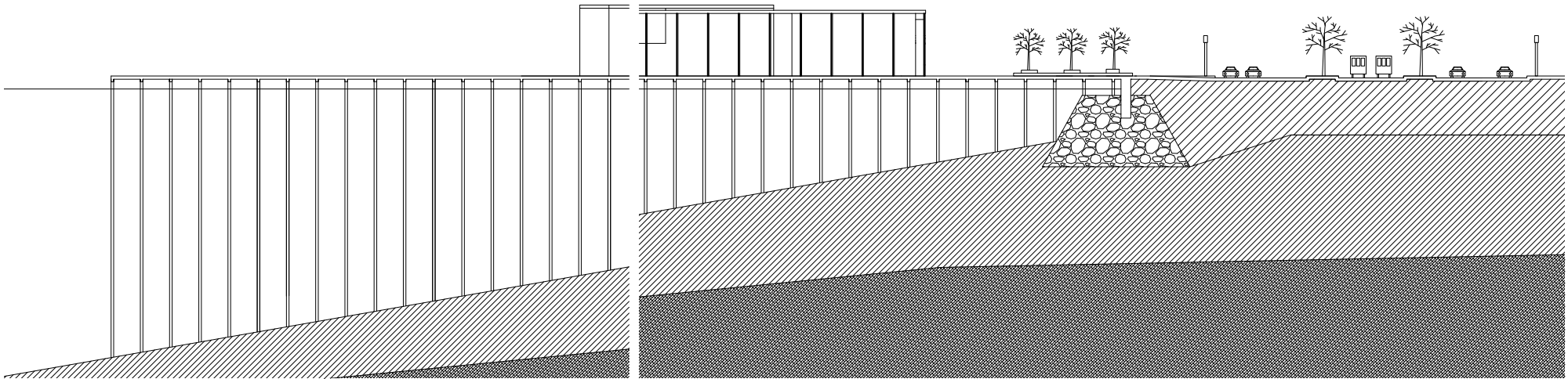
Future



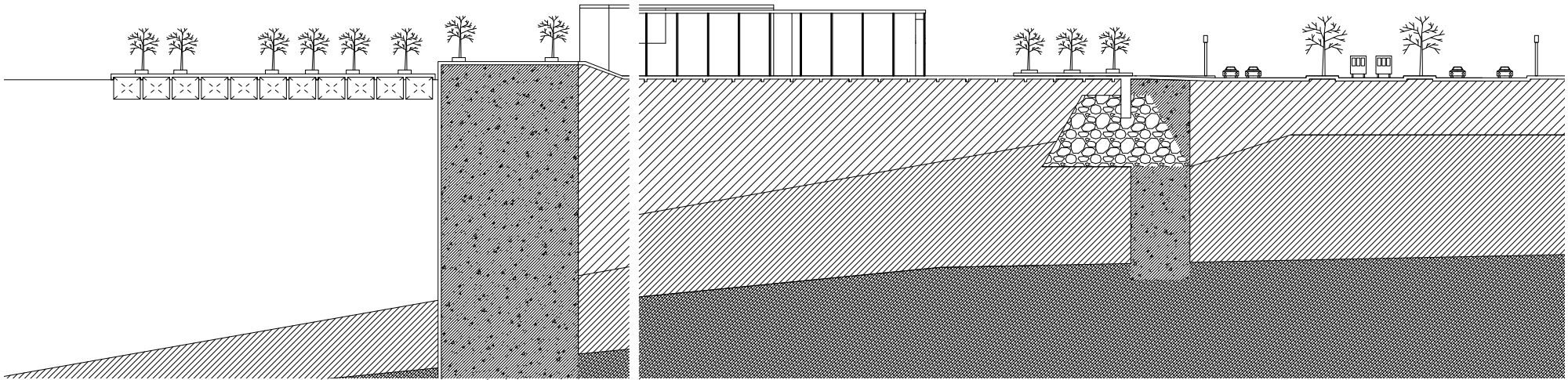
Landfill
+
Hydraulic fill
330,000m³

\$18 million

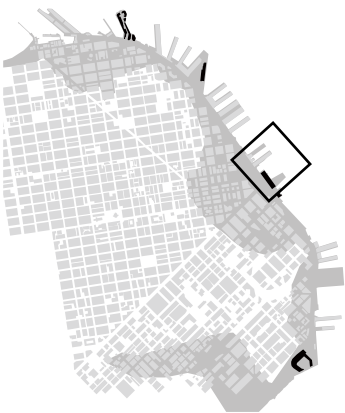
Present



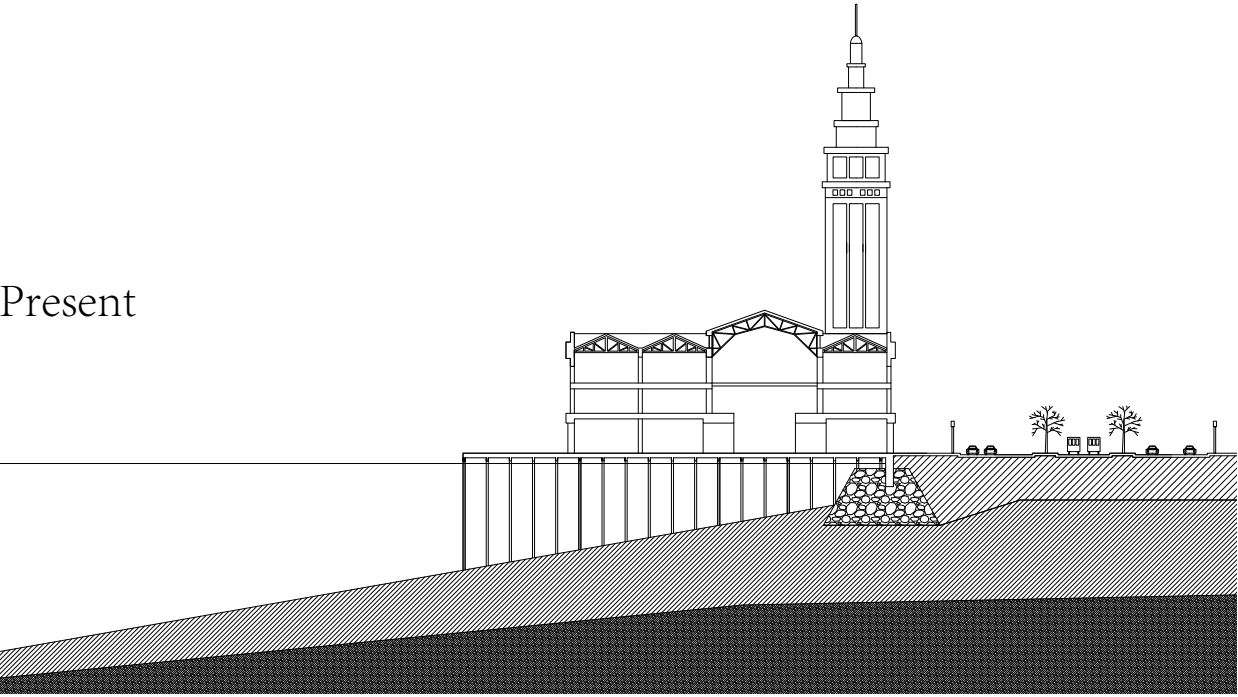
Future



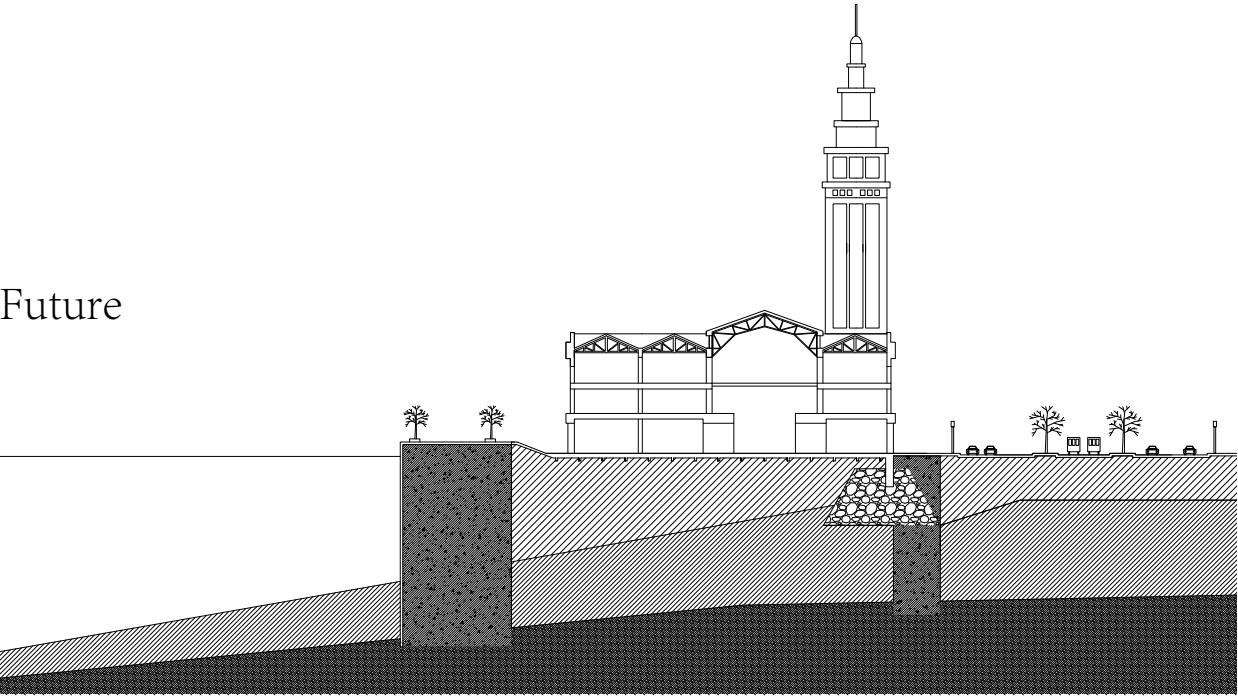
Ferry
building



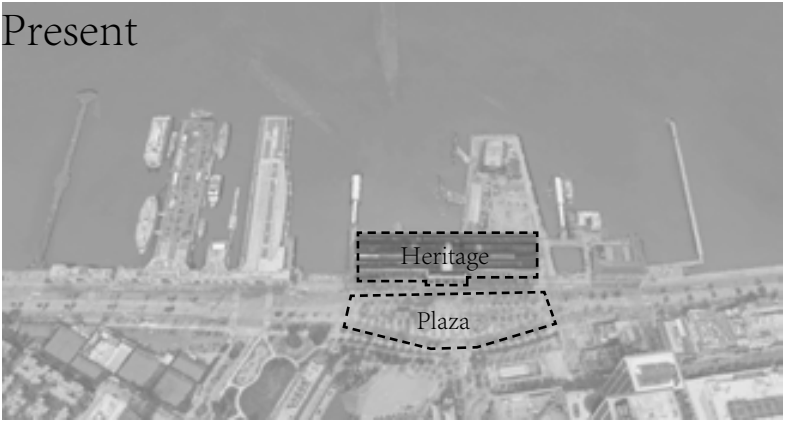
Present



Future



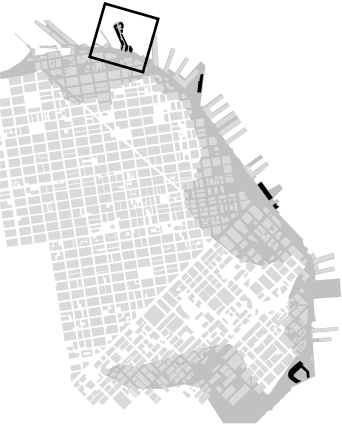
Present



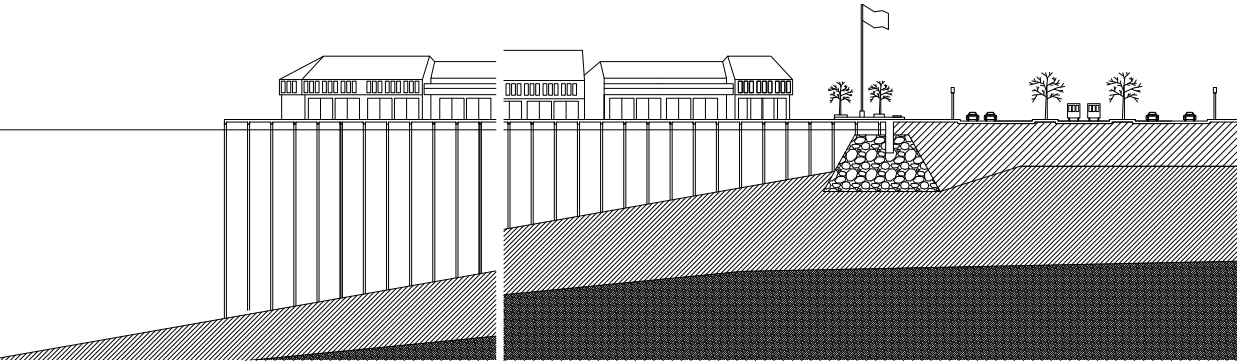
Future



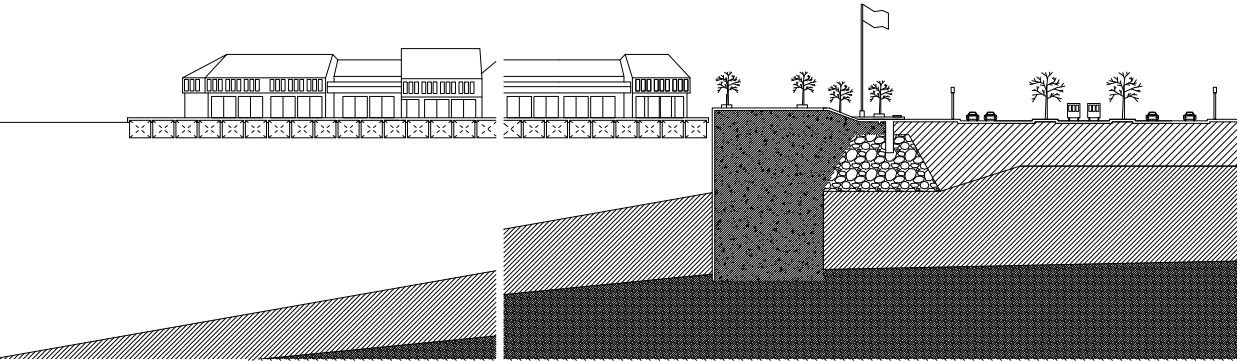
Pier
39



Present



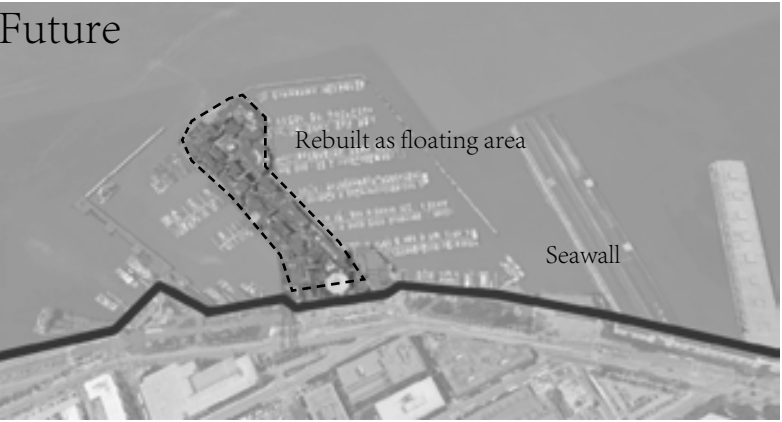
Future



Present



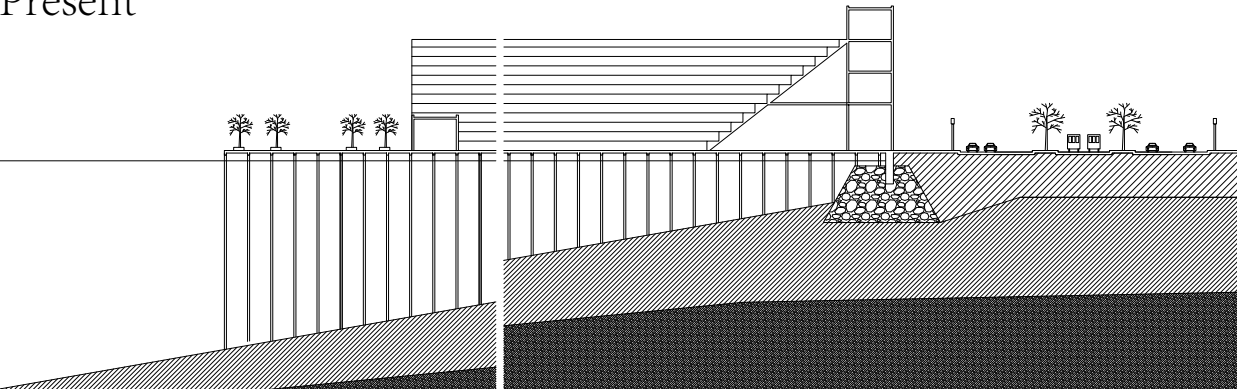
Future



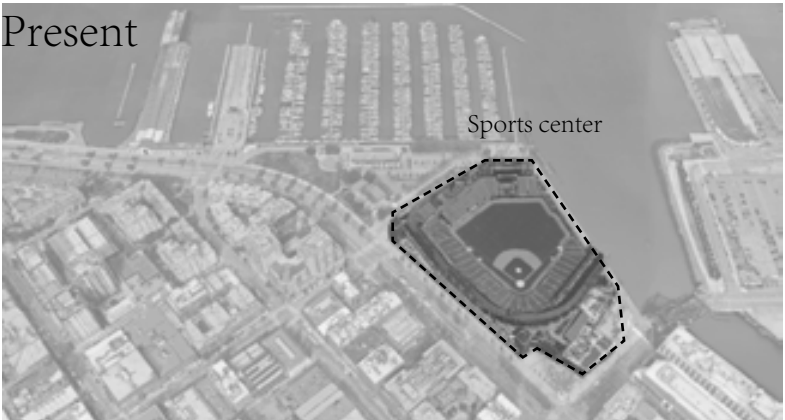
AT&T
park



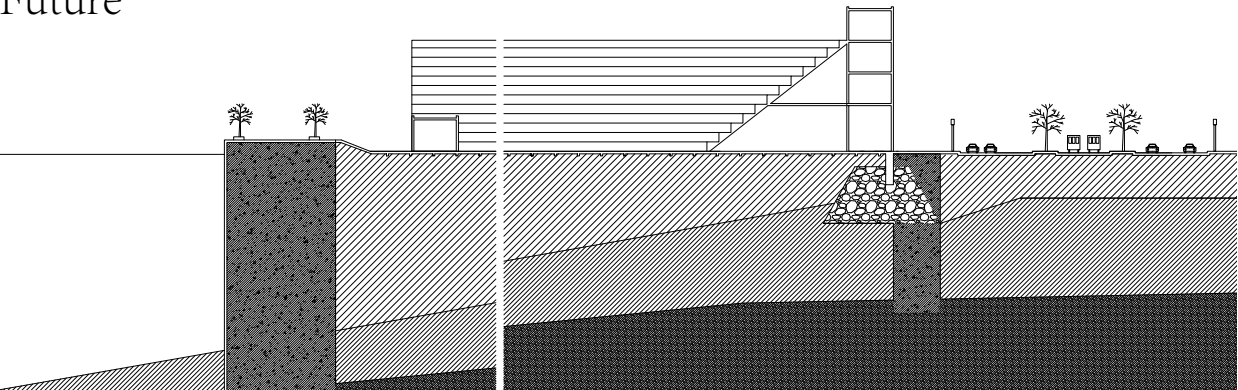
Present



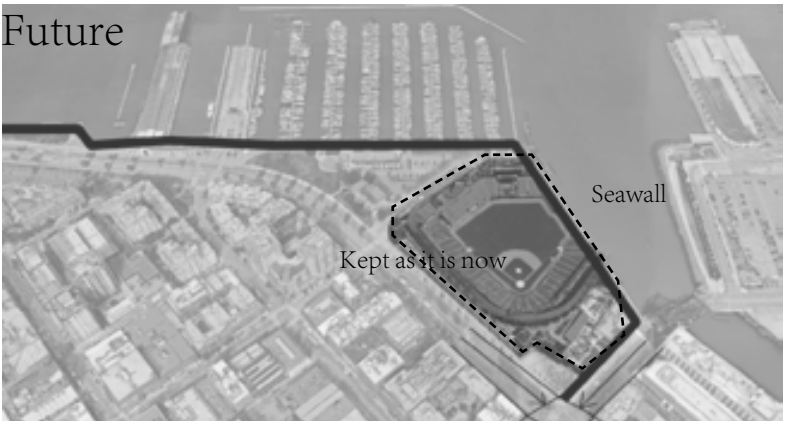
Present



Future



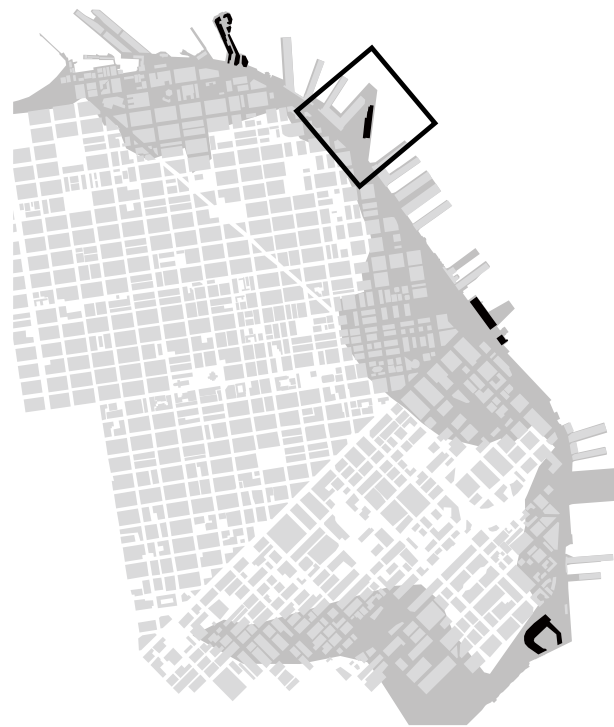
Future



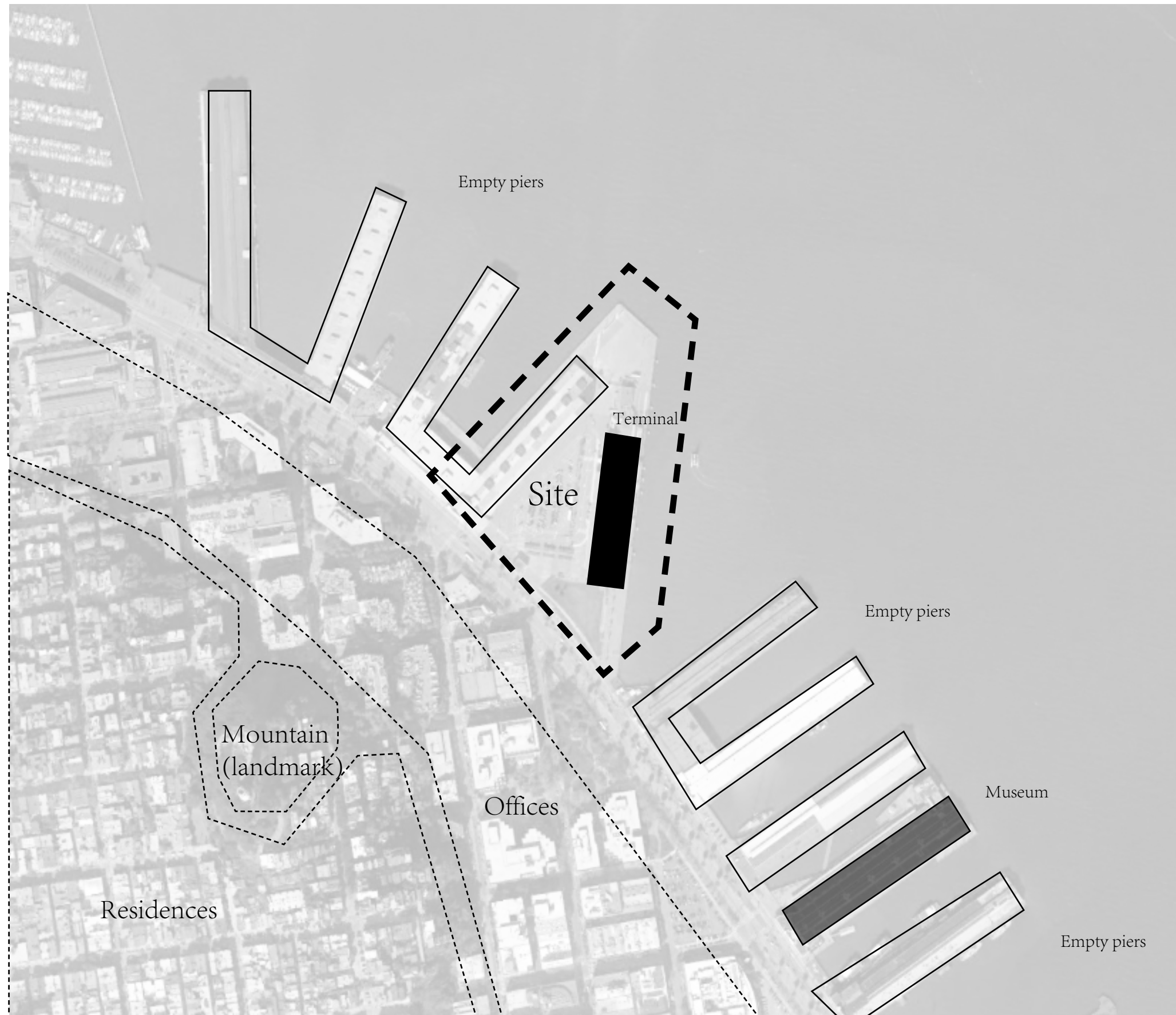
Part 2

Architectural design

Terminal site



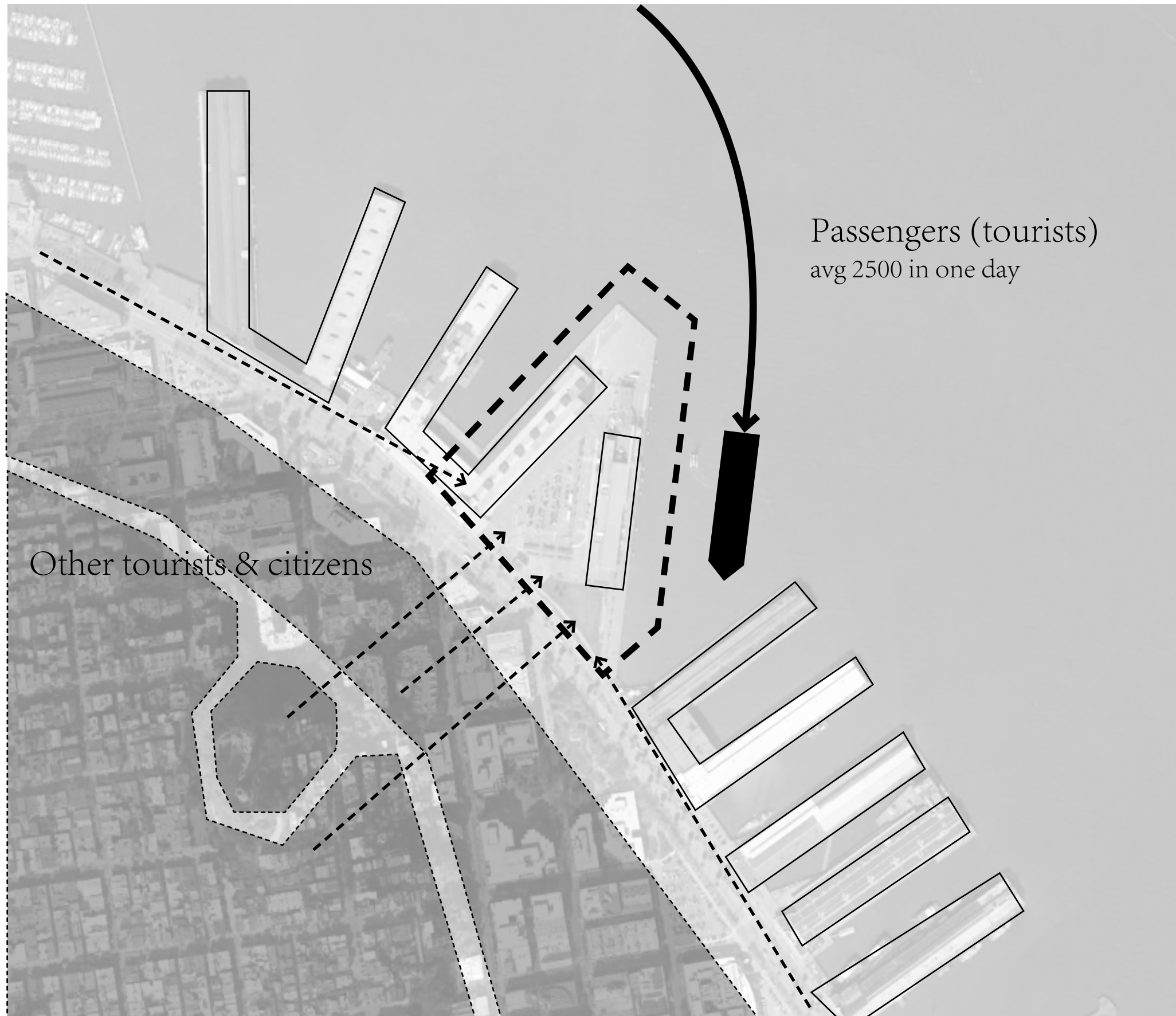
Site analysis



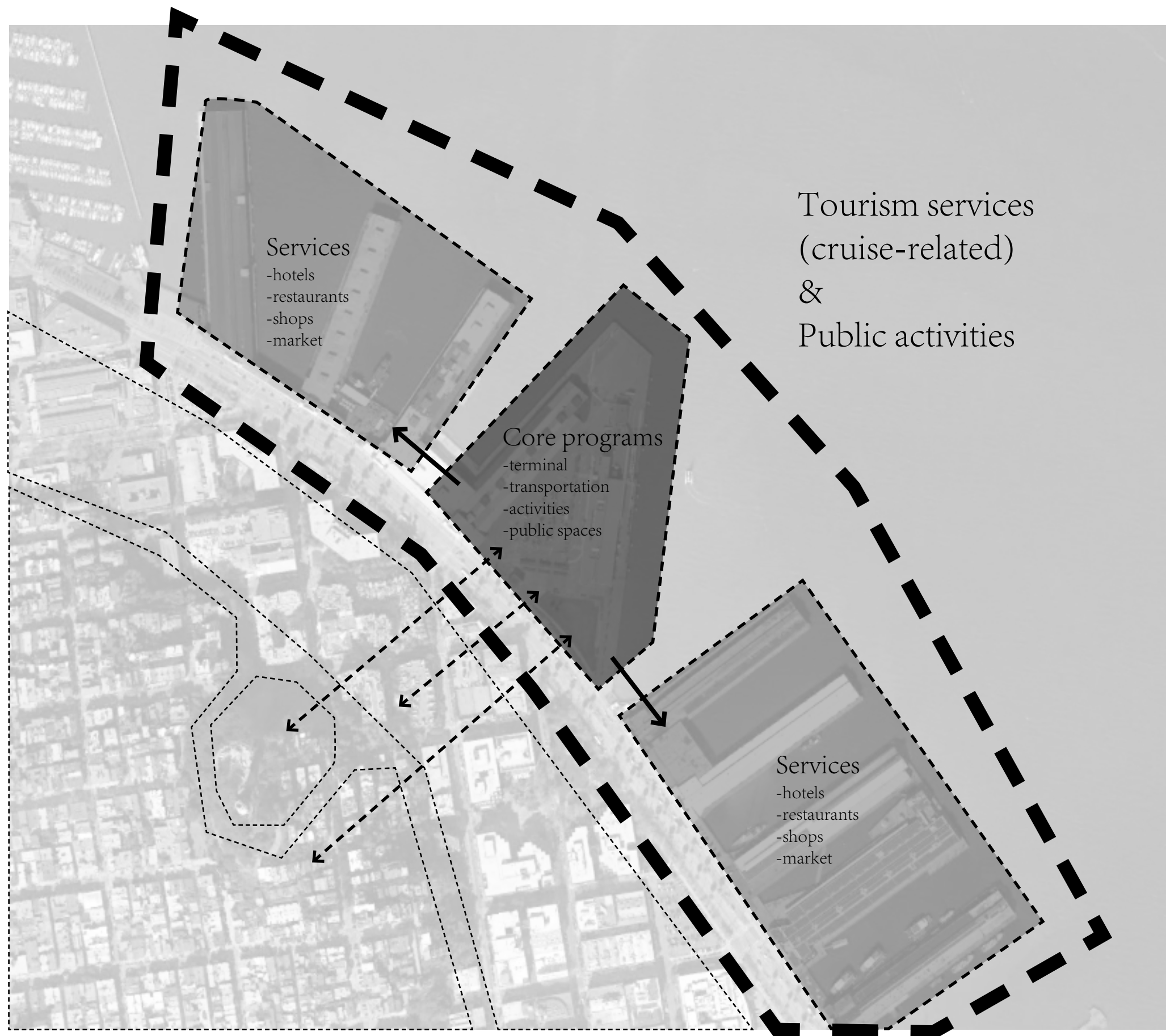
Users

Passengers (tourists)
avg 2500 in one day

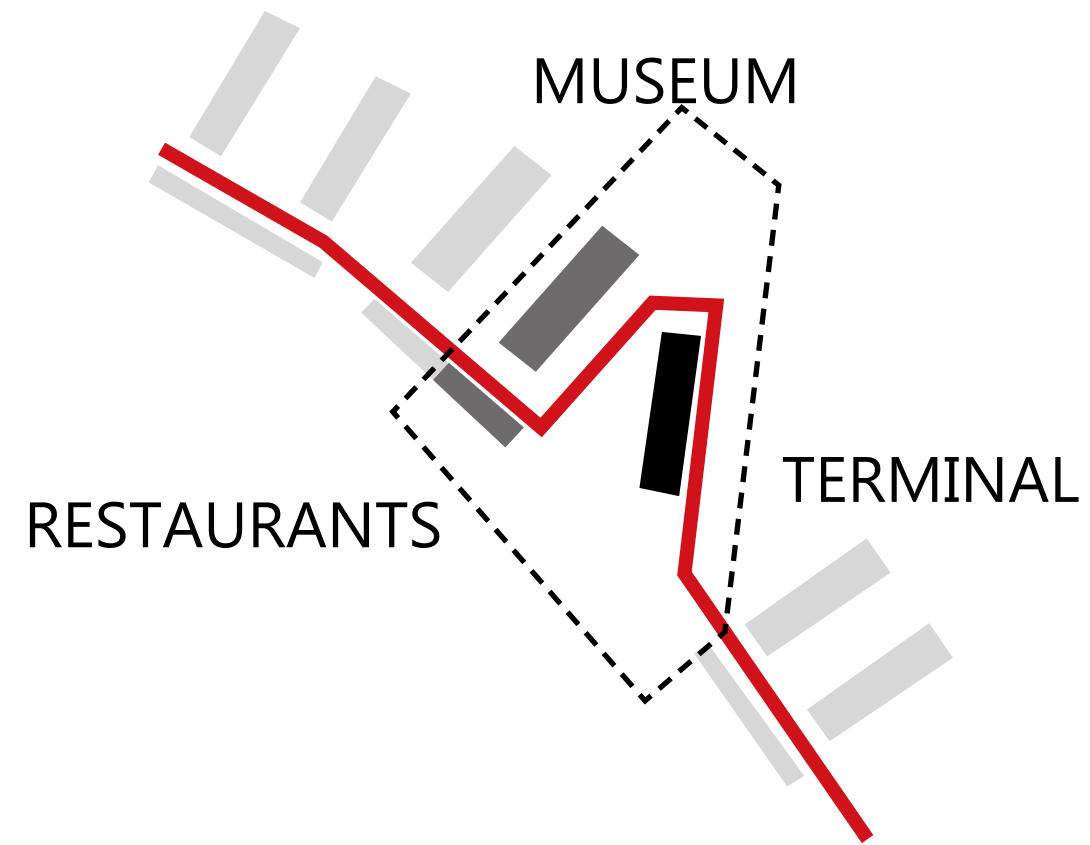
Other tourists & citizens



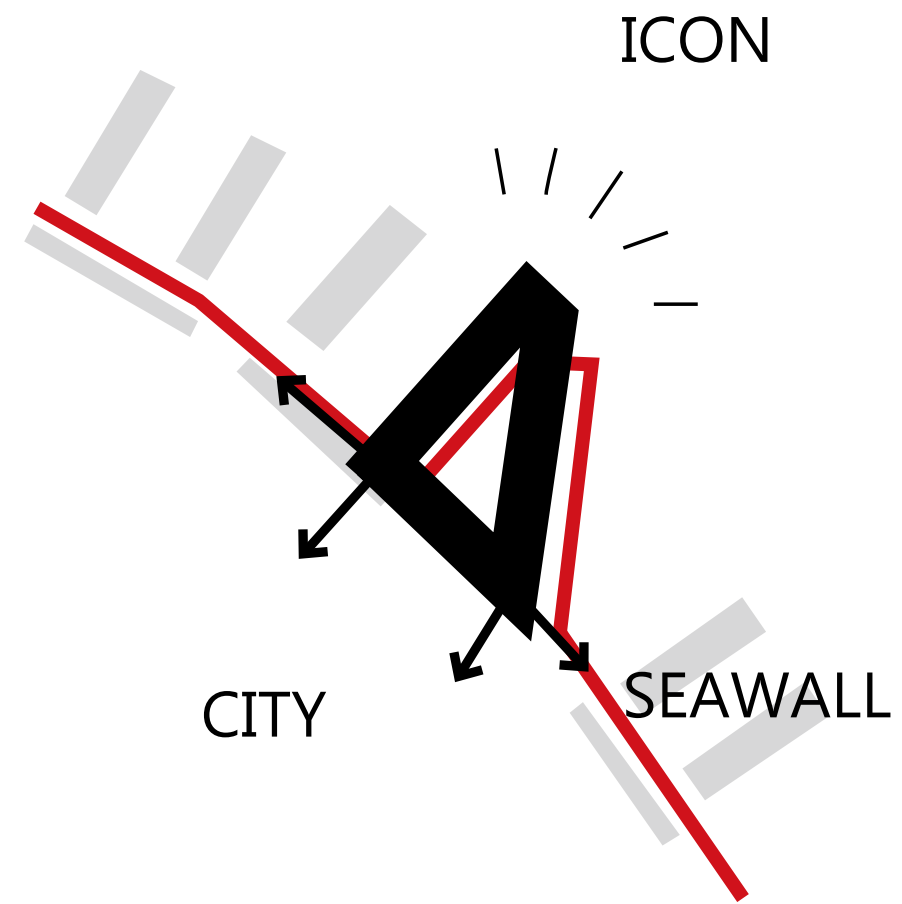
Future plannings



Concept: a public loop



Architecture



Landscape



Seawall



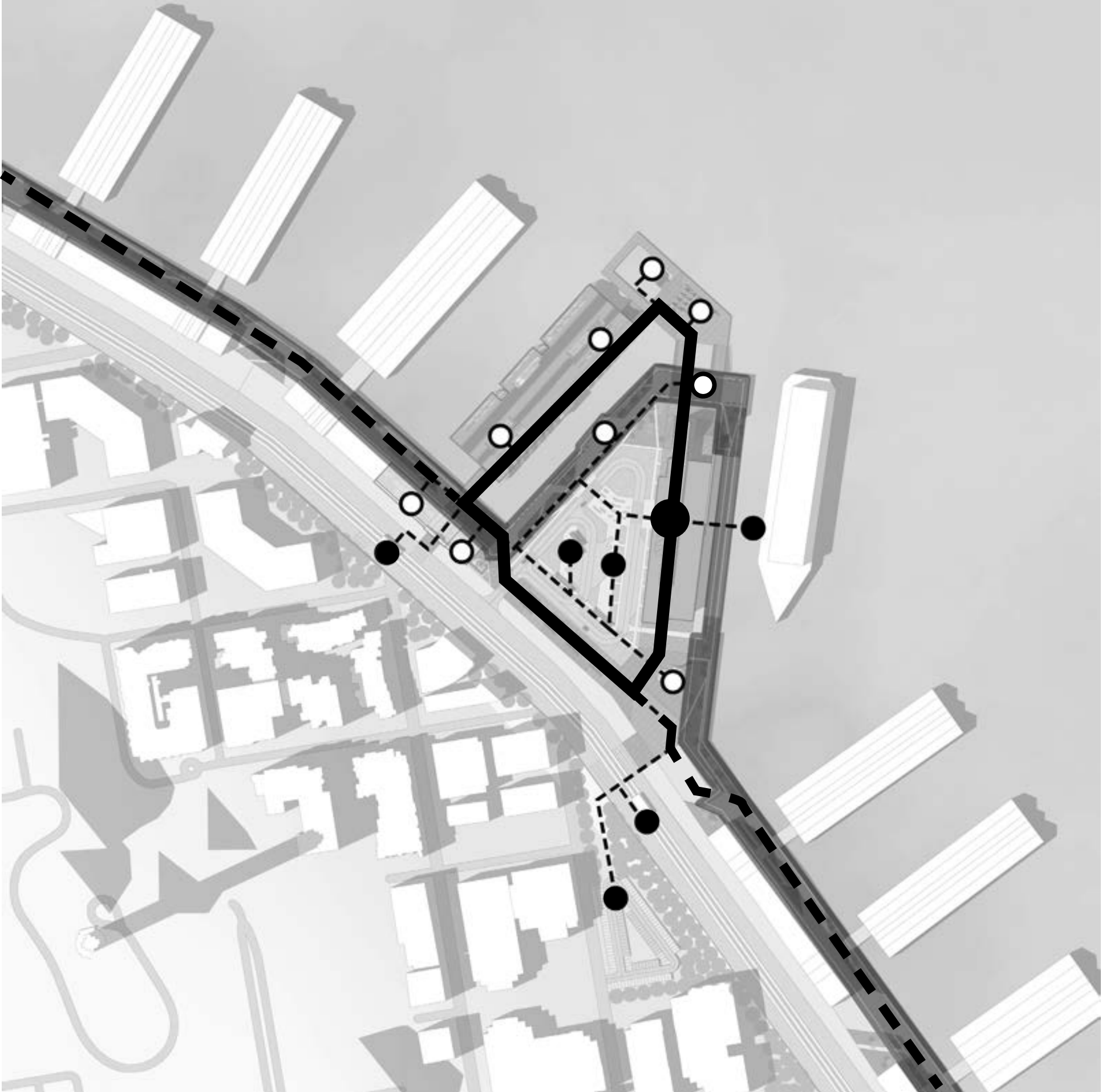
Stairs





Slope

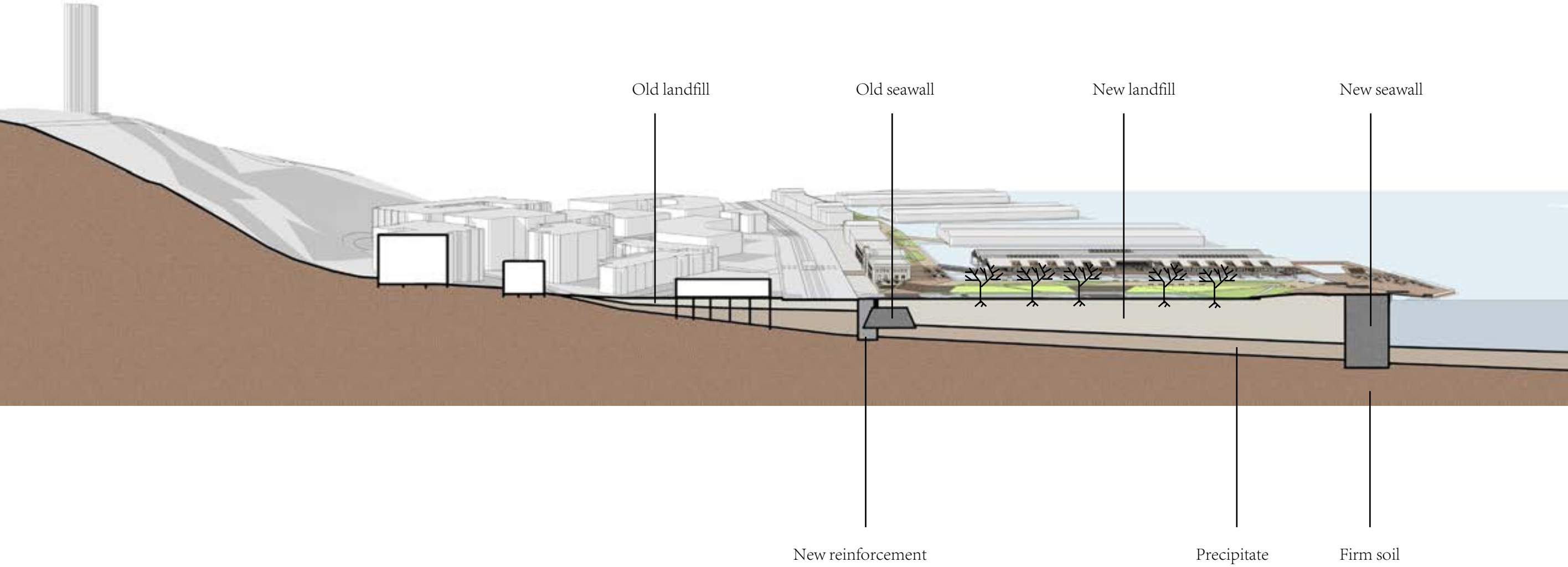
Vehicle circulations

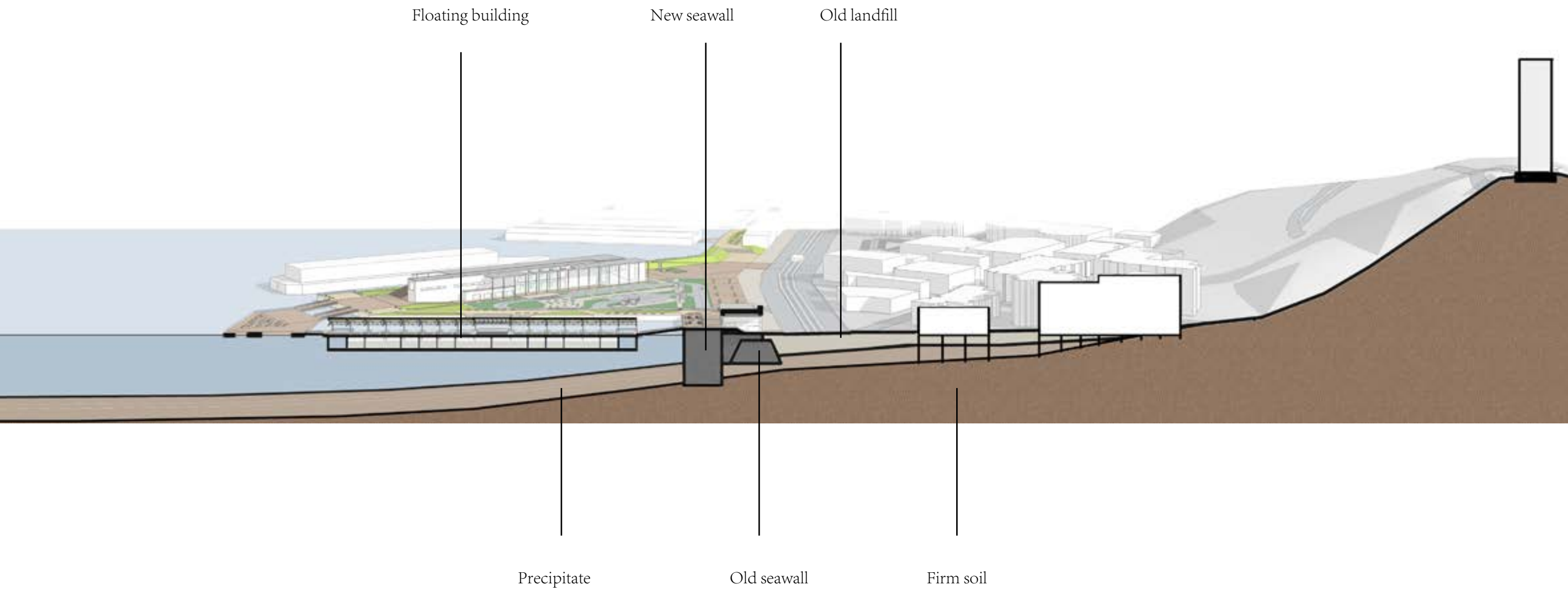


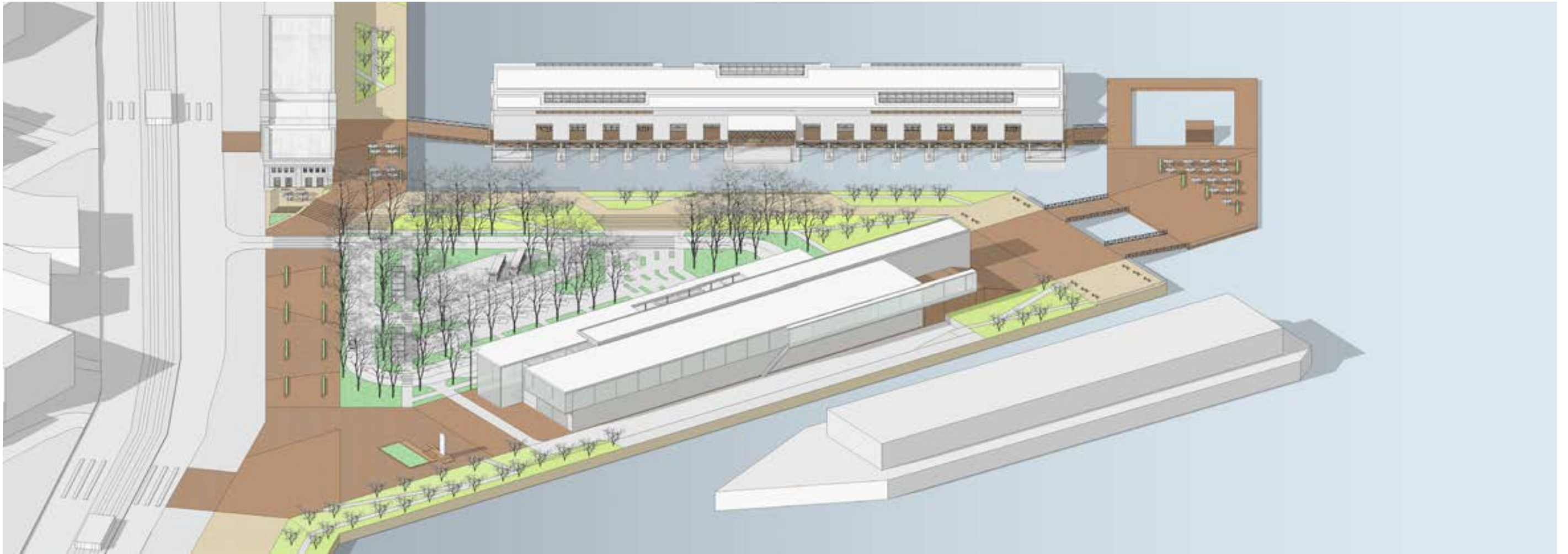
Pedestrian cicalations



-  Promenade
-  Loop
-  Transportation
-  Public activities

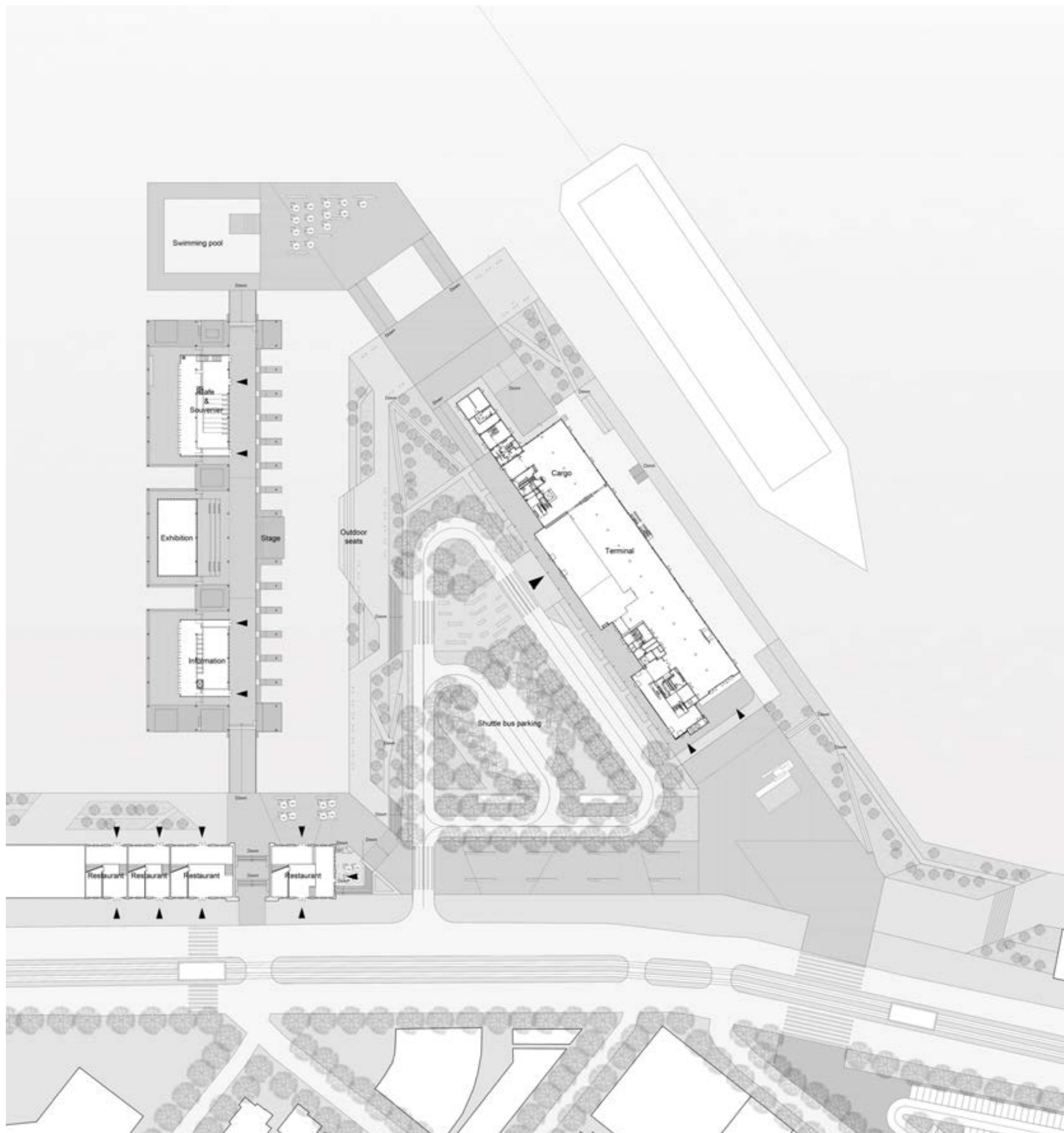


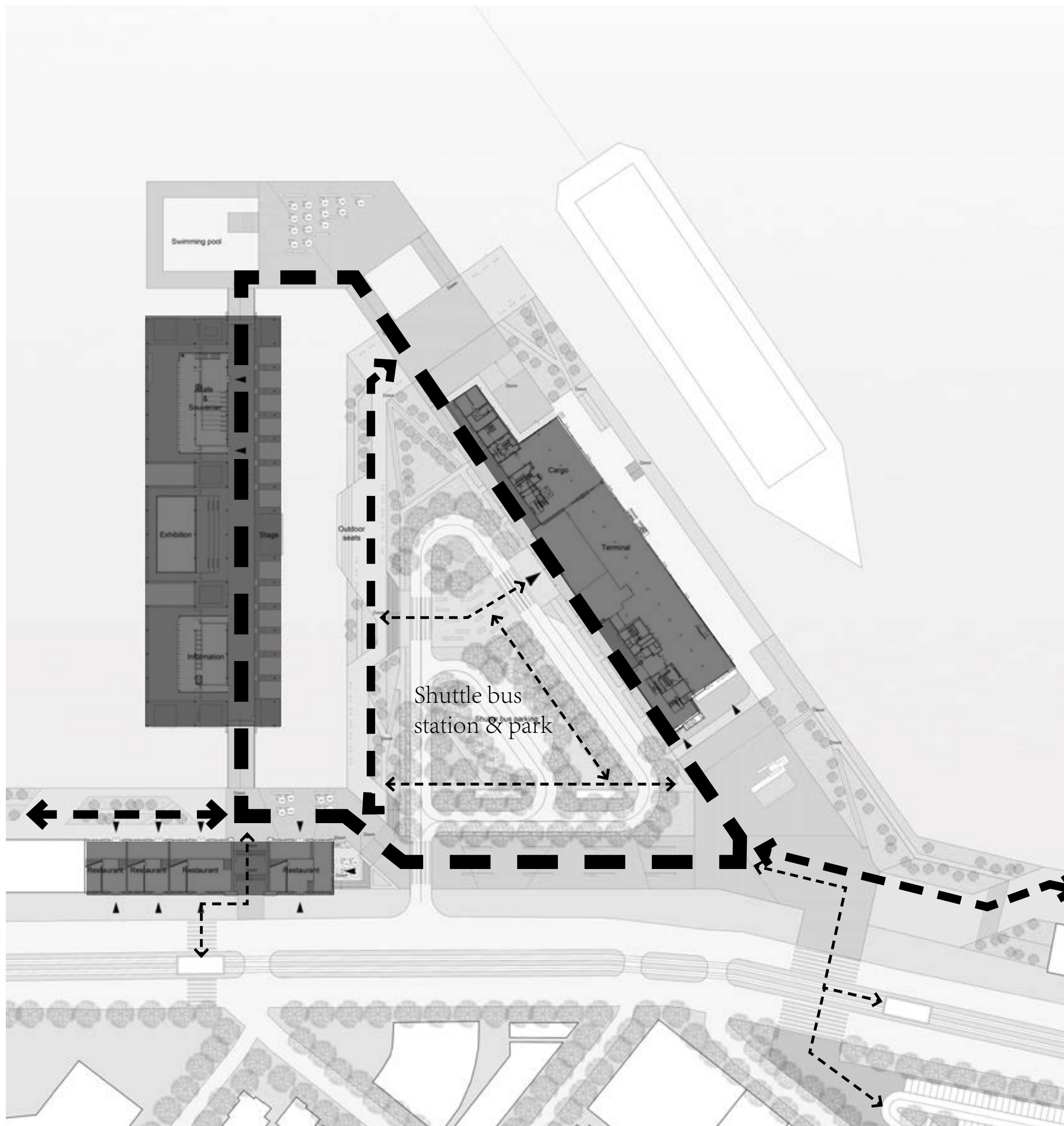


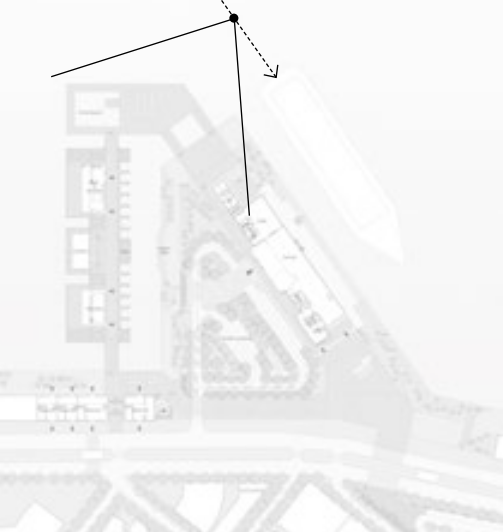


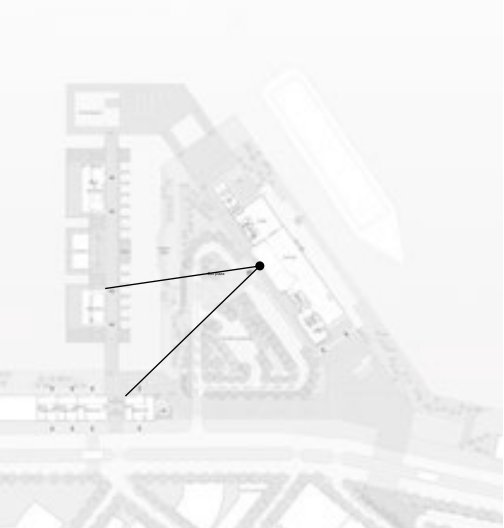


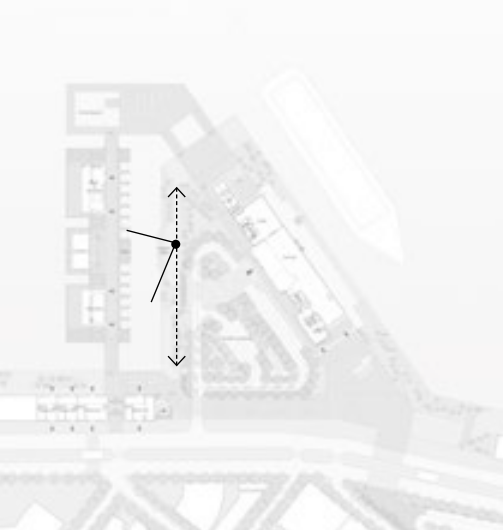




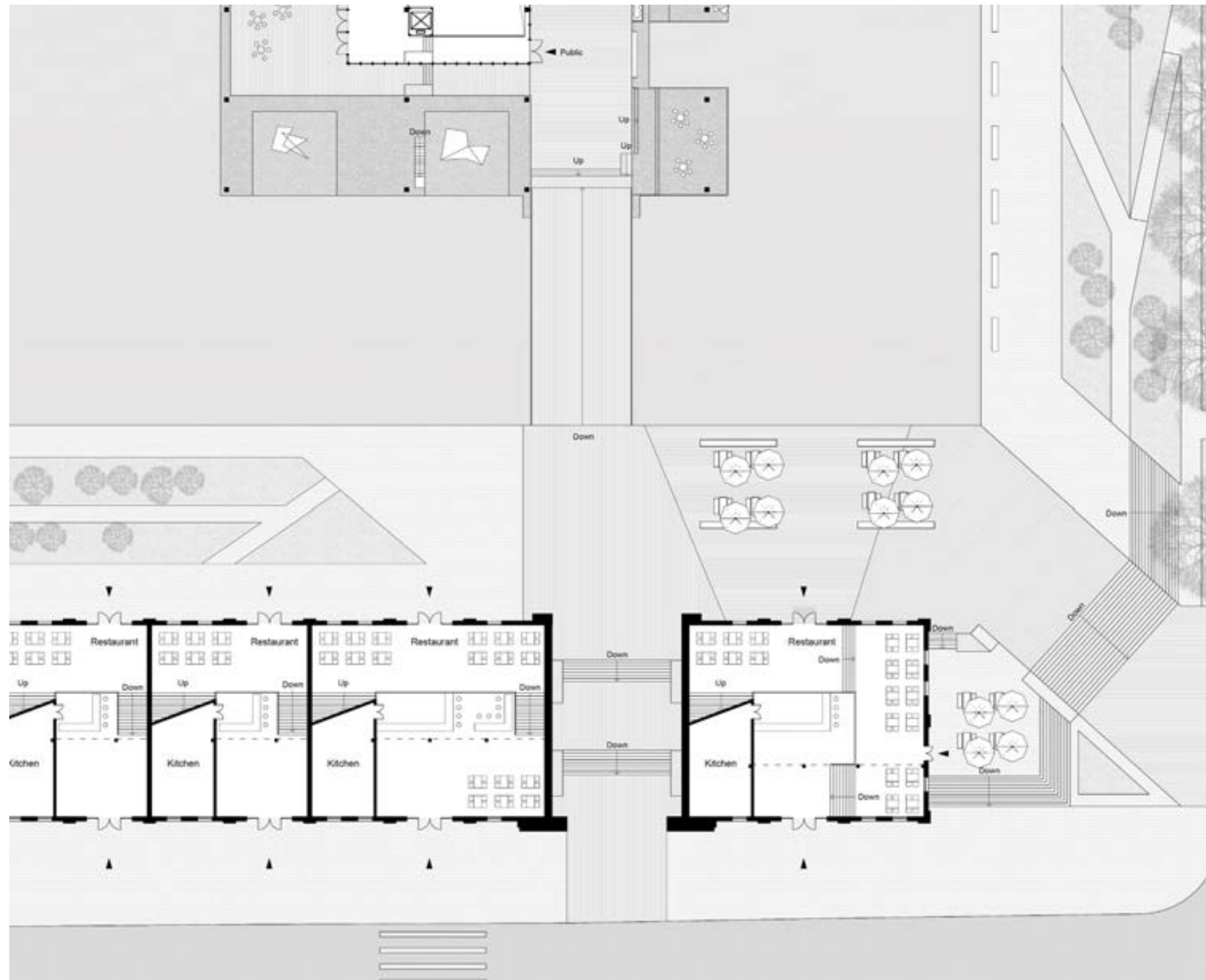


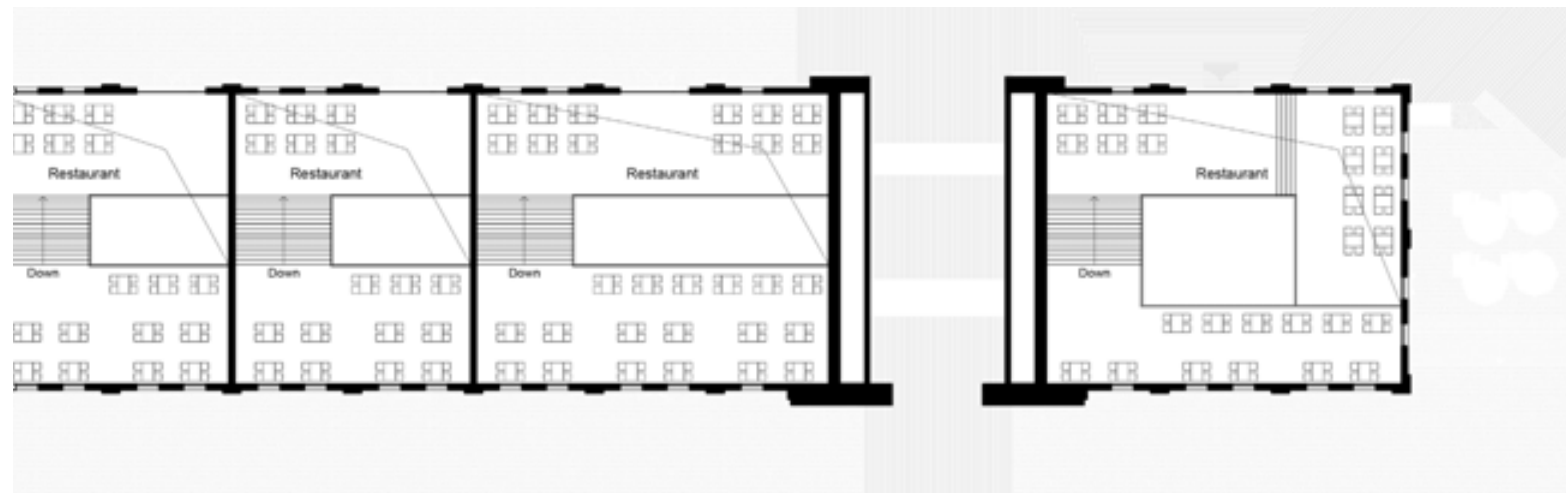




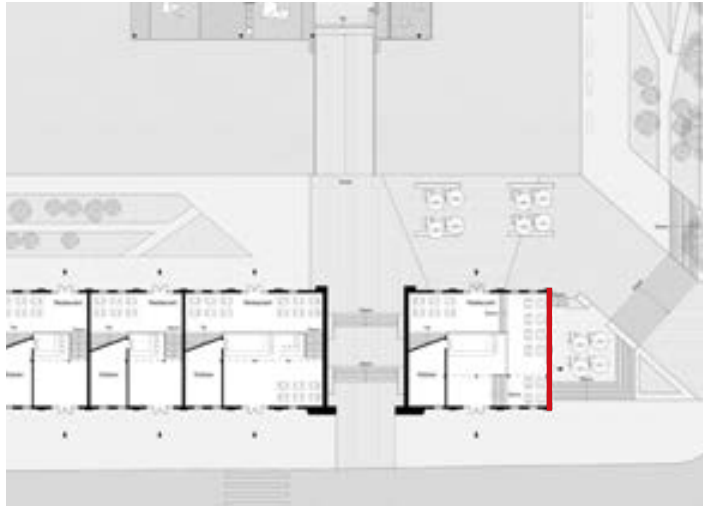






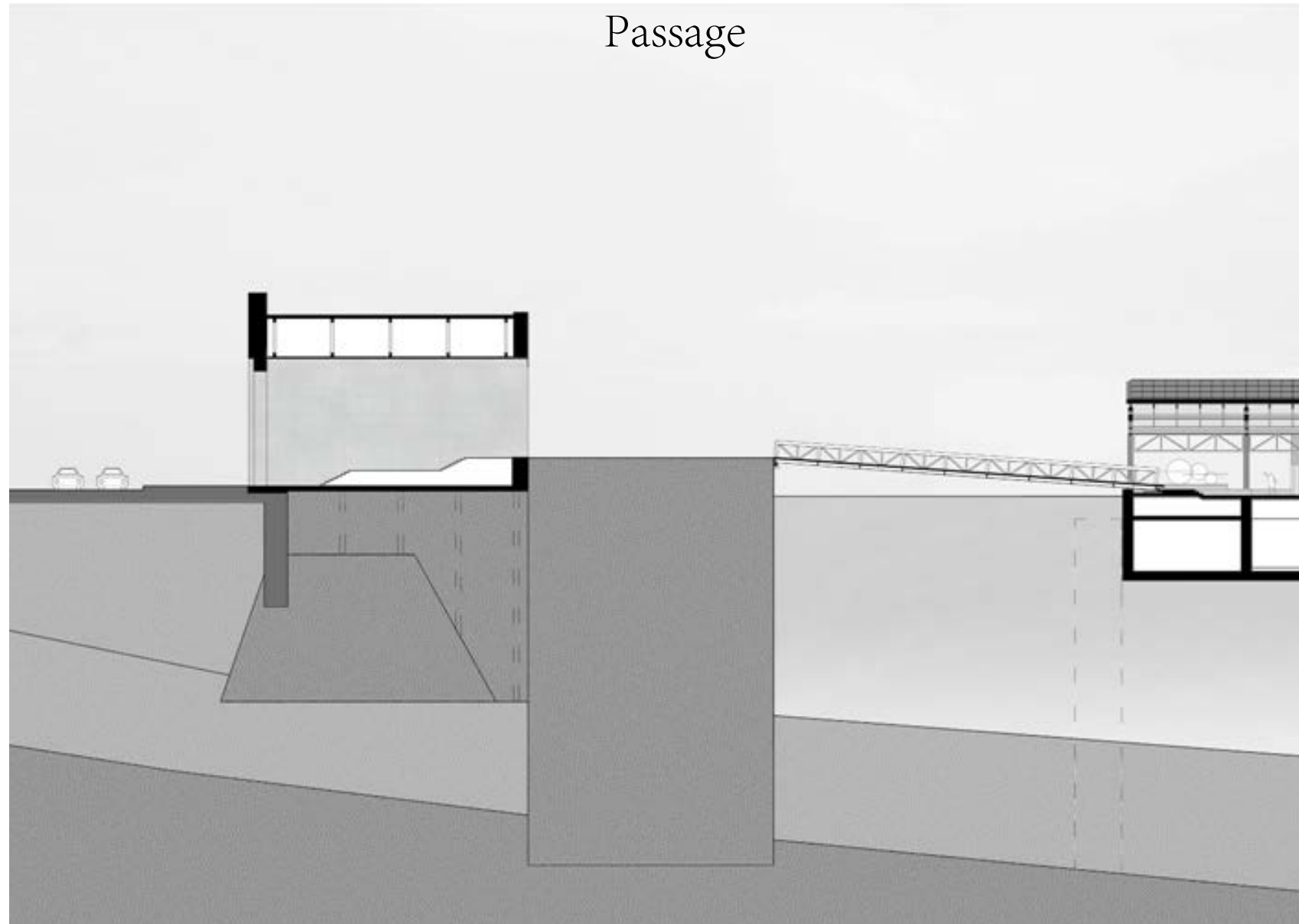






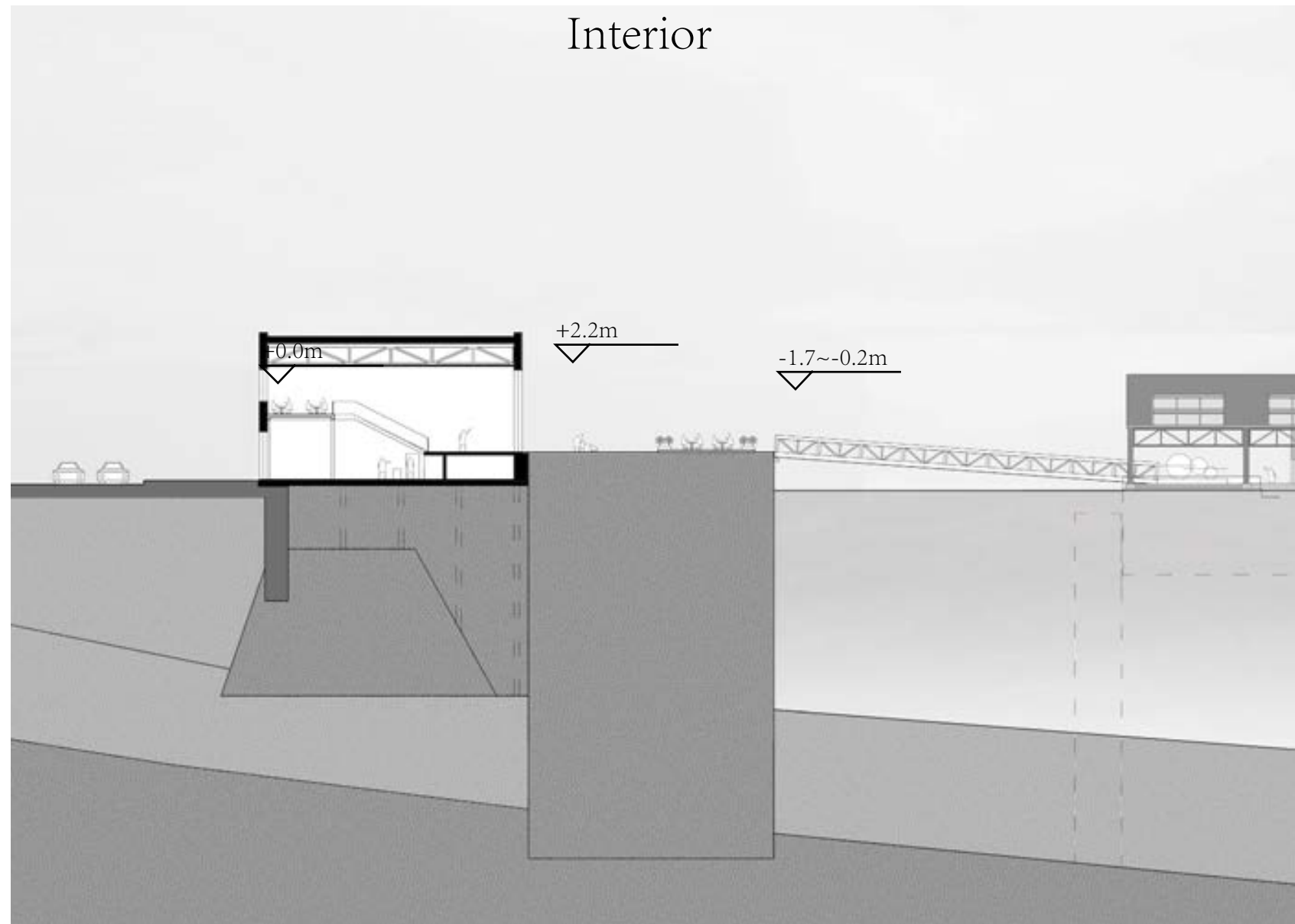


Passage

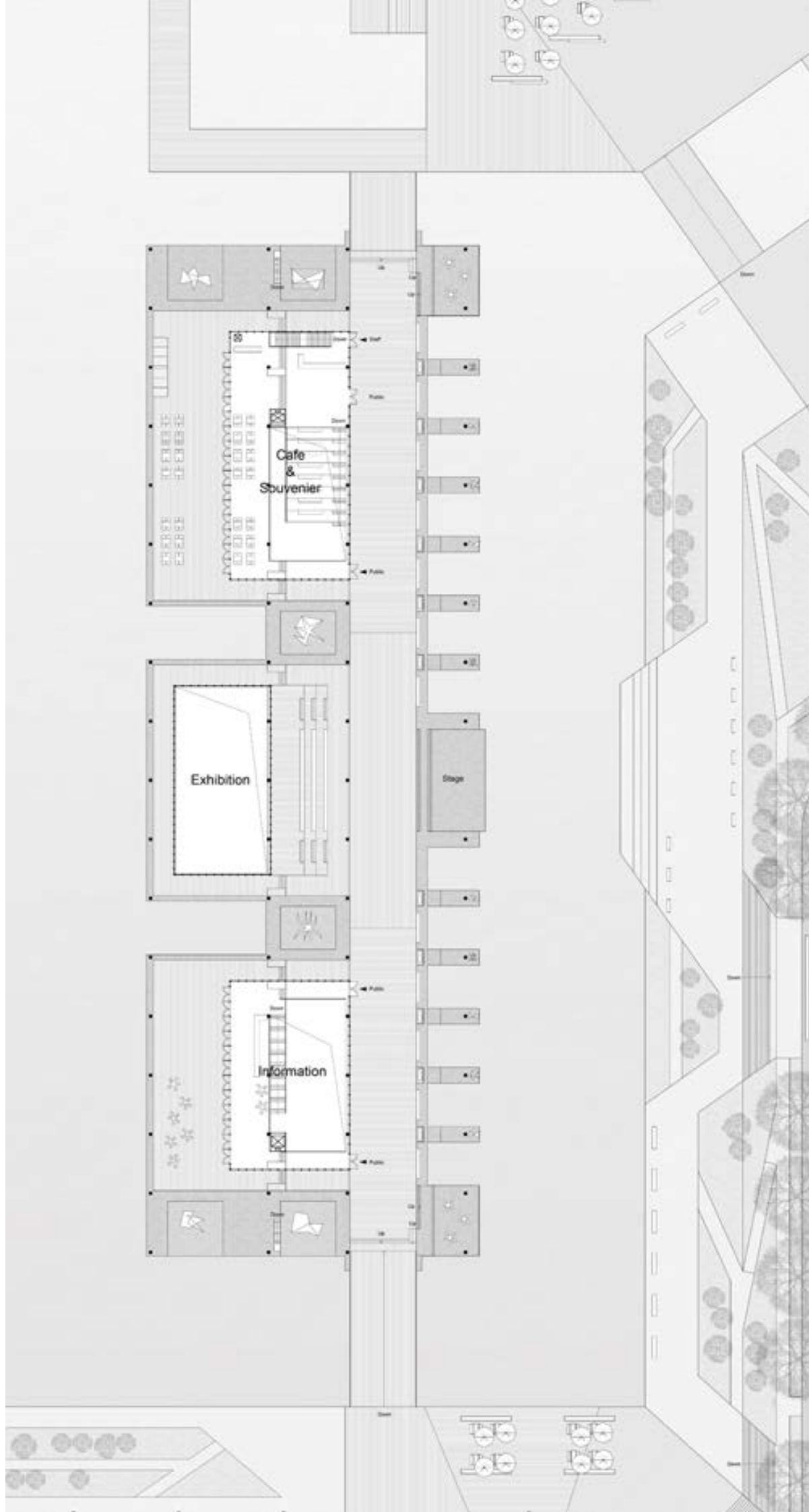




Interior

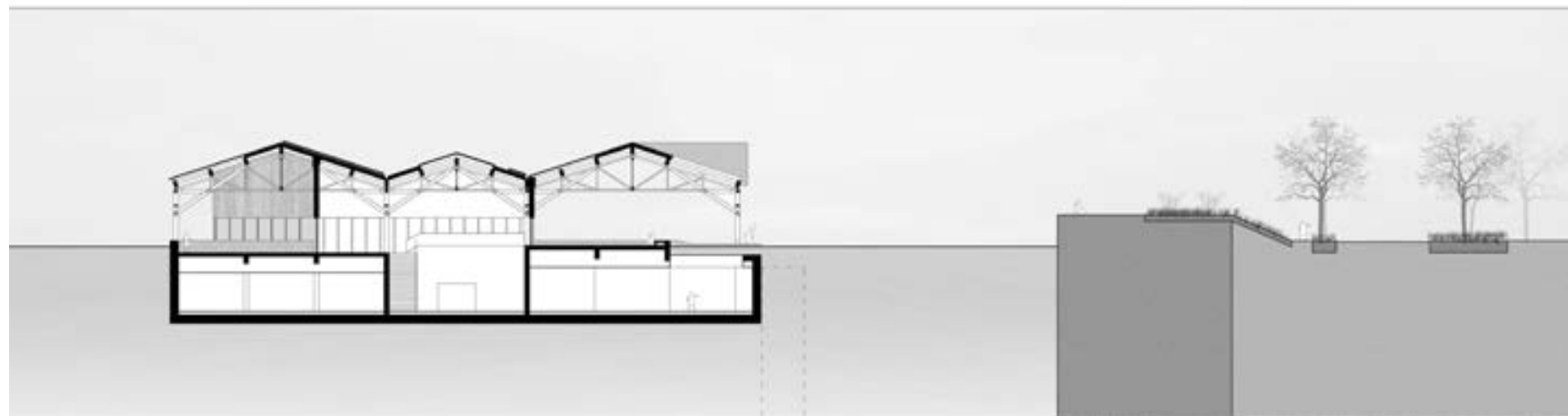
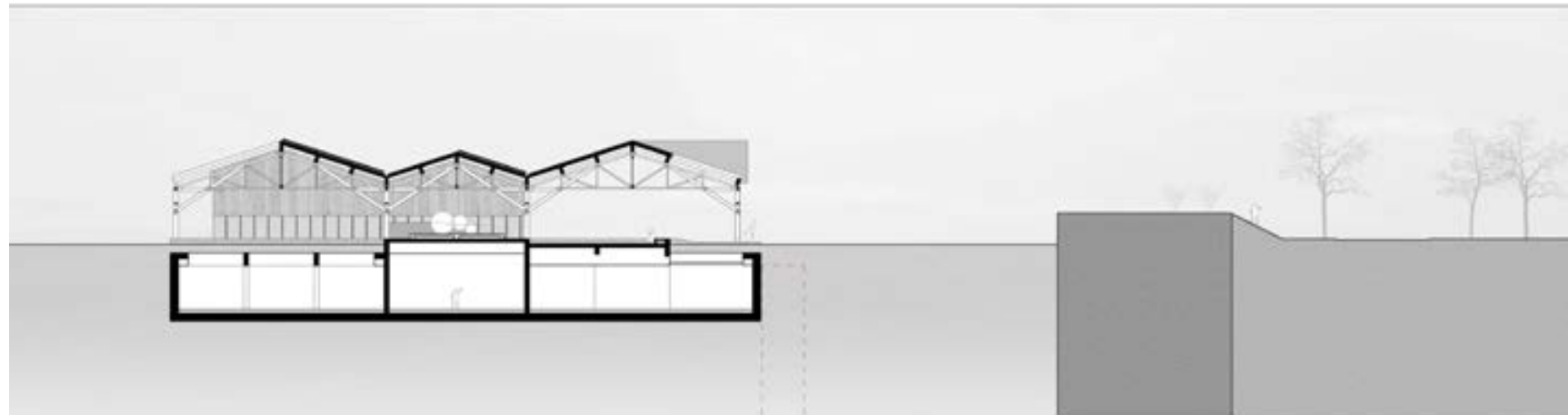
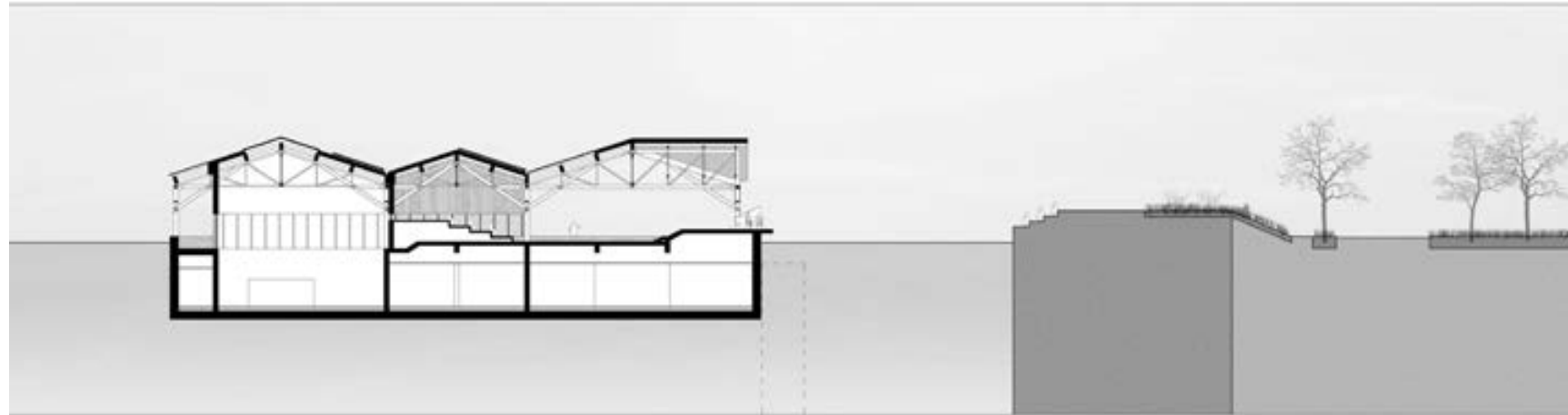
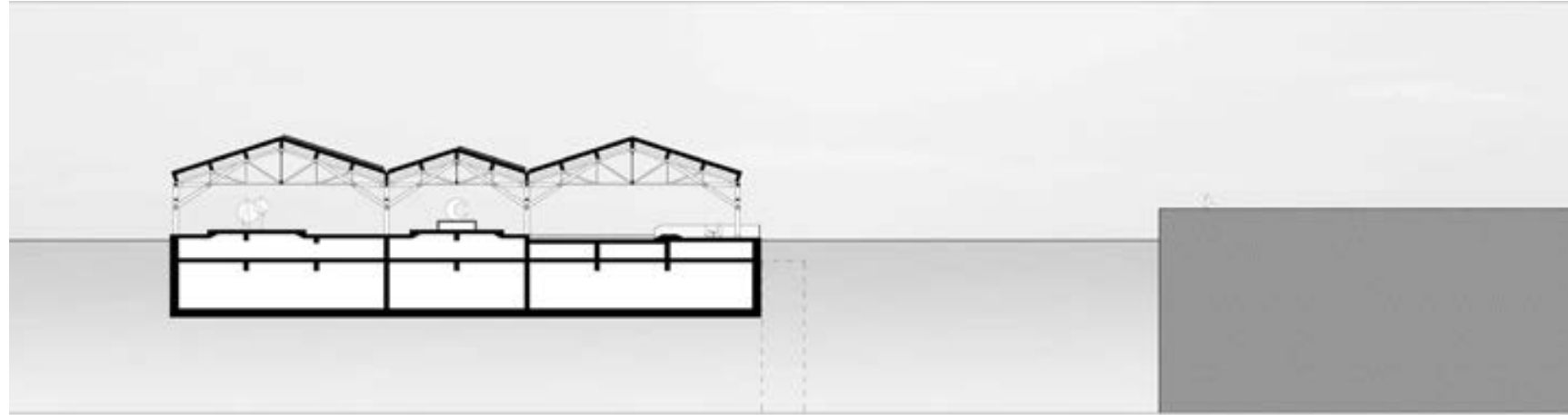


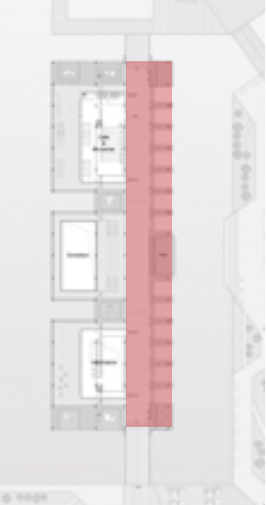


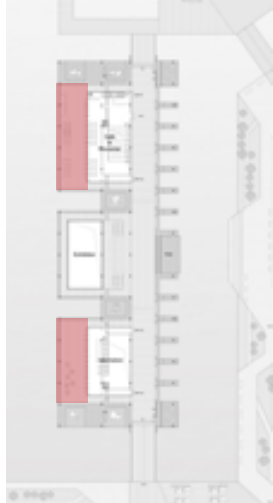


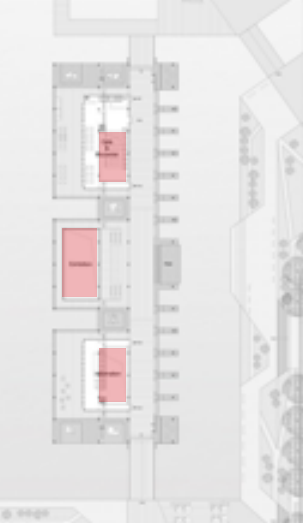


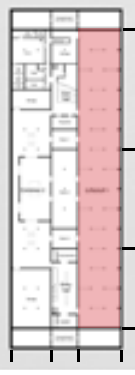








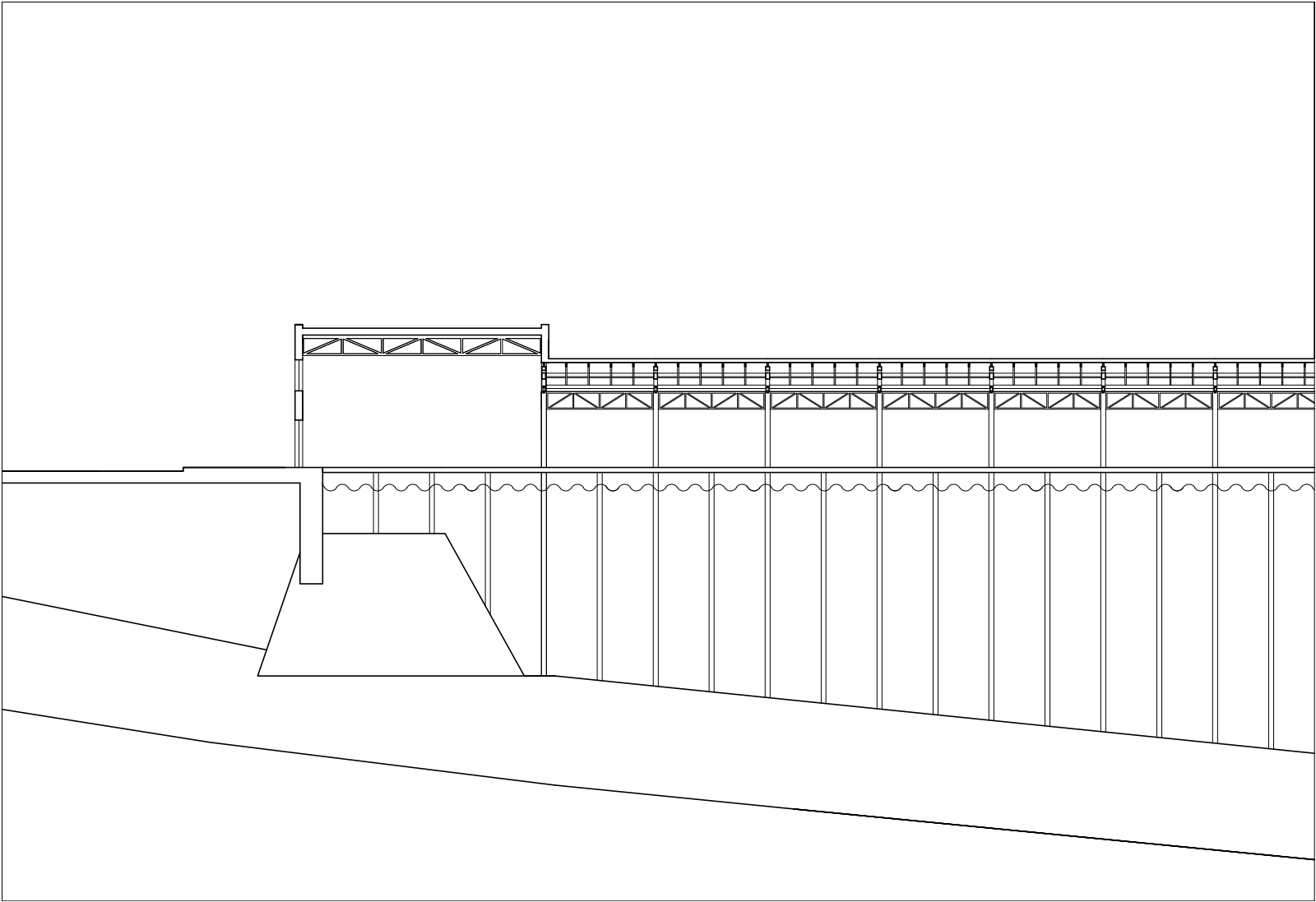




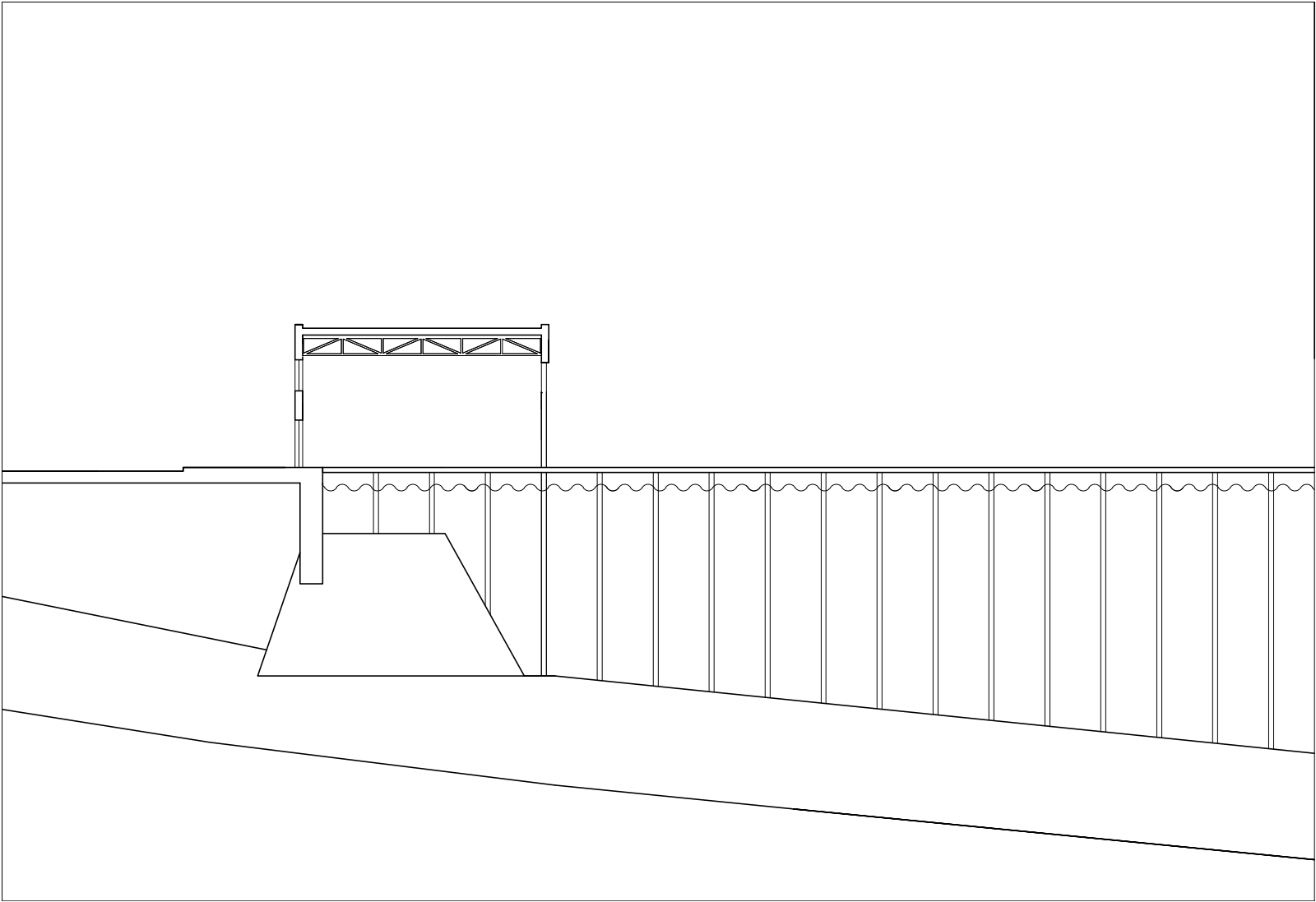
Part 3

Building technology

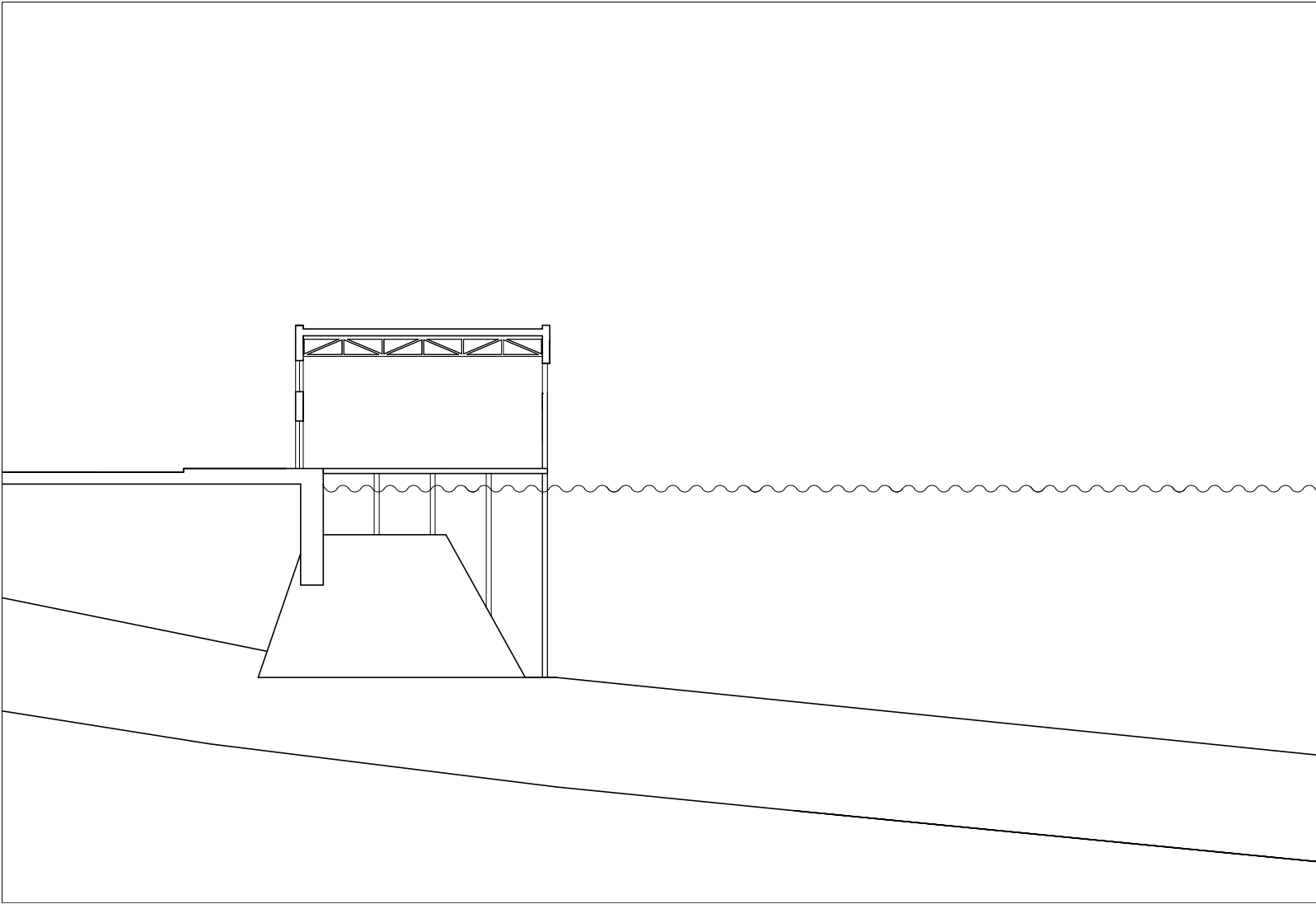
The construction process of seawall



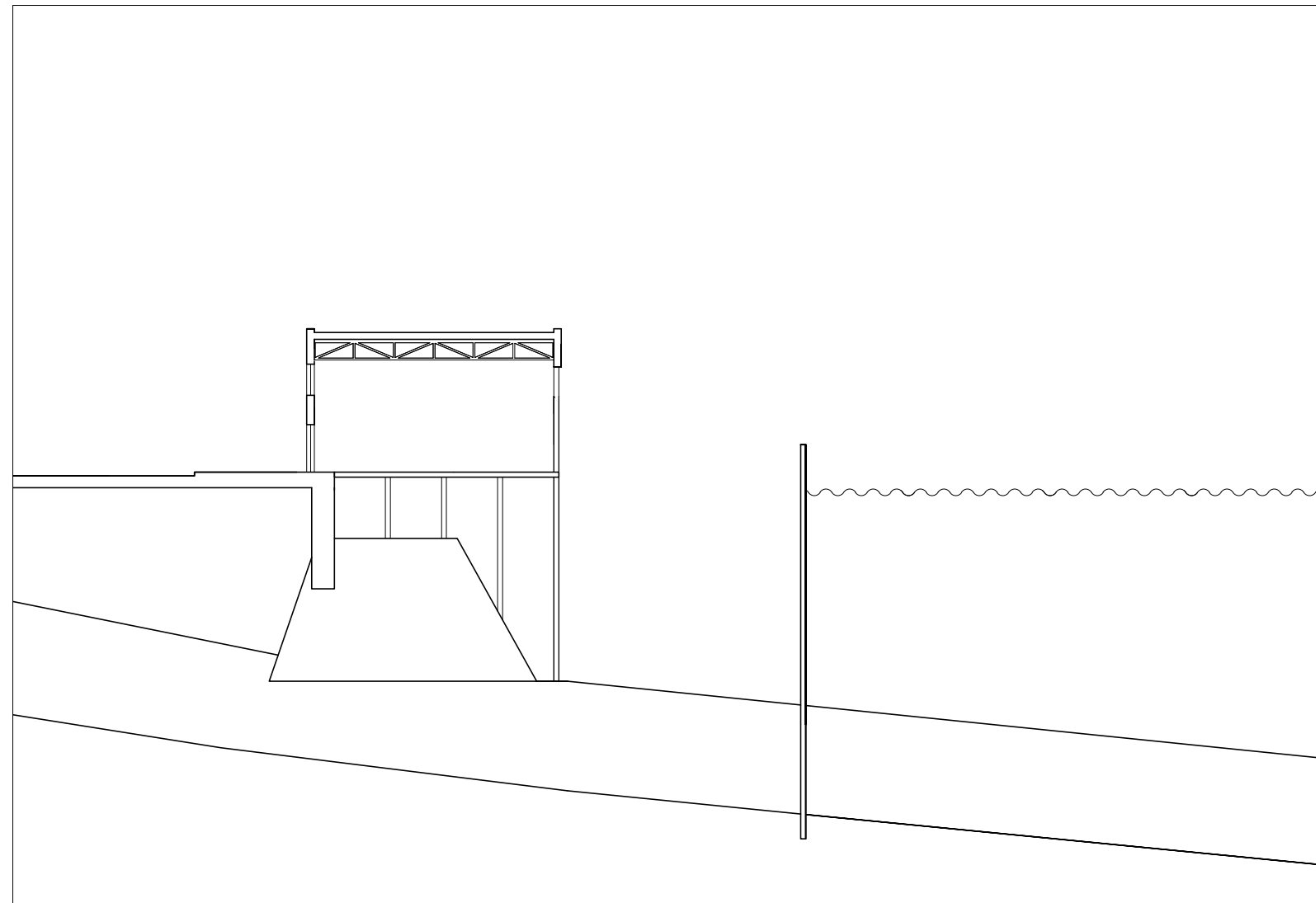
Existing situation.



Dismantle the structure for future uses.

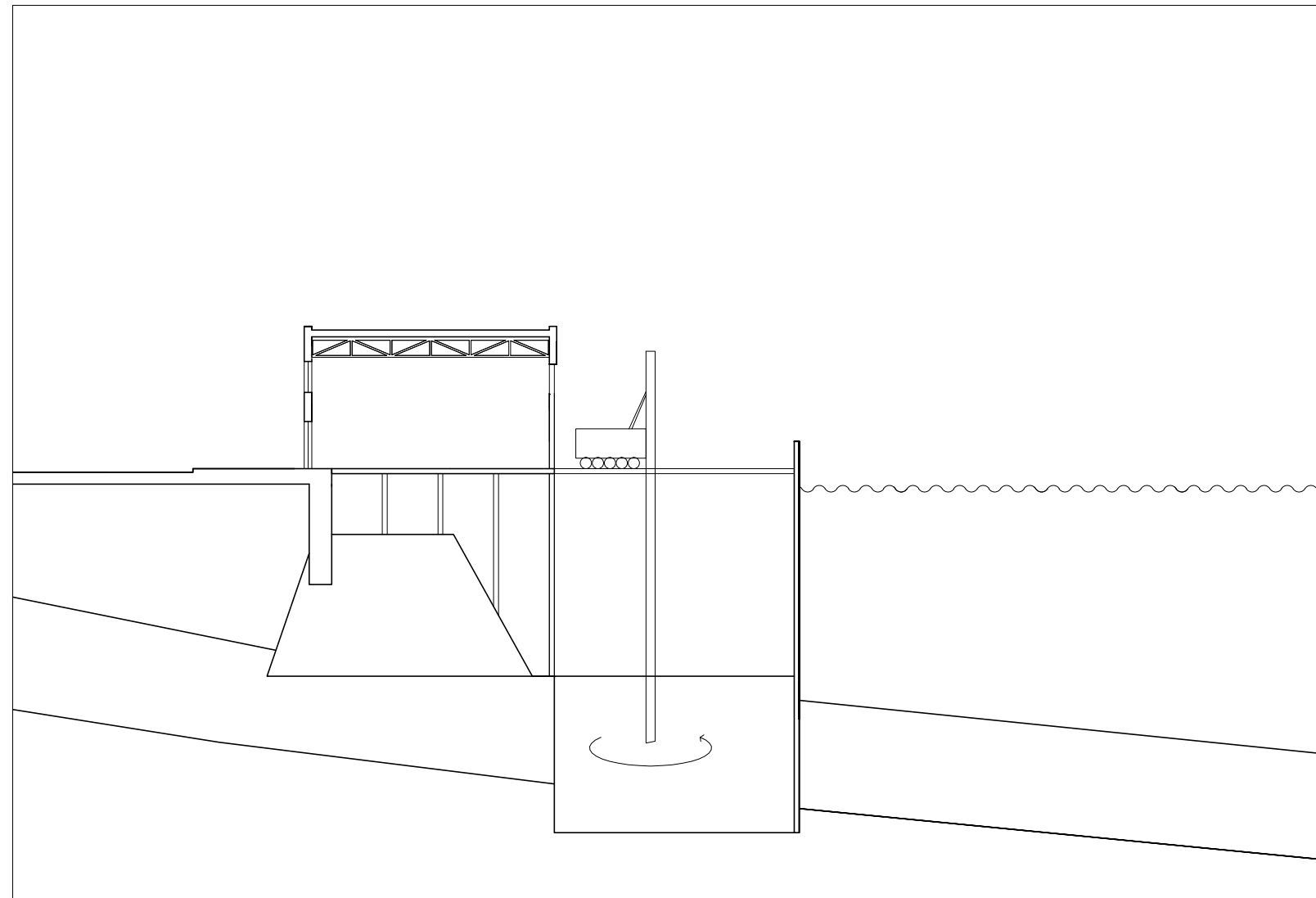


Demolish the deck and pillings.

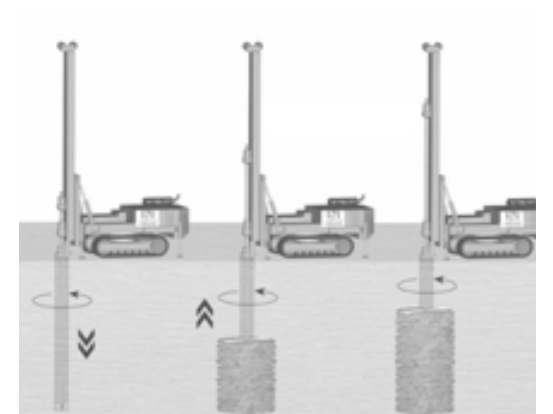


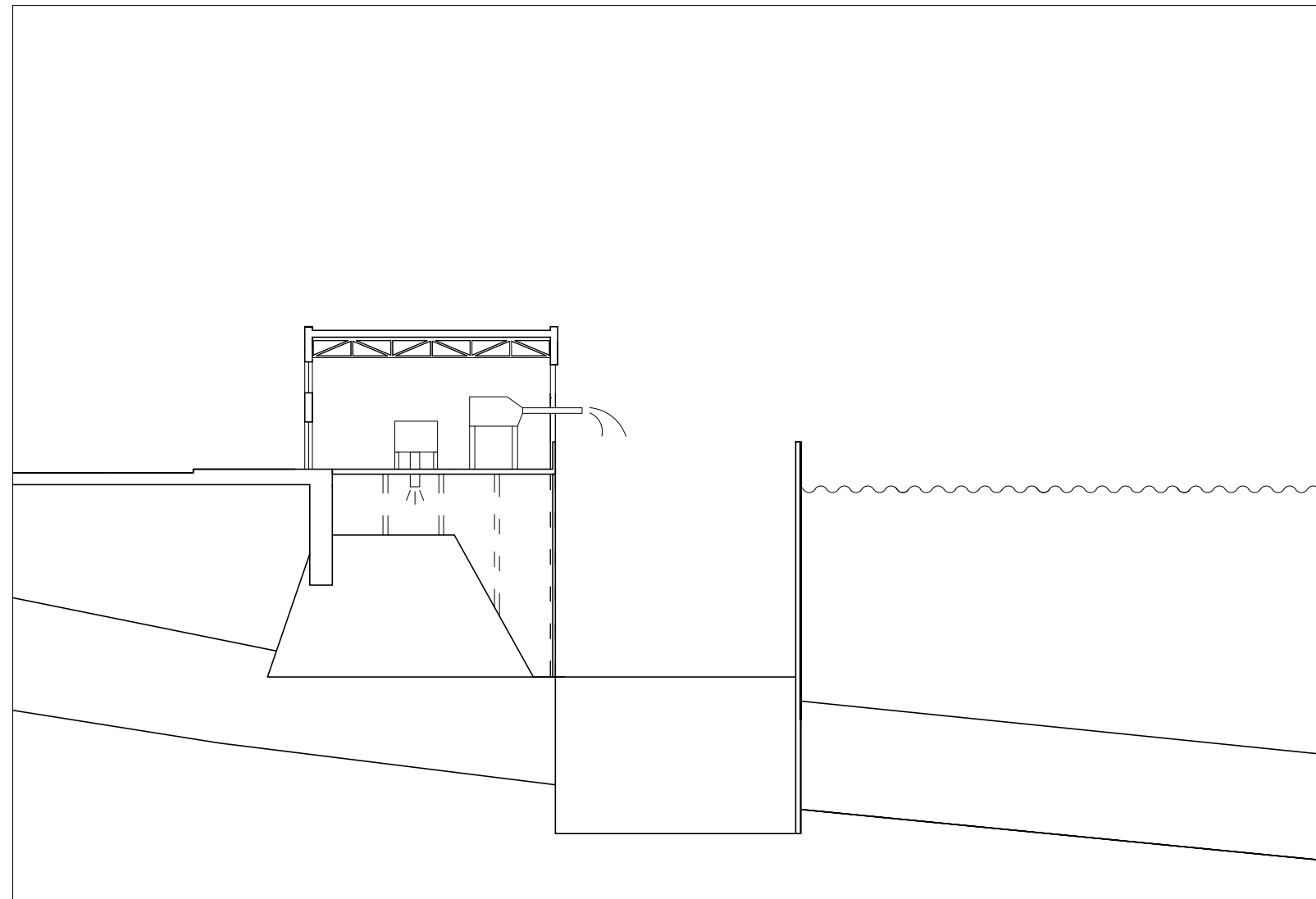
Build sheet pile wall; dewater.





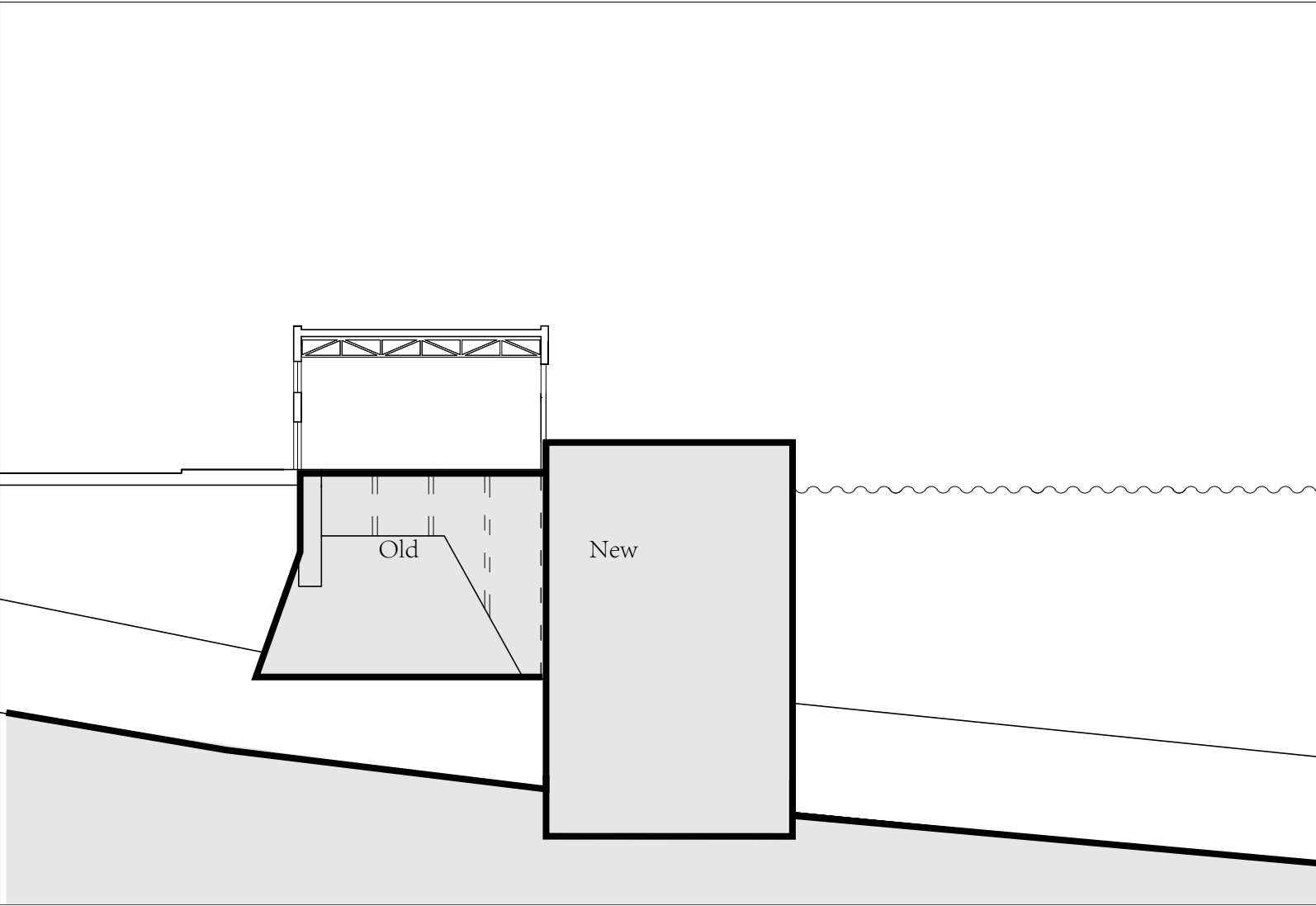
Blend precipitation with concrete (DSM).



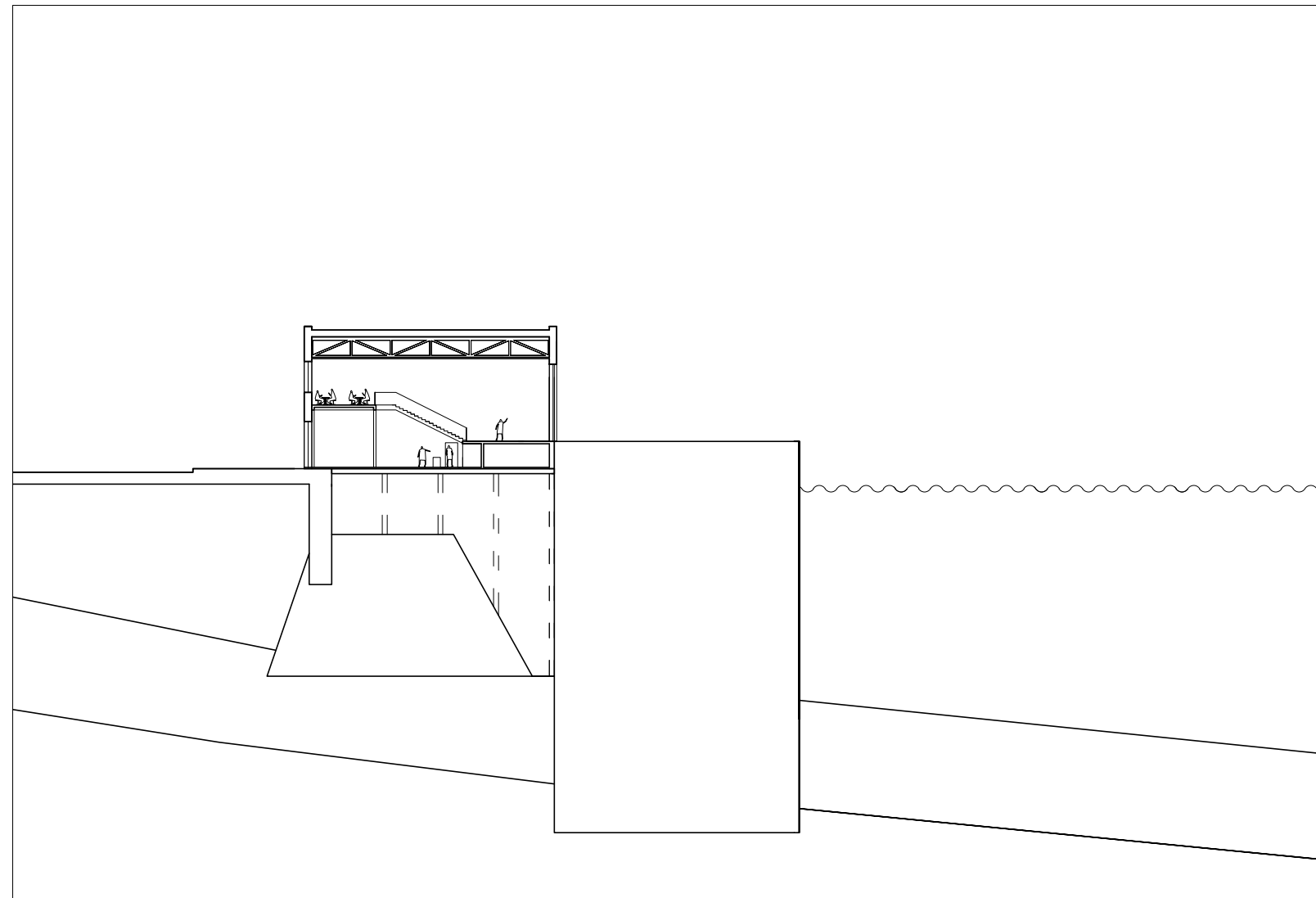


Cast cellular concrete; hydraulic fill (strong concrete).

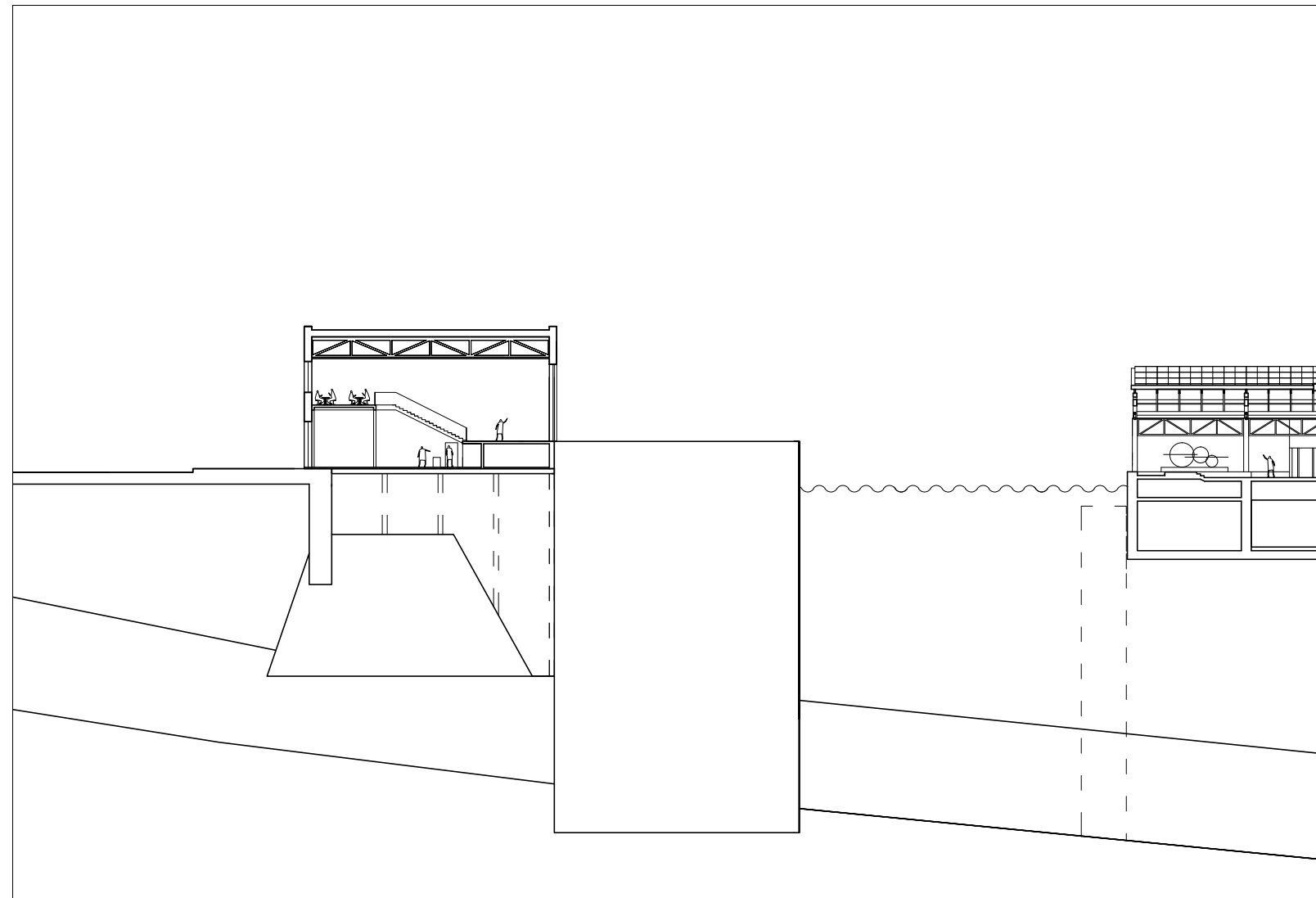




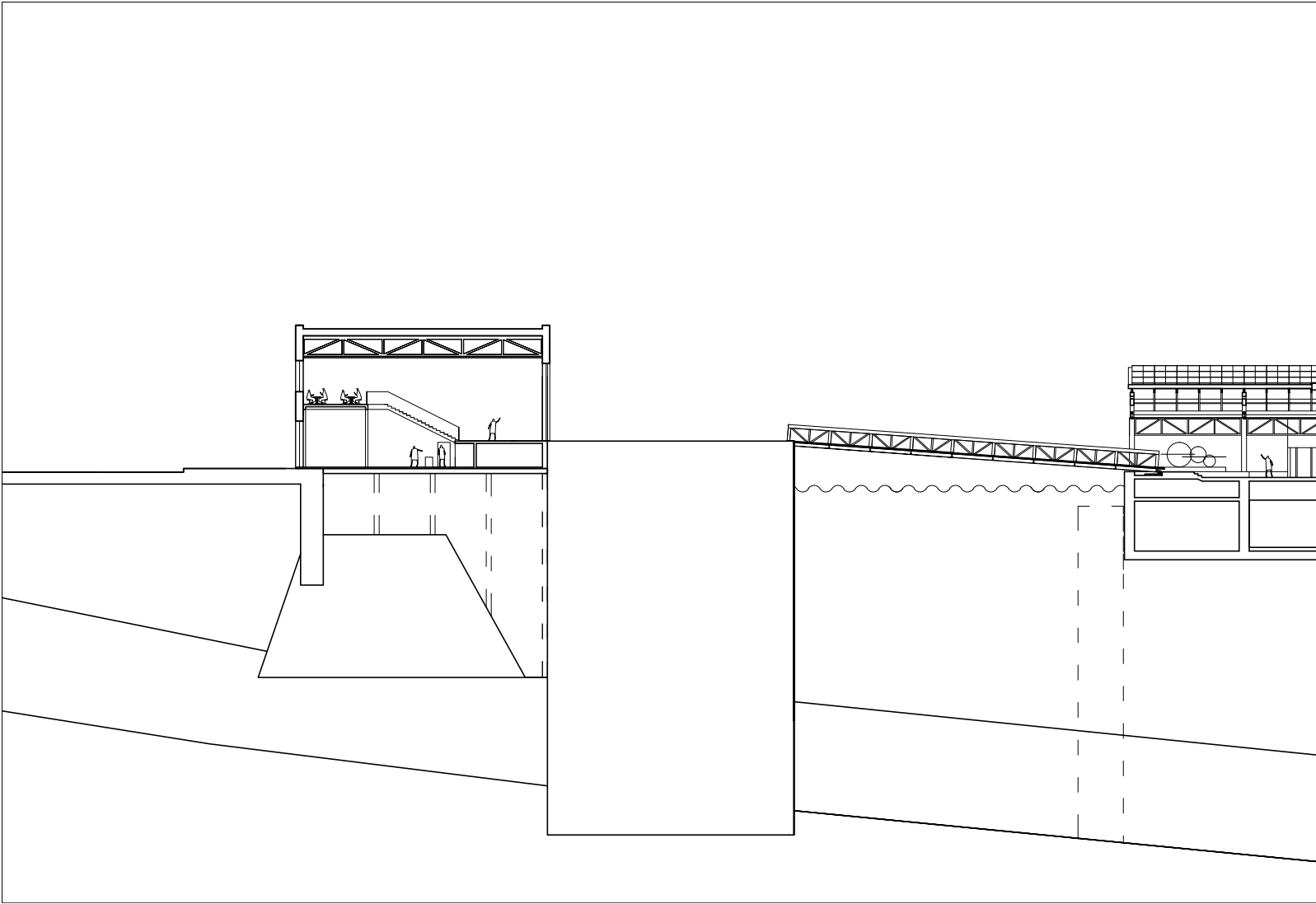
A combined new seawall.



Renovate the front part of the old pier.

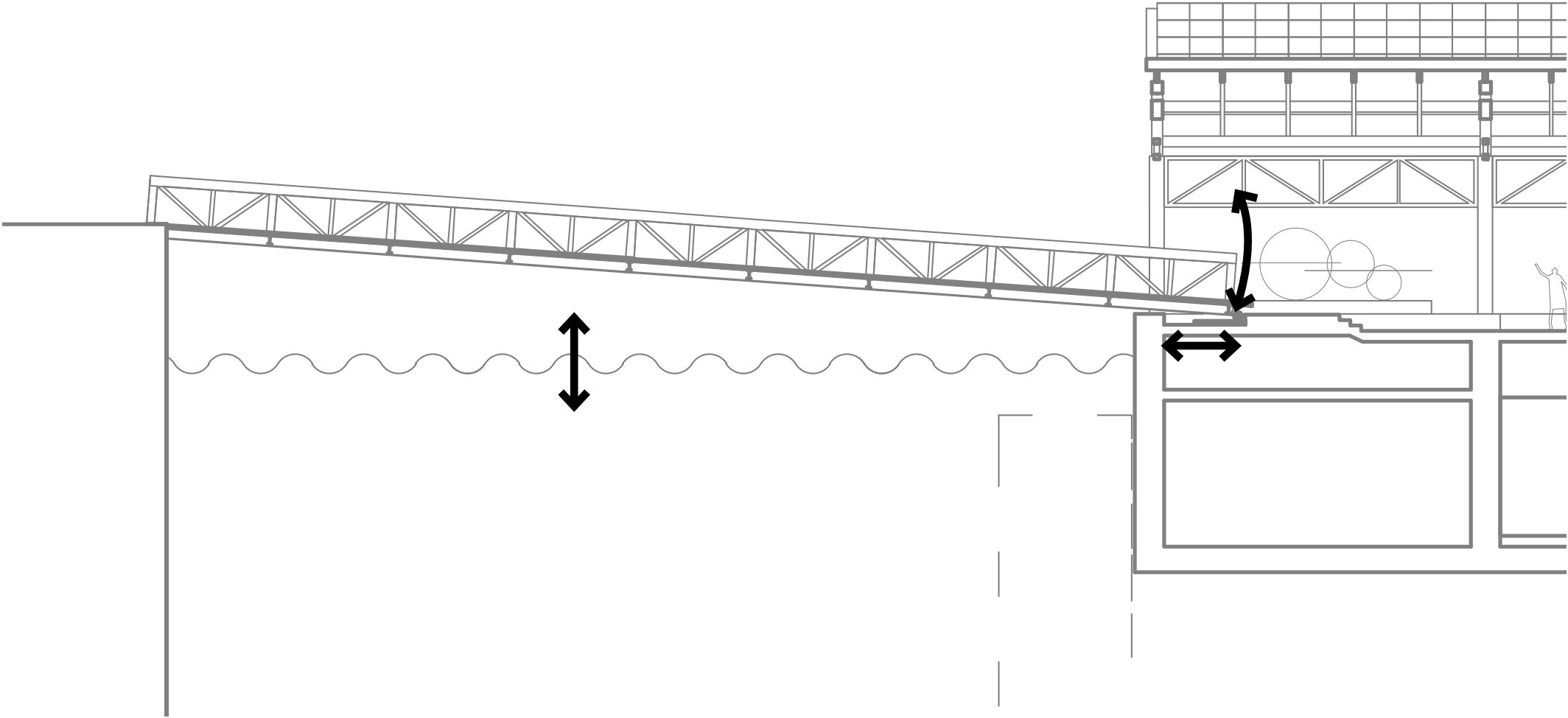


Assemble the dismantled structure on a new floating foundation (concrete box) somewhere else; drag it to the site.



Build the connection.

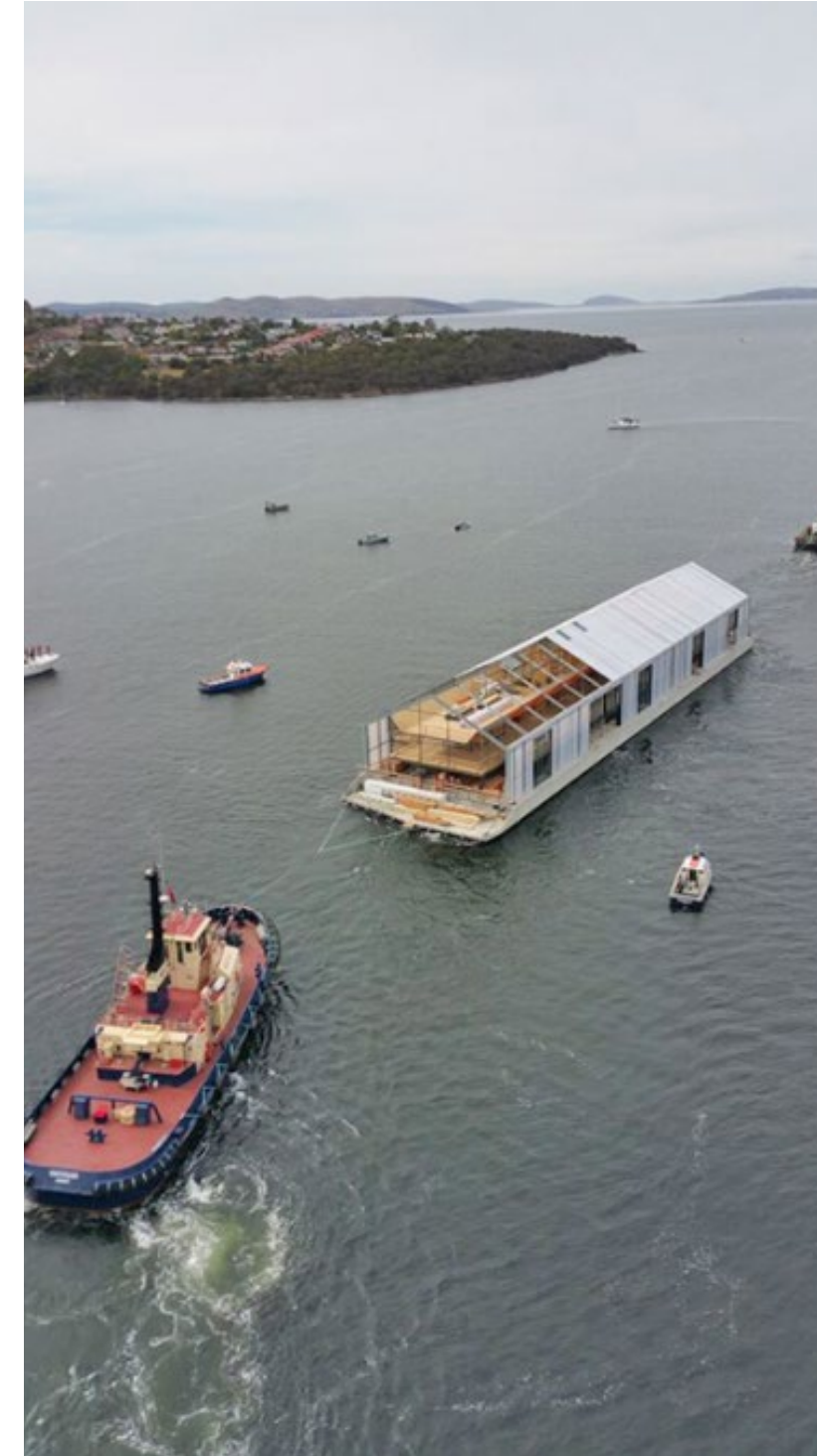
Connection



The floating building

Case: Brooke street pier



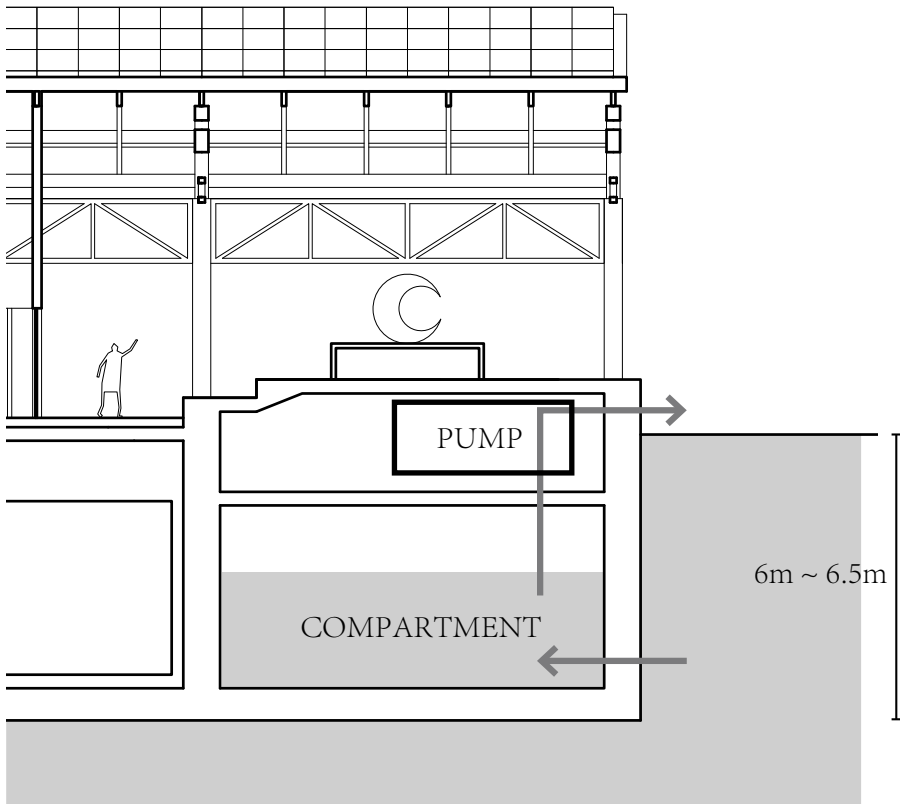


San francisco's shipyards
(assemble place)

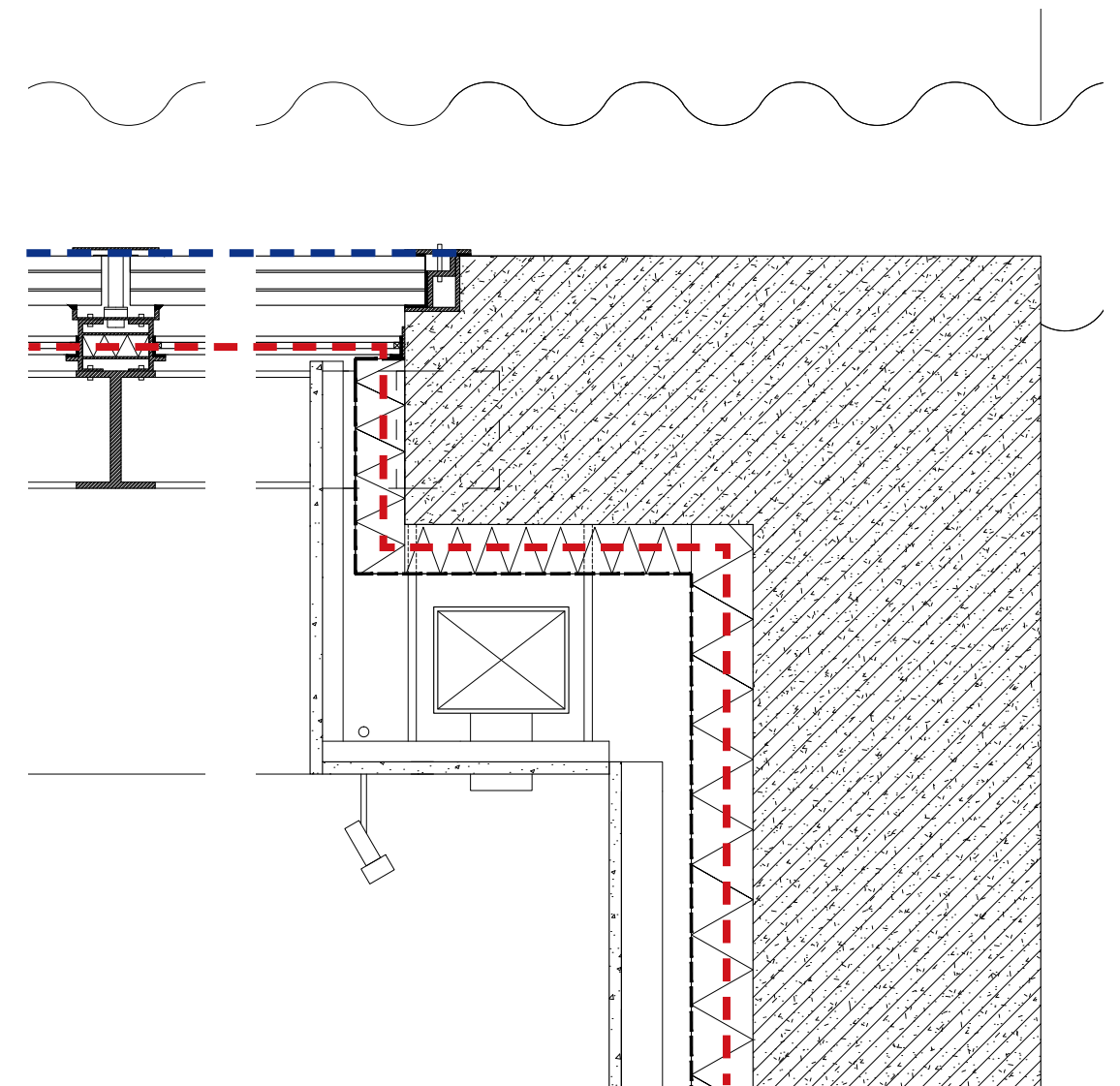
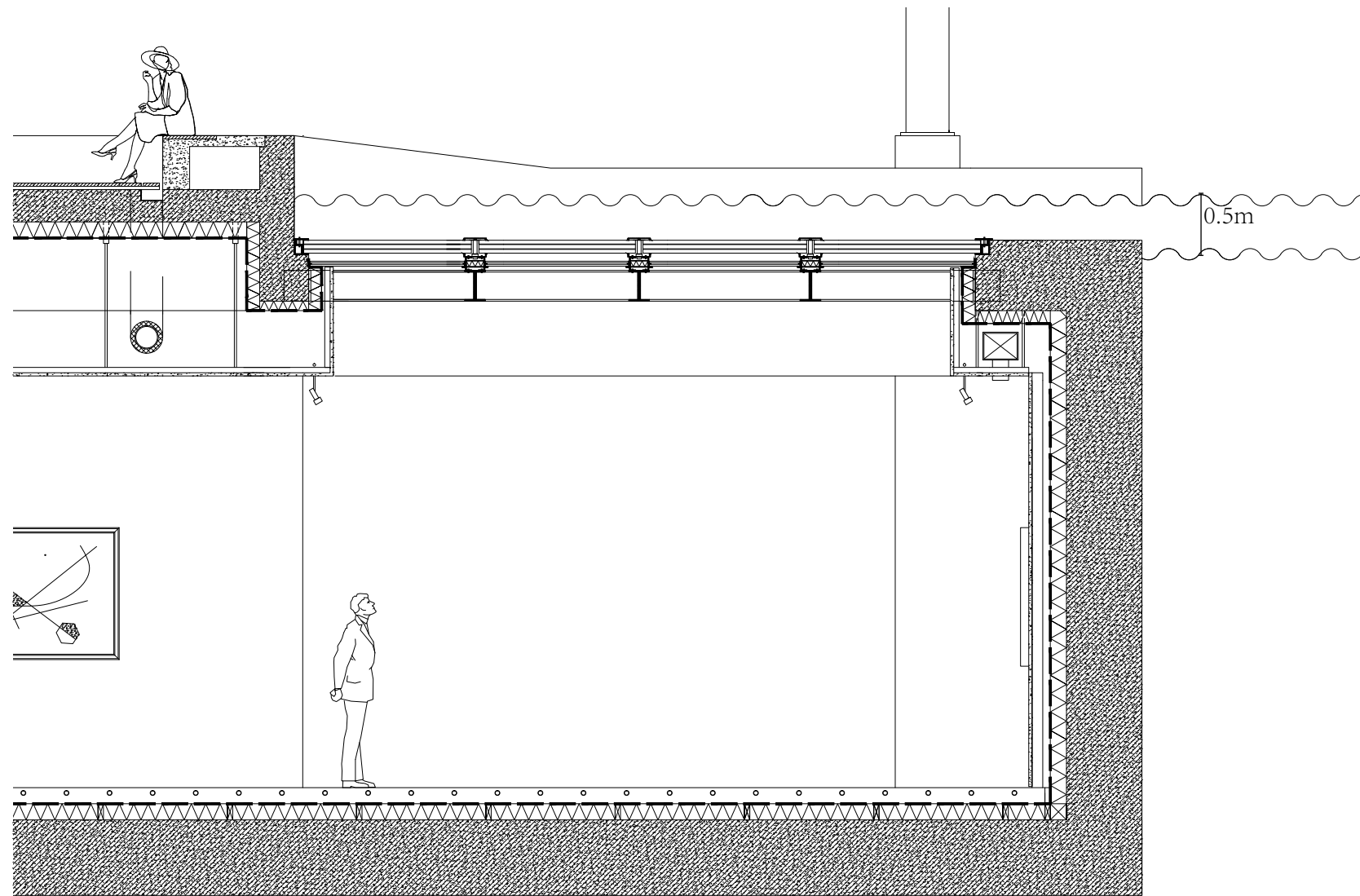
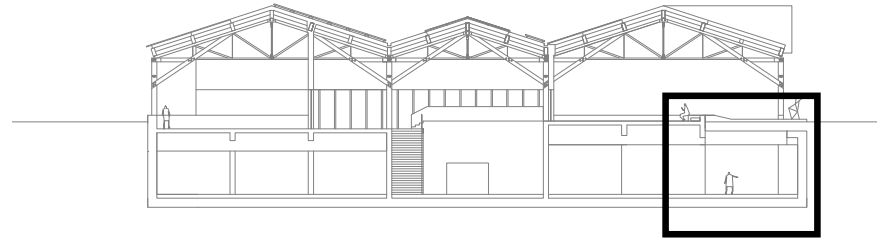


Floating caculation

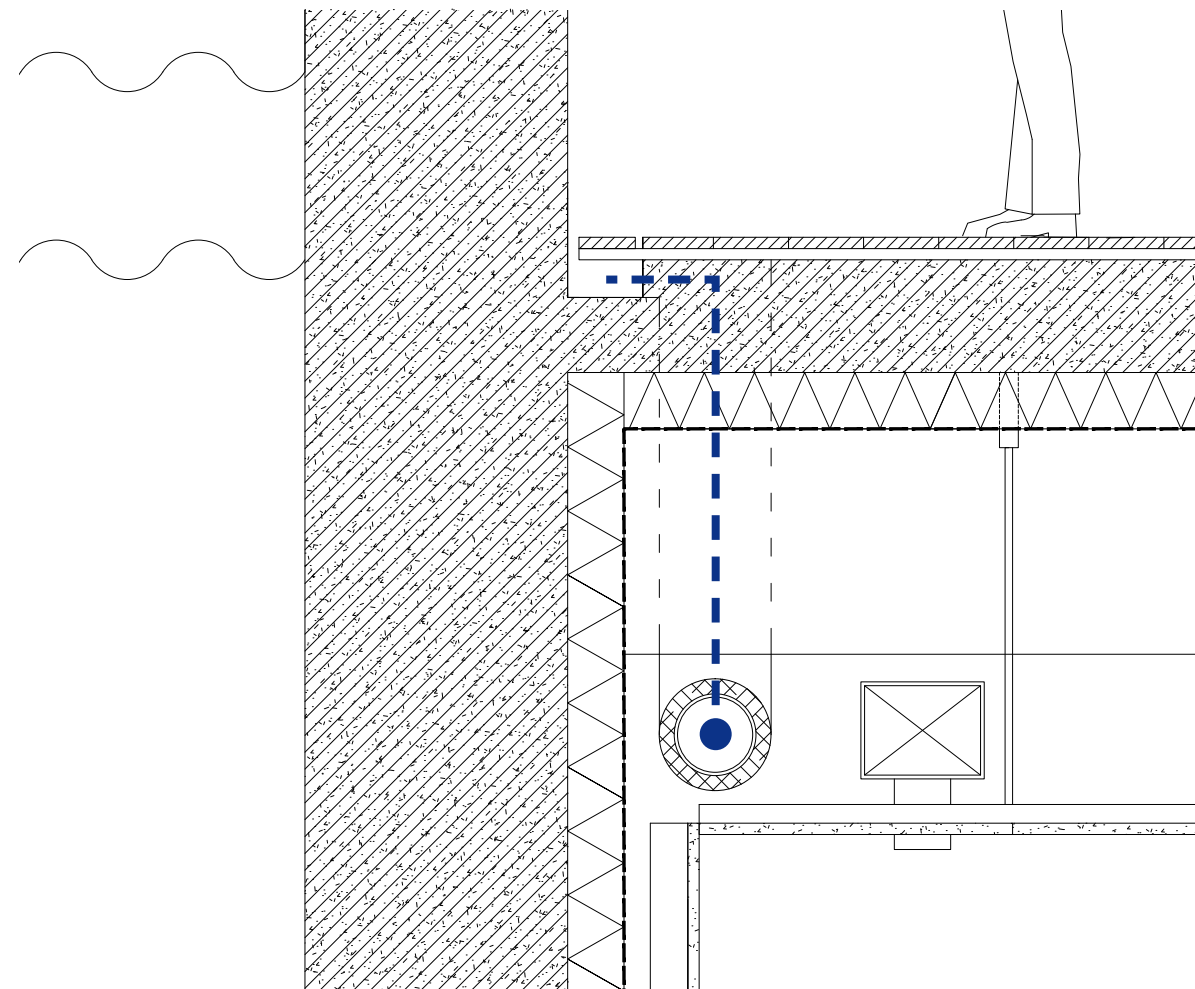
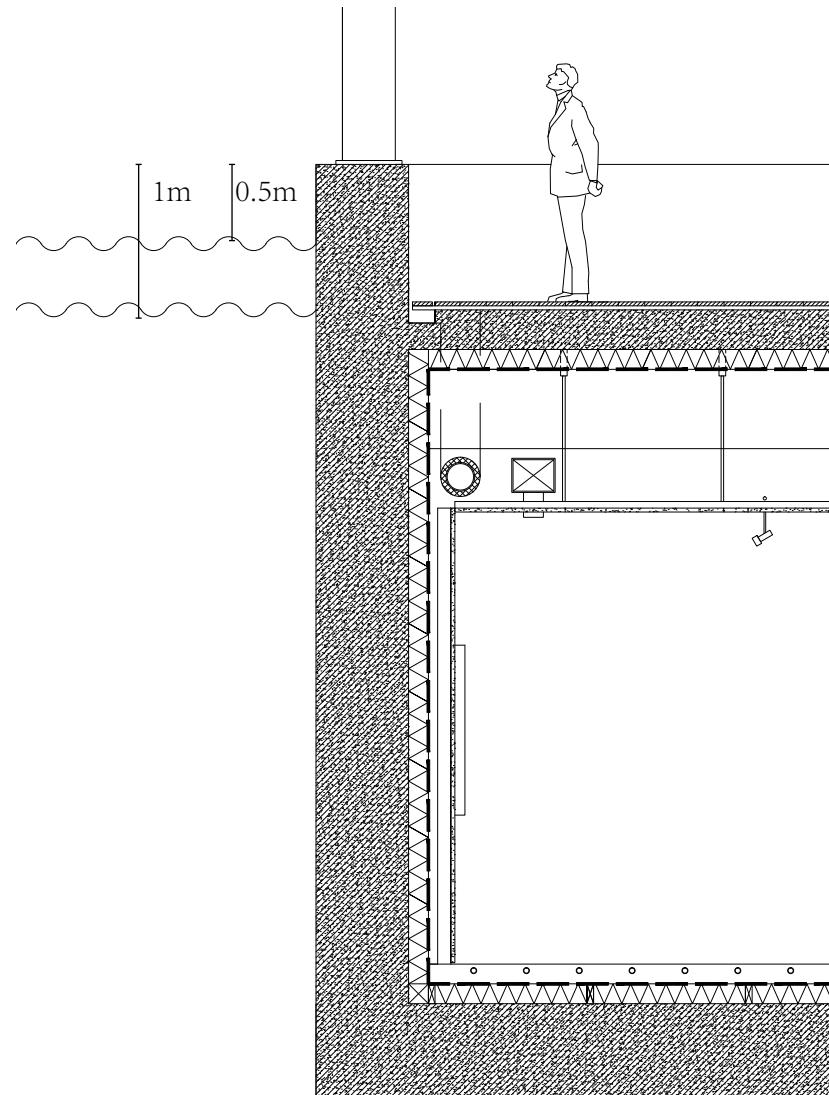
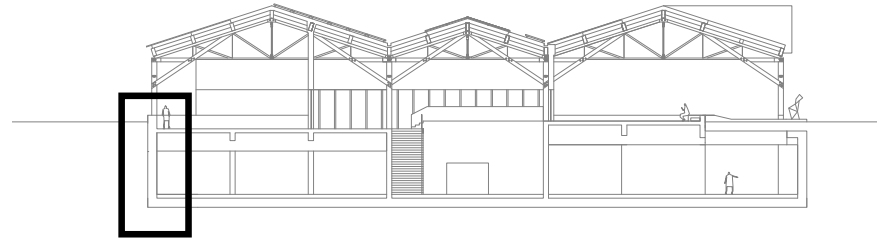
	WEIGHT		SINKING
BUILDING MATERIALS	Total	42000t	6m
	Concrete box	80%	
	Metal structure	6%	
	Wood roof & wall	8%	
	Other elements	6%	
	300 people	0.006%	
COMPARTMENTS	Water	3500t	0.5m
TOTAL	42000t ~ 45500t		6m ~ 6.5m

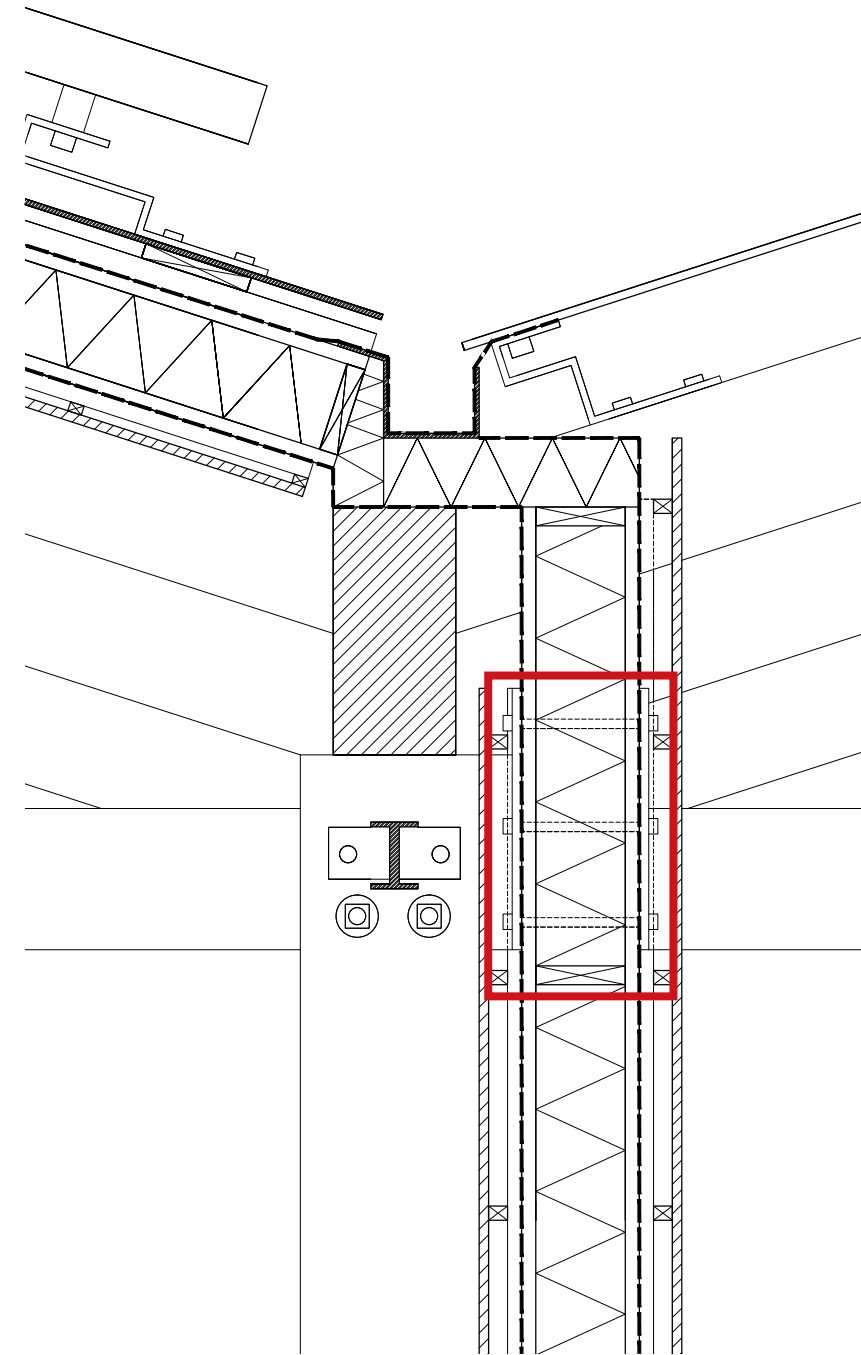
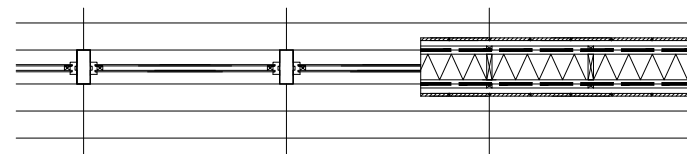
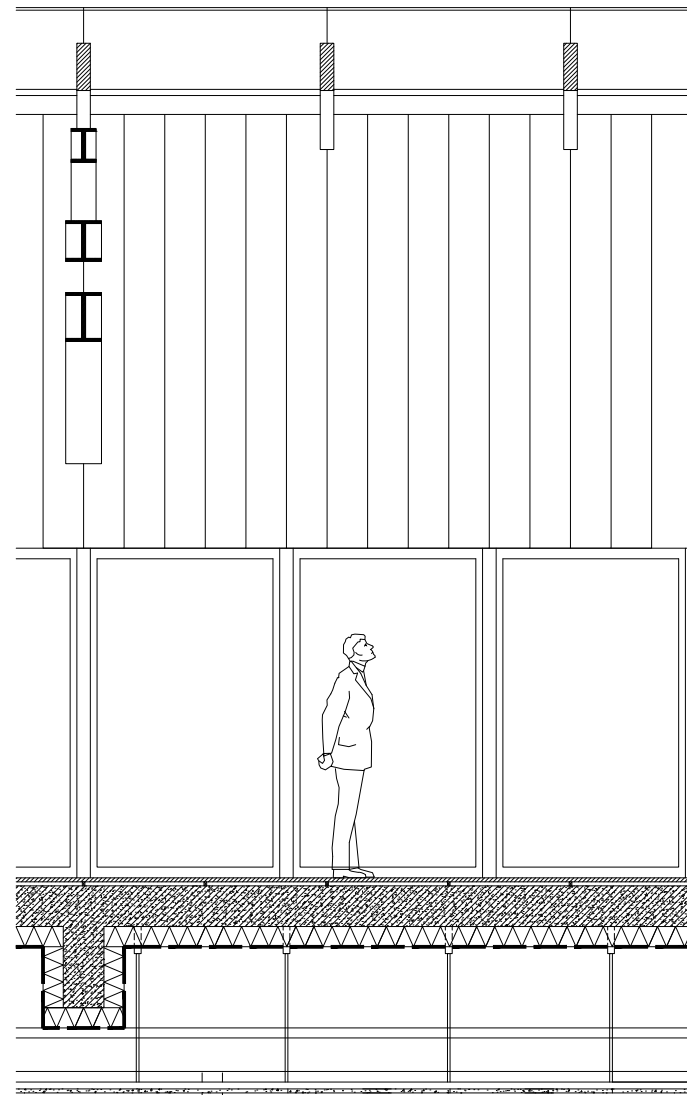
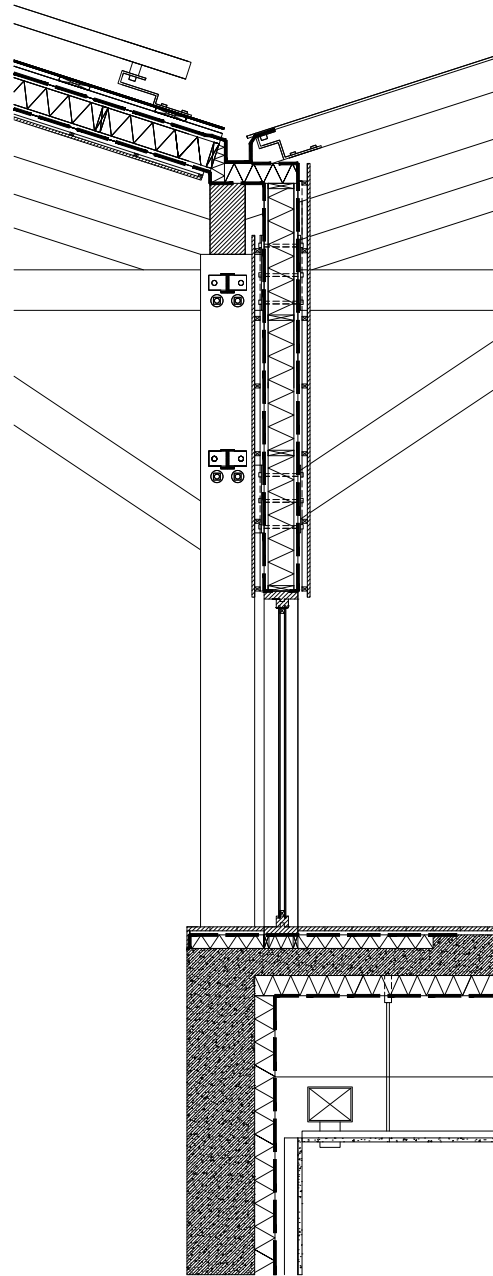
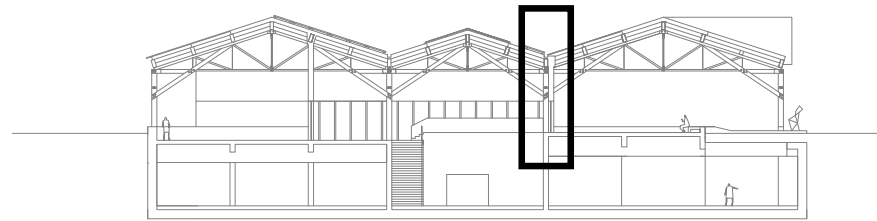


Details

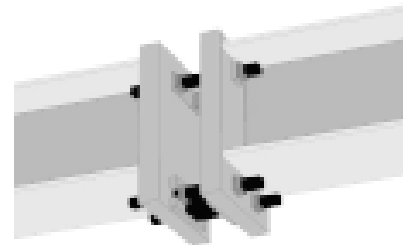


Details





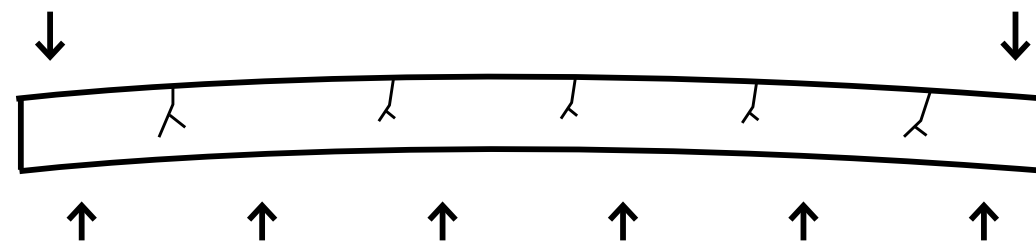
Isokorb (a component dealing with thermal bridge)



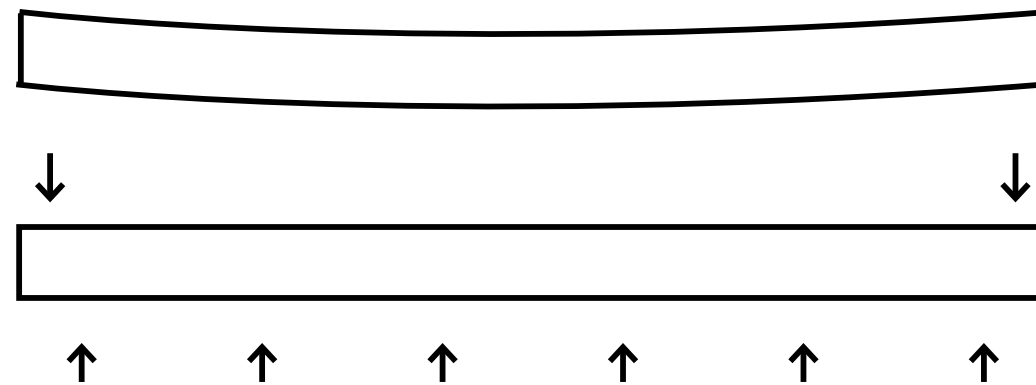
Concrete foundation



Reinforced concrete

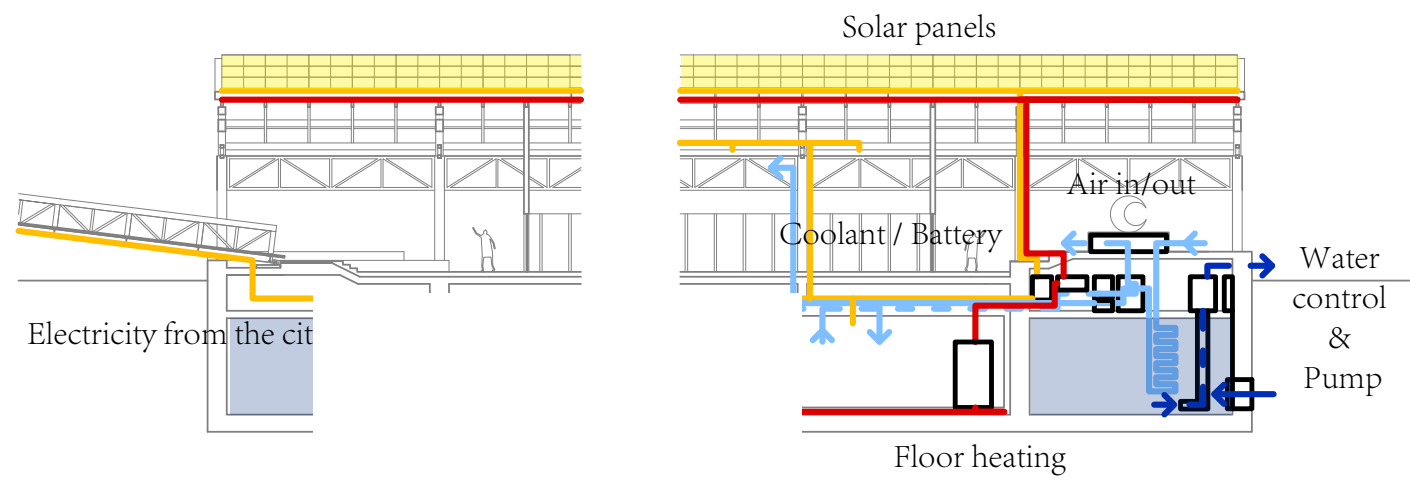
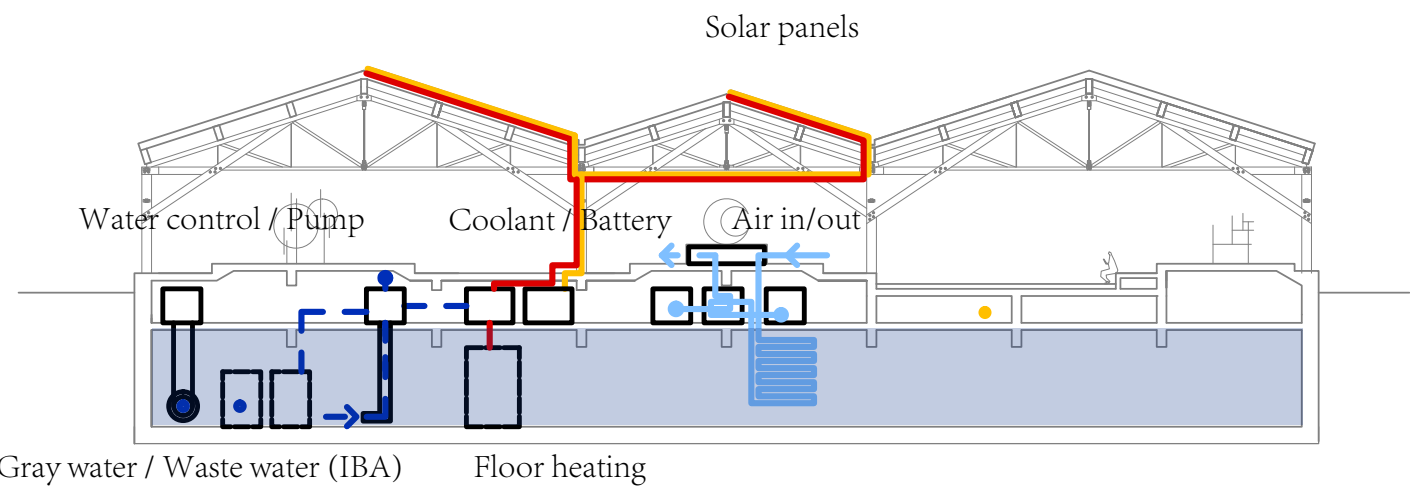
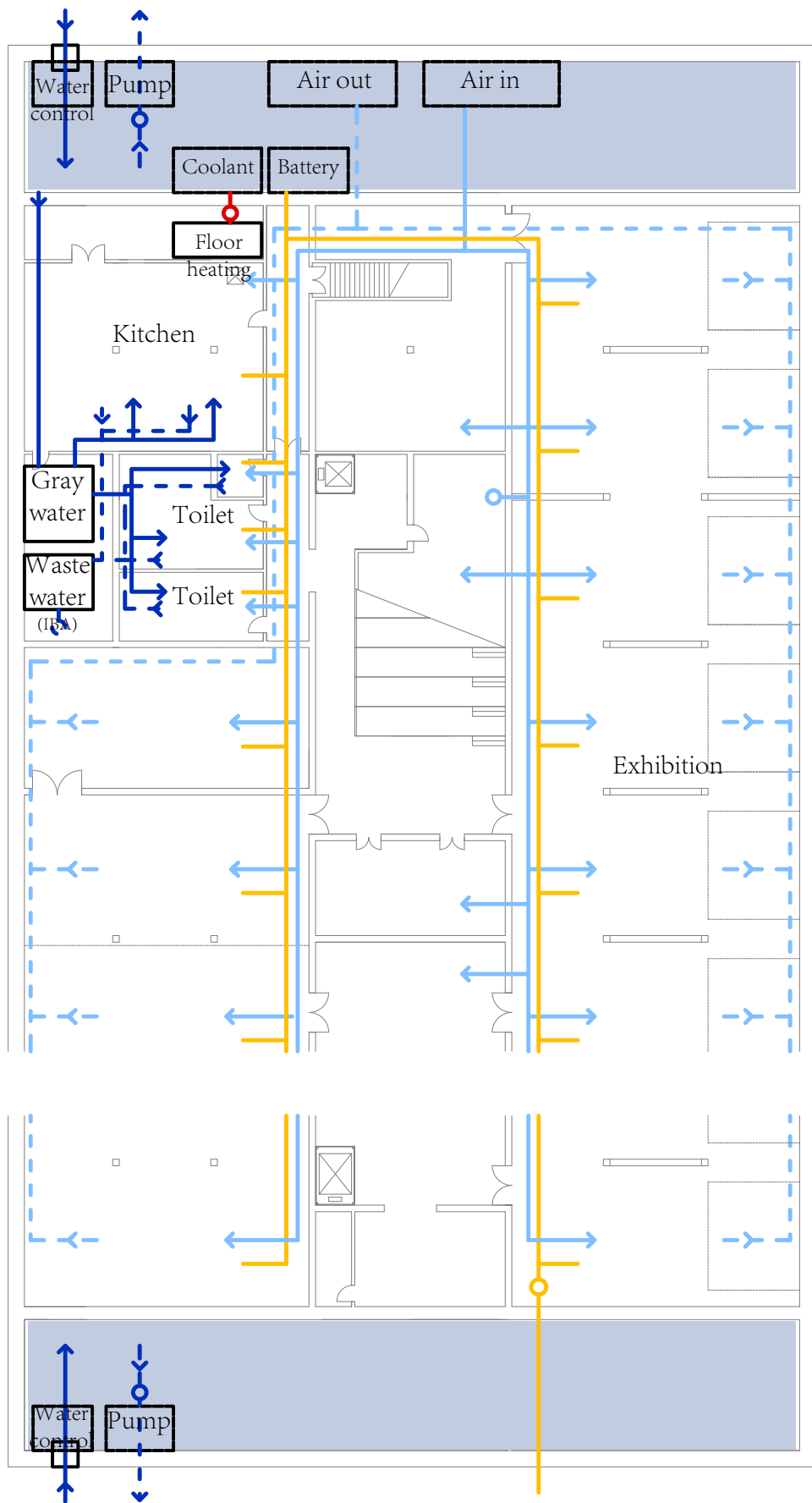


Prestressed concrete



Prestressed concrete

Facilities



- Air in
- - - Air out
- Electricity
- Water in
- - - Water out
- Coolant / Floor pipes (heating)

Ventilation

Mechanical Ventilation

↑ air out
 ↓ air in

Heating & Cooling system

● heating pipes

Air flows

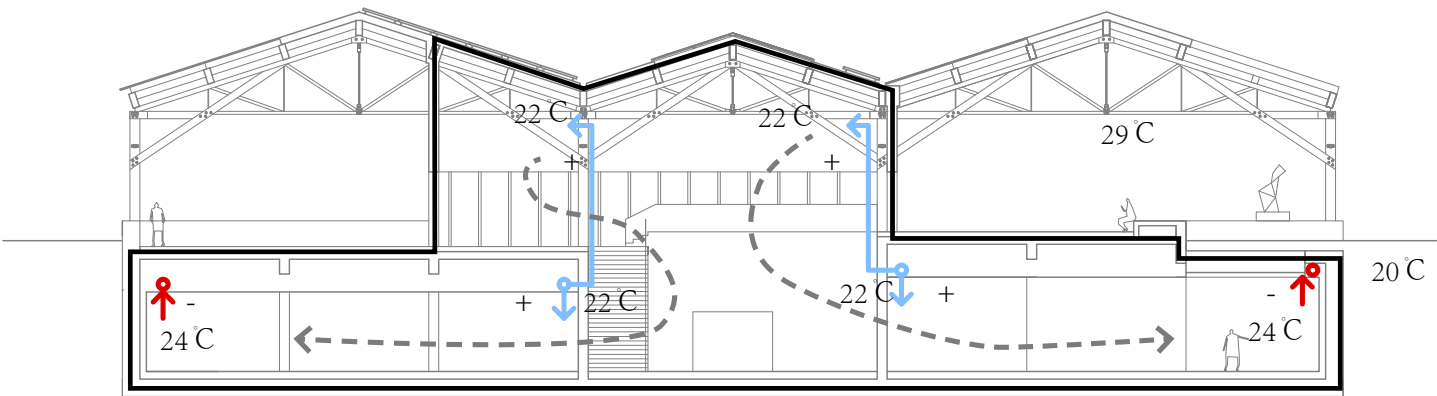
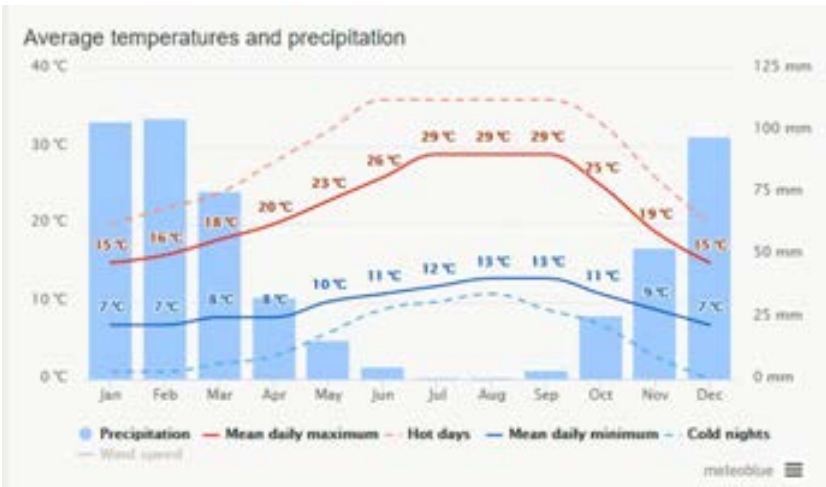
--> Direction
 + High pressure
 - Low pressure

Heating & cooling:

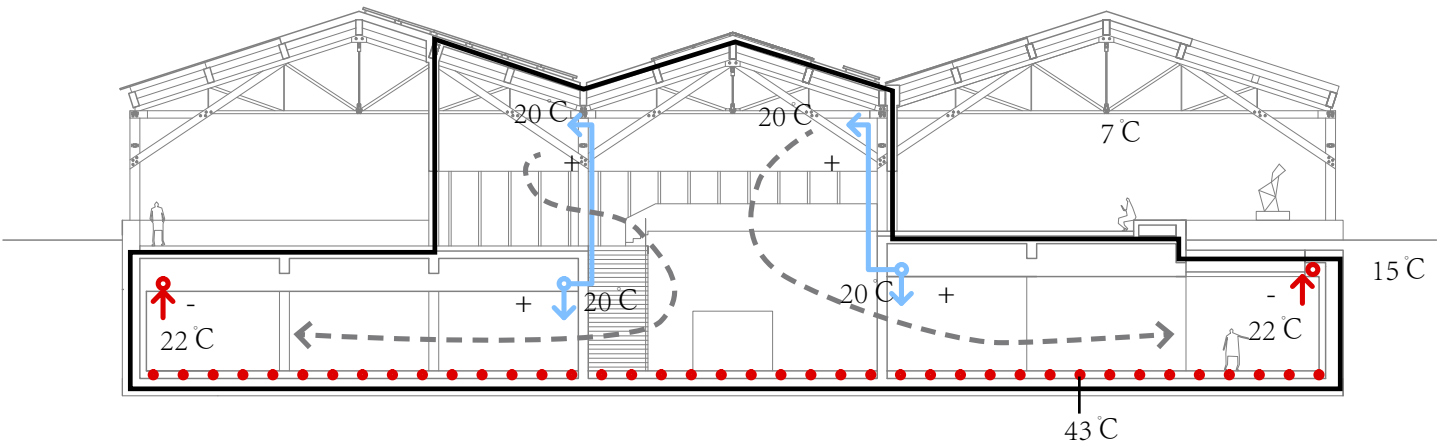
In winter, the hot coolant produced by the solar panels will be used by floor pipe system to warm the interiors. Cooling is not needed in the building.

Ventilation:

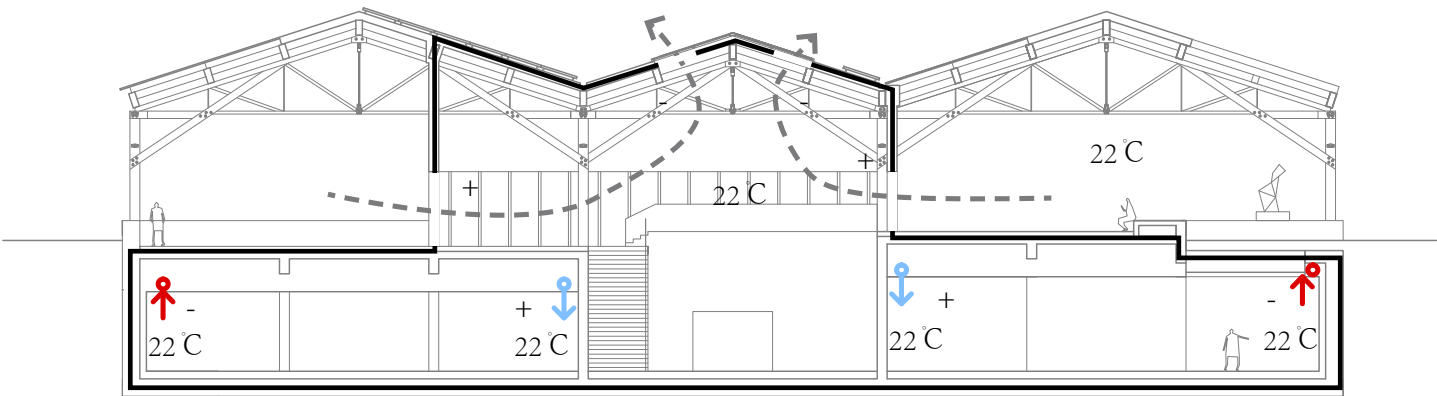
The sea water could be used to exchange the heat with the fresh air in both summer and winter. In winter, the cold fresh air will also exchange the heat with the warm exhausted air after the exchange with sea water.



Summer

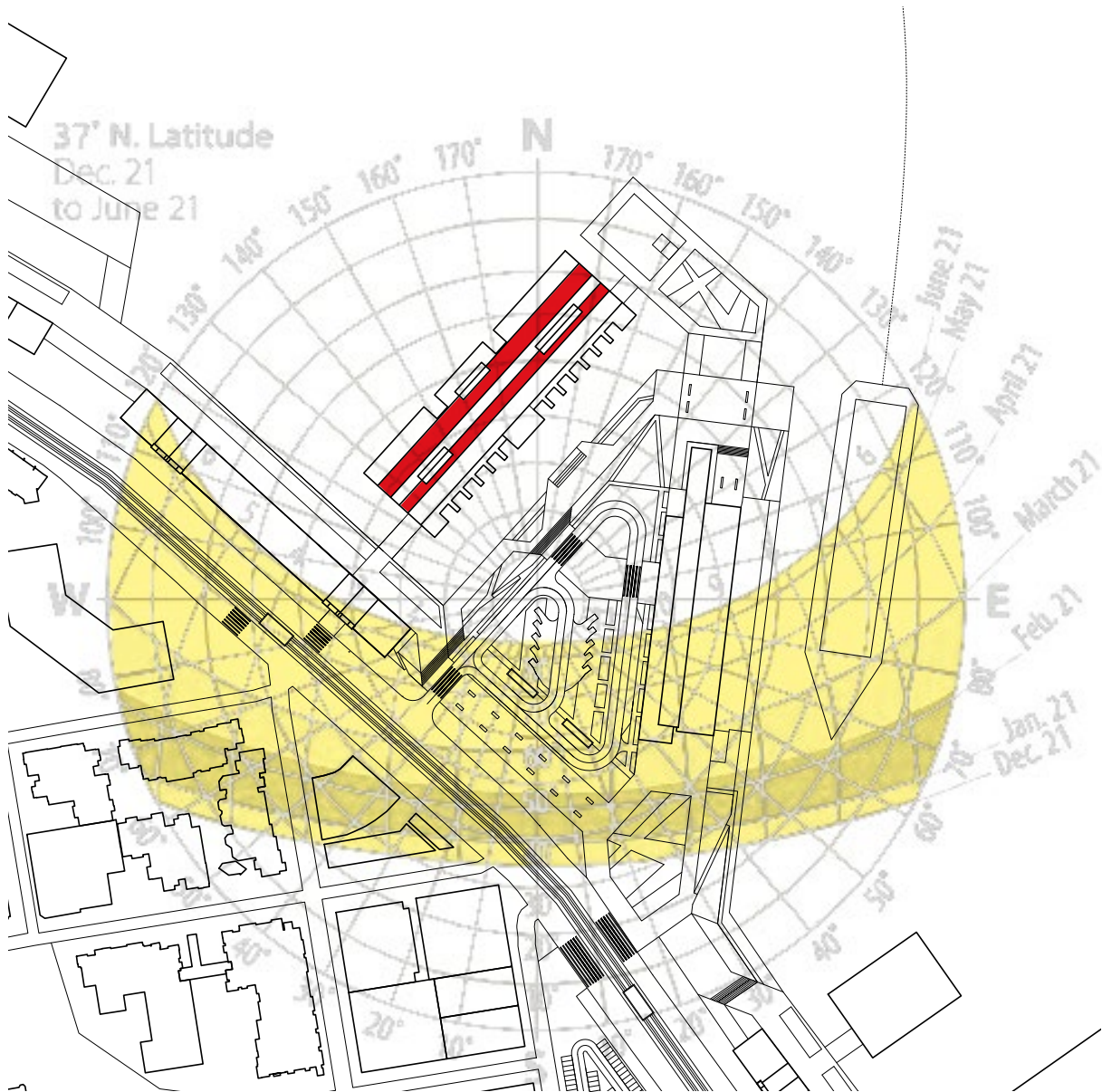
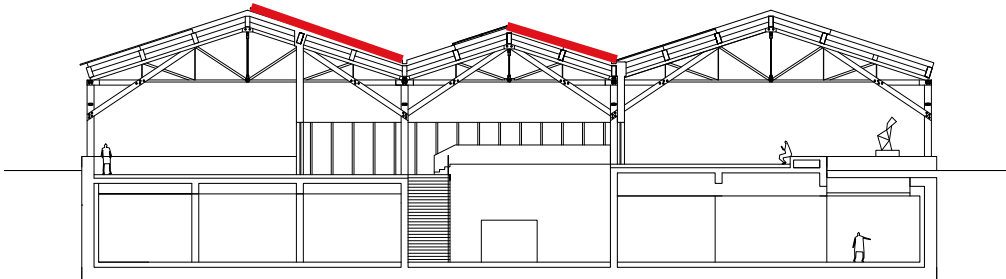


Winter



Spring / Autumn

Solar energy



\$ 70,860 per year

RESULTS

789,082 kWh per Year *

System output may range from 758,229 to 802,496kWh per year near this location

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)	Energy Value (\$)
January	3.10	39,493	3,546
February	4.11	47,040	4,224
March	4.94	63,060	5,663
April	6.19	75,326	6,764
May	6.80	85,544	7,682
June	7.09	85,734	7,699
July	7.59	93,930	8,435
August	6.90	85,263	7,657
September	6.40	75,908	6,817
October	4.90	60,554	5,438
November	3.34	40,925	3,675
December	2.82	36,305	3,260
Annual	5.35	789,082	\$ 70,860

Location and Station Identification

Requested Location	san francisco
Weather Data Source	(TMY2) SAN FRANCISCO, CA 11 mi
Latitude	37.62° N
Longitude	122.38° W

PV System Specifications (Commercial)

DC System Size	507.6 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Economics

Average Cost of Electricity Purchased from Utility	0.09 \$/kWh
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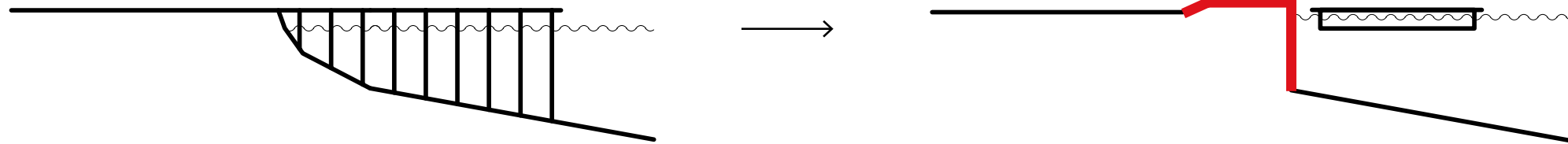
Performance Metrics

Capacity Factor	17.7%
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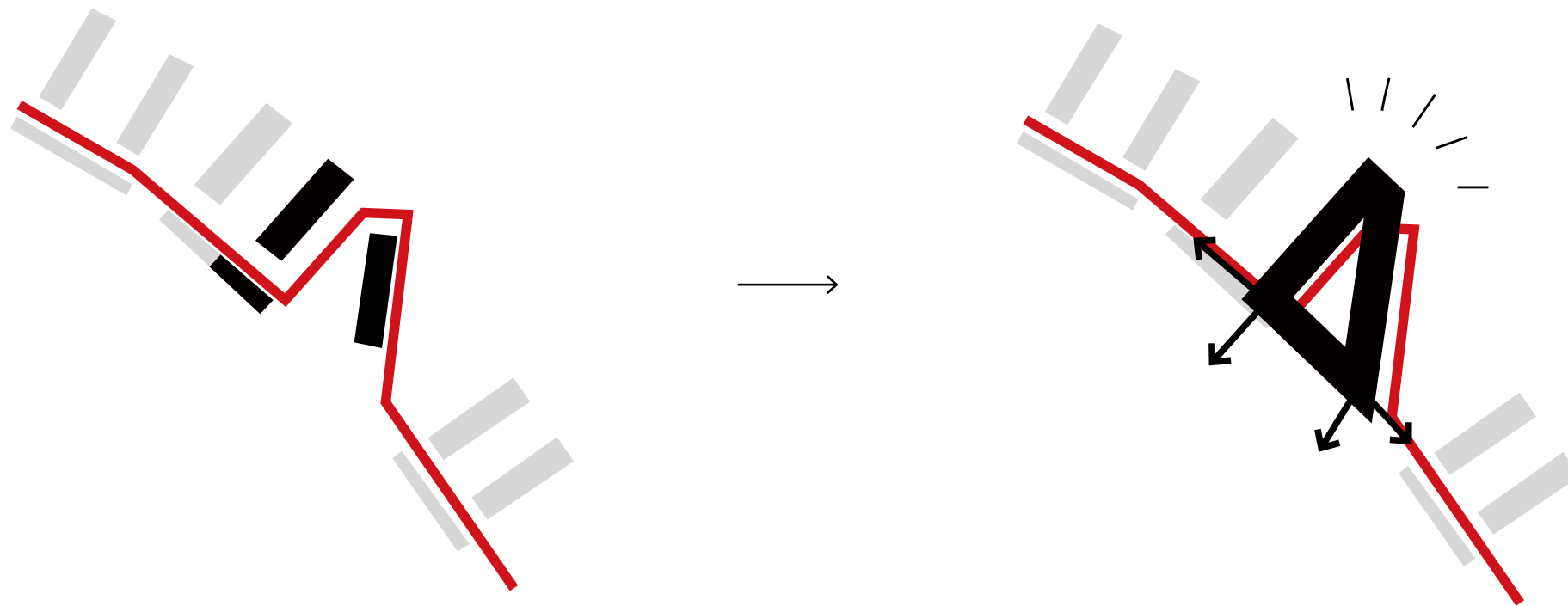
source: <http://pvwatts.nrel.gov/pvwatts.php>

Conclusion

Urban design



Architectural design



New York 2400



Mega Cities Under Water
Documentary 2014

A sustainable solution for all coastal cities



Koen Olthuis
Architect, The Hague