

# **From Furnace to Fairness: Atmospheric Sequences in Steel Museum**

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Master of Architecture  
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## **Abstract**

This thesis explores the atmospheric sequences within a steel museum located in the South Side Works of Pittsburgh, Pennsylvania. The South Side Works, once a historic steel production area, is now undergoing renewal and redevelopment, yet it still retains traces of its industrial past.

The exploration begins by examining the pre-union steel production space, characterized by hazardous conditions, limited natural lighting, and uncomfortable indoor temperatures. Visitors are transported to the 19th-century factory workers' world, experiencing the dim light from above, sweltering heat, dirt on the ground, and the large scale of the production space. This atmosphere contrasts with the post-union era, marked by enhanced natural light, modern steel construction, and a connection to the outdoors. The shift signifies increased attention to workers' rights and well-being, moving from dehumanization to humanization, symbolized by the "Union Hall" where workers advocated for their rights. The "Union Hall", which is the turning point of the journey, serves as a symbol of empowerment and progress for steelworkers. Technological advancements have further improved the working environment, making the production process more standardized and automated.

This thesis aims to narrate the story through the qualities of spaces—scale, steel construction, materials, and light—by utilizing architecture study methods including modeling, sketches, lighting studies, and architectural drawings. By showcasing two contrasting spaces, it explores how the sequence of space, along with materials, light, and scale, shapes the architectural spaces and atmosphere within the museum, reflecting the evolution from furnace to fairness.

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## **General Audience Abstract**

This thesis explores the atmospheric sequences within a steel museum located in the South Side Works of Pittsburgh, Pennsylvania. The South Side Works, once a historic steel production area, is now undergoing renewal and redevelopment, yet it still retains traces of its industrial past.

The exploration begins by examining the pre-union steel production space, characterized by hazardous conditions, limited natural lighting, and uncomfortable indoor temperatures. This atmosphere contrasts with the post-union era, marked by enhanced natural light, modern steel construction, and a connection to the outdoors. The shift signifies increased attention to workers' rights and well-being, moving from dehumanization to humanization, symbolized by the "Union Hall" where workers advocated for their rights. The "Union Hall", which is the turning point of the journey, serves as a symbol of empowerment and progress for steelworkers.

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Last but certainly not least, I am profoundly grateful to my parents for your unwavering support and encouragement. Your belief in me and your selfless desire for my happiness have been the guiding lights throughout my journey. I am truly fortunate to have such loving and supportive parents.

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## Introduction

*Artworks, Heidegger contends, are things.*

**Heidegger explains the viewer's responsibility to consider a variety of questions about the shoes, not only concerning form and matter—what are the shoes made of?—but also bestowing the piece with life by questioning its purpose—what are the shoes for? What world do they open up and belong to?**

*The Origin of the Work of Art, 1960, Martin Heidegger*



Martin Heidegger argues that a pair of worn, dirty shoes can reveal the life of their owner, hinting at long working hours, harsh conditions, and their economic situation. This perspective led me to consider how to utilize Heidegger's insights to reveal architectural ideas. For example, a piece of a steelworker's boots or a tool they used can lead visitors to envision the essence of the buildings they worked in, the harsh environments they were exposed to, and the emotions they experienced while working in the steel factory back then.

It is proposed that the steel museum be located in the South Side Works area of Pittsburgh. The South Side Works, once a historic steel production area, is now undergoing renewal and redevelopment, and it still retains traces of its industrial past. My proposition is to design a steel museum that allows visitors to experience sequential spaces and tells the labor story of steelworkers, as well as the materiality of steel, within the context of Pittsburgh.

# Steel Echoes:

## Pittsburgh's Industrial Past, Union Victories, and City Renewal

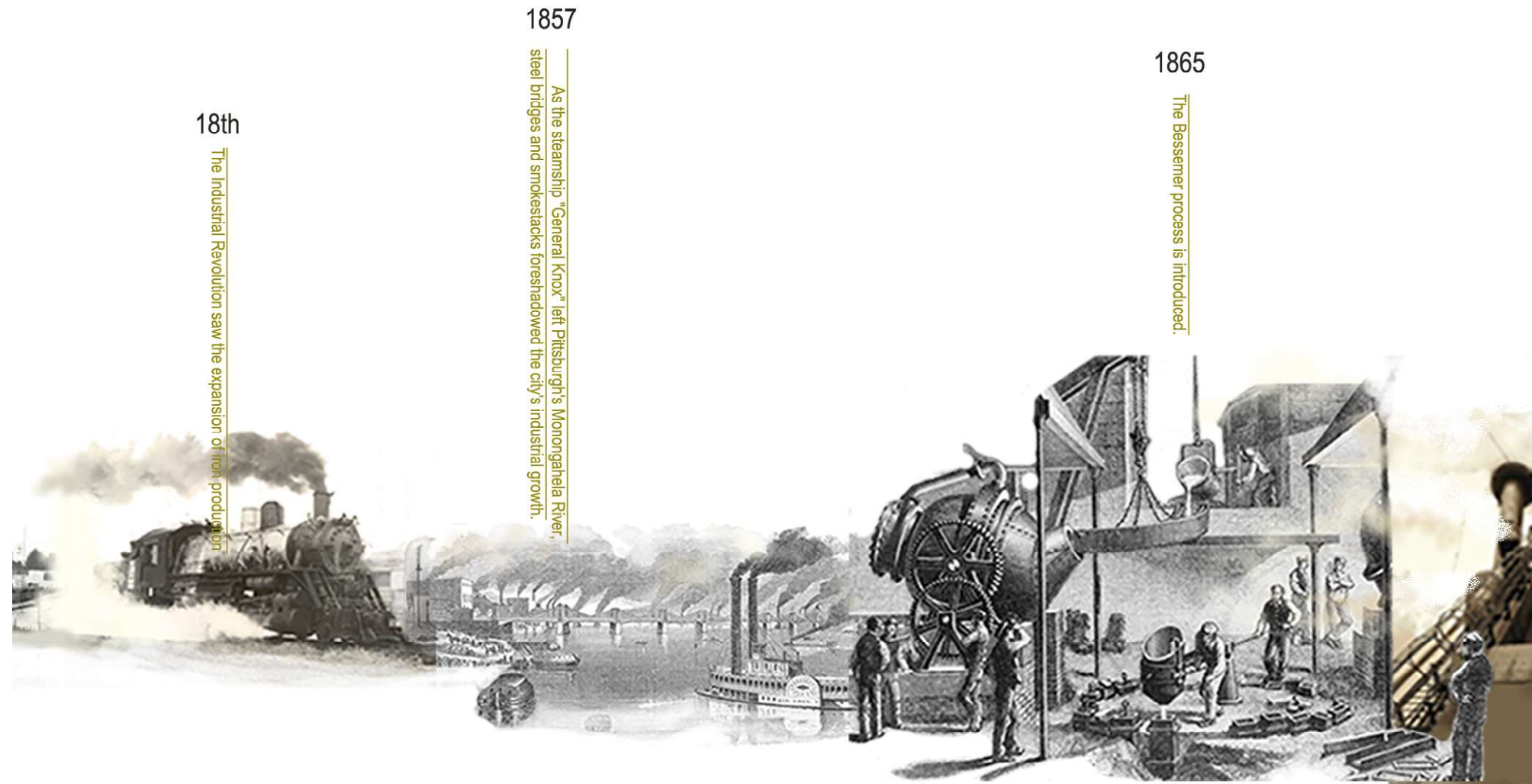
In Pittsburgh's industrial past, the Monongahela River stands as the city's silent storyteller, witnessing its transformation. This collage weaves together Pittsburgh's narrative, tracing its industrial roots along the river to the urban landscape defining the city today.

It begins with a picture of the Monongahela River, quietly absorbing the industrial energy around it. In 1854, the departure of the Steamer General Knox marked the onset of significant changes, thrusting Pittsburgh toward its destiny as a center for steel production.

Enter Andrew Carnegie in 1883, a visionary industrialist who acquired the Homestead Steel Works, reshaping Pittsburgh's fate. By 1888, Carnegie established a steel empire with trains and ships. A photo from 1912 showcases the Colonial Steel Company, highlighting Pittsburgh's dominance in the steel industry.

Fast forward to around 1939, and steelworkers are seen leaving work—the unsung heroes of Pittsburgh's industrious spirit. Jump to 1980, and a protest at Homestead highlights the resilience of workers and unions advocating for better conditions.

The journey concludes with an image of today's Pittsburgh skyline—a city reborn and embracing a new energy. This collage encapsulates Pittsburgh's industrial history, from its steel-making glory days to the efforts of workers, culminating in the contemporary urban scene.



Late 19th Century

1883

Homestead Steel Works was bought by wealthy industrialist Andrew Carnegie in 1883

Steel magnate Andrew Carnegie established and expanded his steel empire in Pittsburgh, making the city a prominent hub for steel production during the late 19th century.

1888

Carnegie bought Homestead Steel Works, his major steel production rival, securing vital railroad networks and steamships.

1892

Homestead Strike

Early 20th Century

Pittsburgh became the world's leading steel producer, but it also grappled with environmental problems.

Late 20th Century

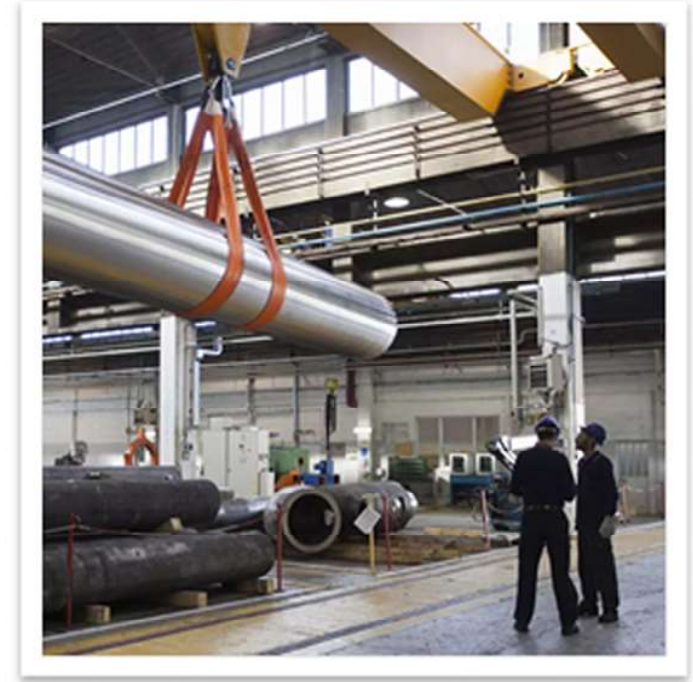
The U.S. steel industry declined, leading to the closure of many mills and job losses in Pittsburgh.

Late 20th Century - Present

Pittsburgh's steel industry shrinks, diversifies, and preserves its legacy as a tech, healthcare, and education hub while addressing environmental concerns.



# Labor History



← Labor Union →



Late 19th Century  
Harsh working conditions

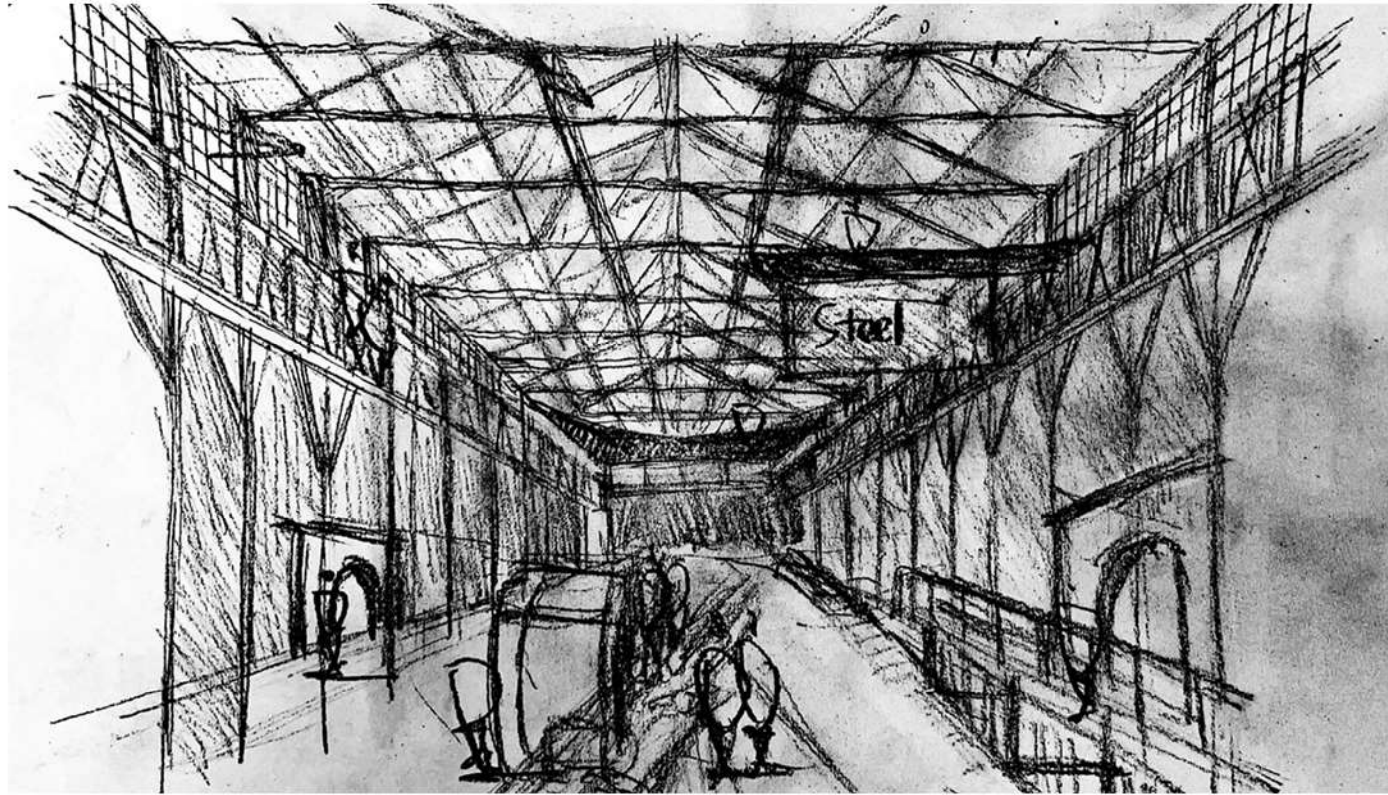
1892  
Homestead Strike

Mid-20th Century  
The United Steelworkers of America

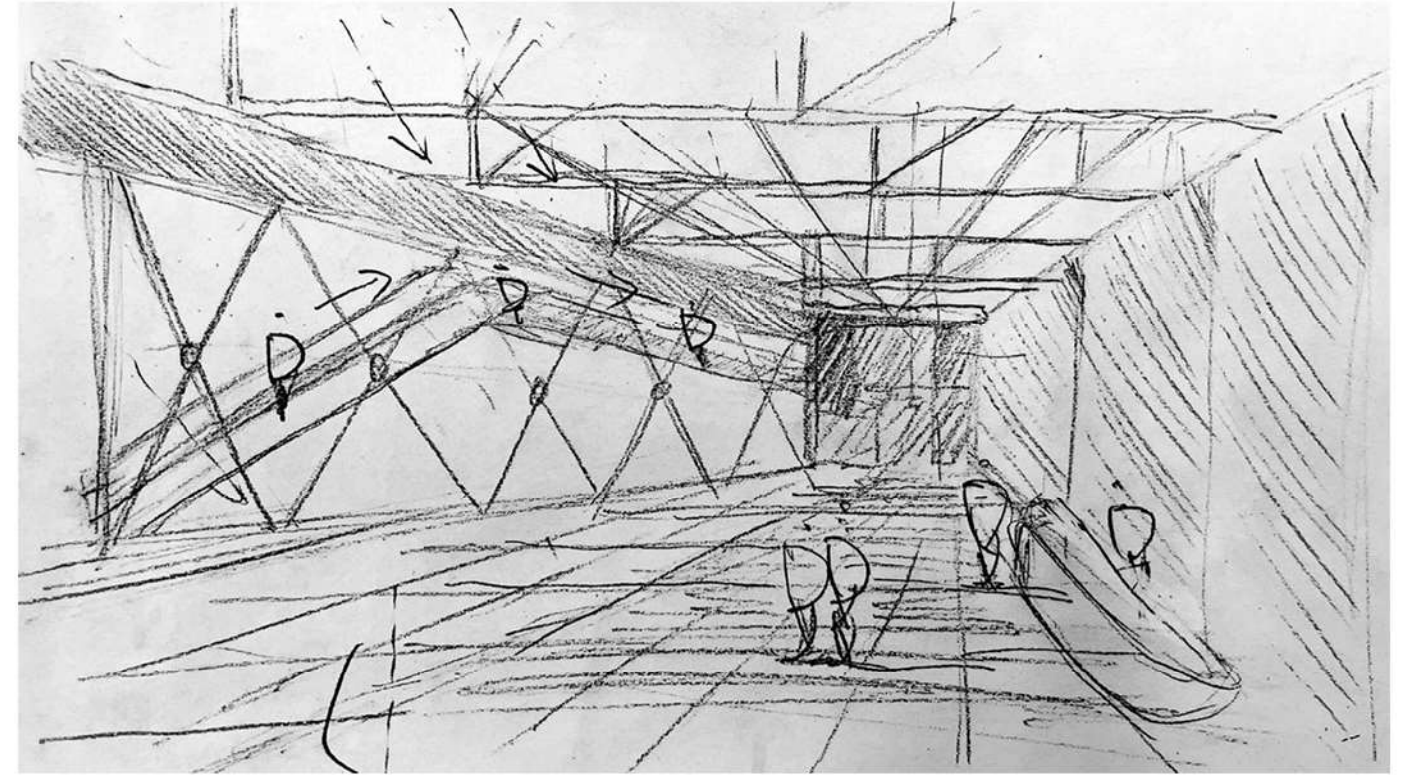
Late 20th Century  
Labor unions strive to protect their members.

Late 20th Century  
Working conditions have been greatly improved

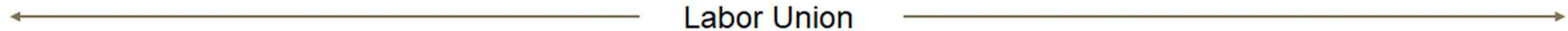
Present  
Labor unions continue to represent workers



**Pre-Union Steel Production Space**

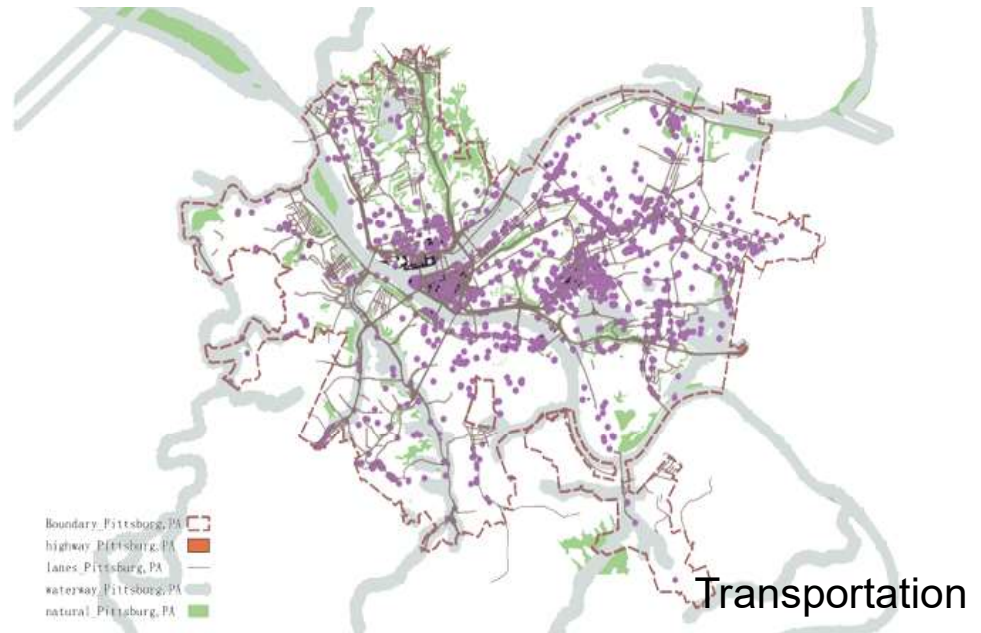
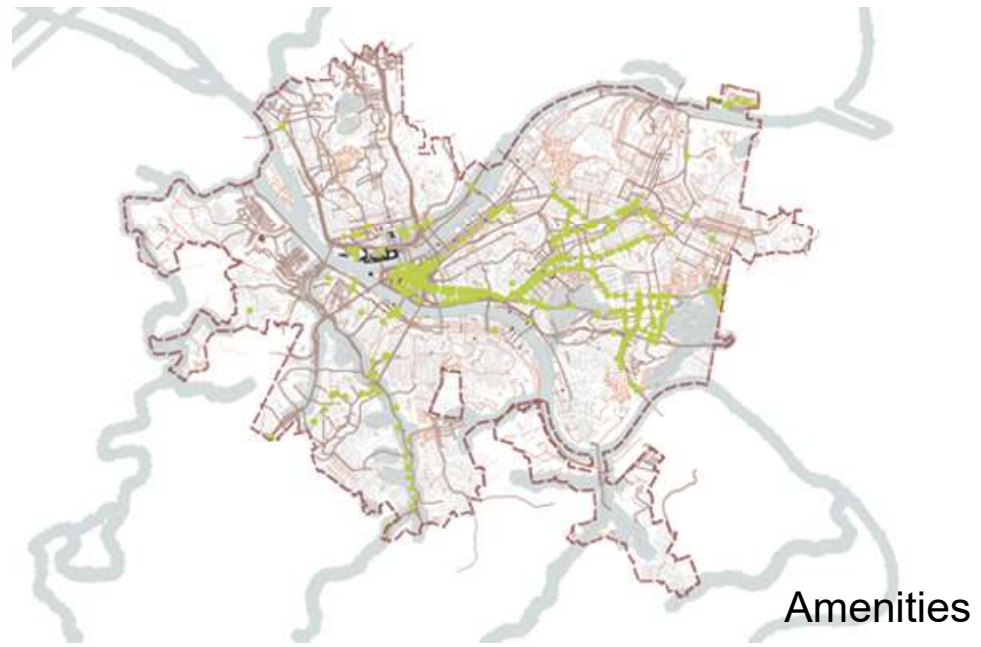


**Post-Union Steel Production Space**

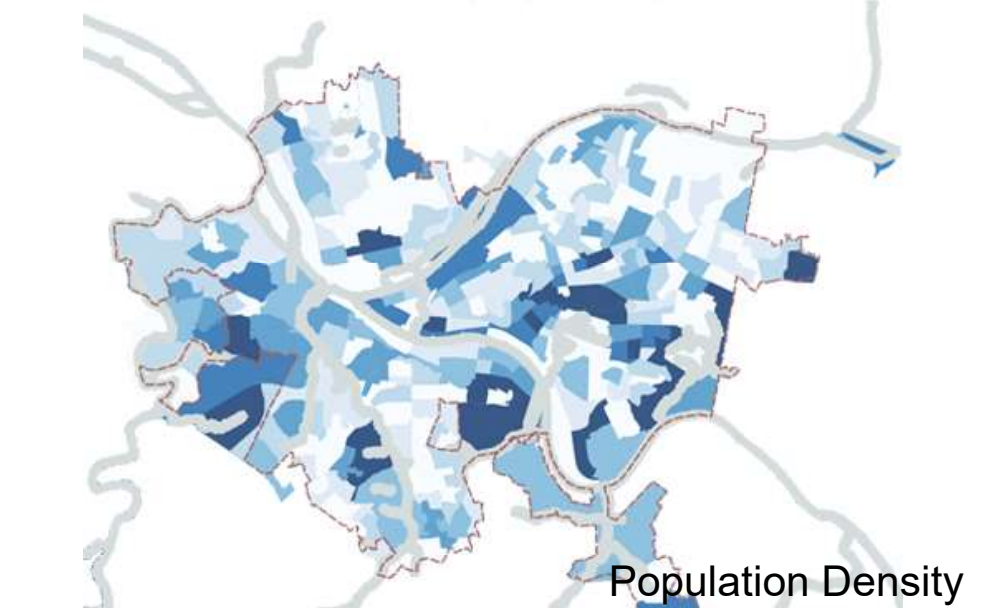


Steelworkers in Pittsburgh labored under harsh conditions in the early days of the industry, facing long hours and hazardous environments. However, through labor unions and strikes, they fought for improved working conditions and rights. Over time, their efforts led to significant advancements in workplace safety, shorter workdays, and better wages. The evolution of labor rights and the establishment of unions played a crucial role.

The idea is to construct two contrasting spaces that depict the working conditions of steelworkers in different eras. The first space will represent the 19th-century steel factories, characterized by dim lighting, large-scale spaces that made workers feel small, and exposure to extreme heat and toxic fumes. The second space will showcase modern steel production facilities, featuring more natural light, comfortable indoor temperatures, and enhanced safety protections. A union hall will serve as a connector between these two spaces

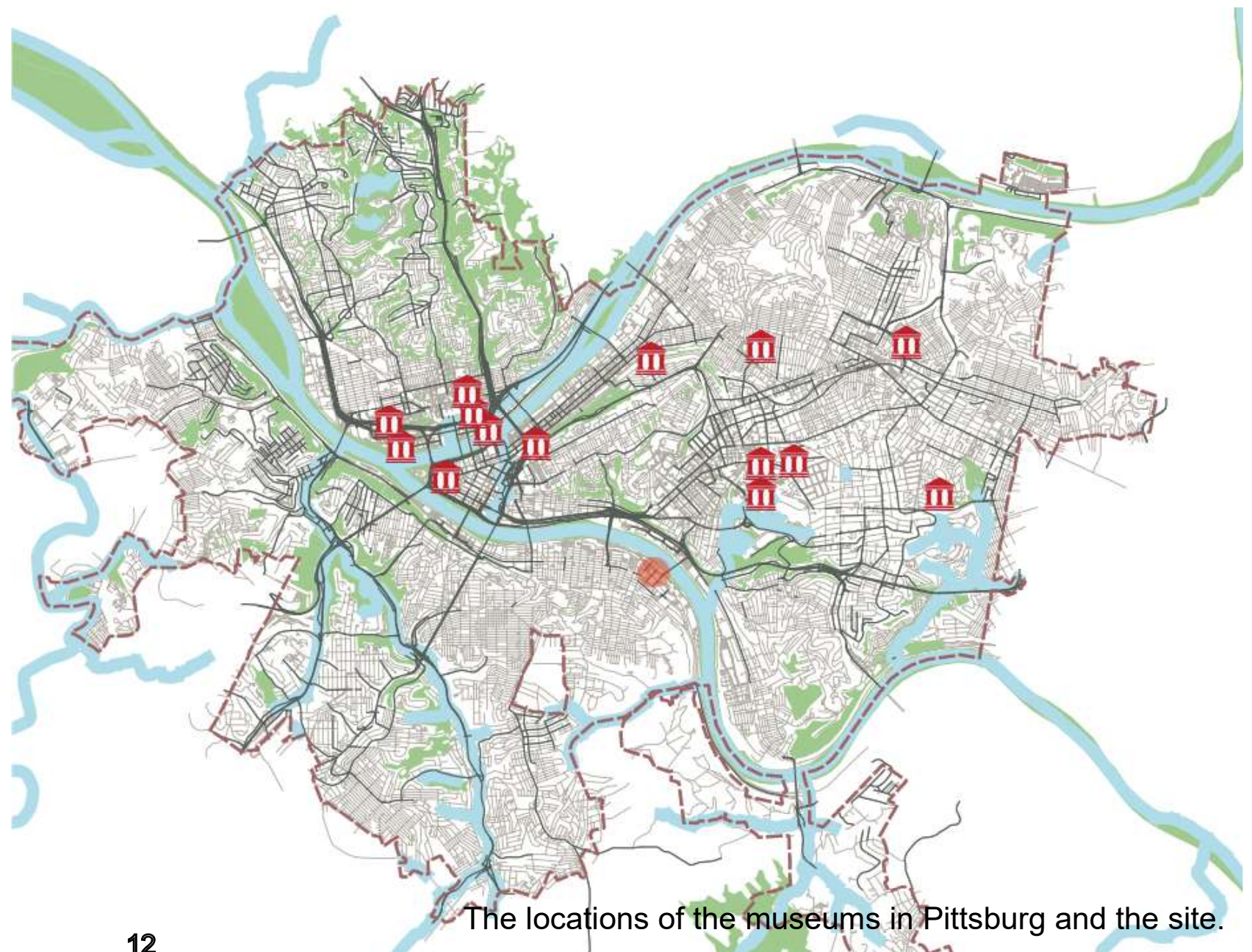


Boundary\_Pittsburg, PA  
 highway\_Pittsburg, PA  
 lanes\_Pittsburg, PA  
 waterway\_Pittsburg, PA  
 natural\_Pittsburg, PA



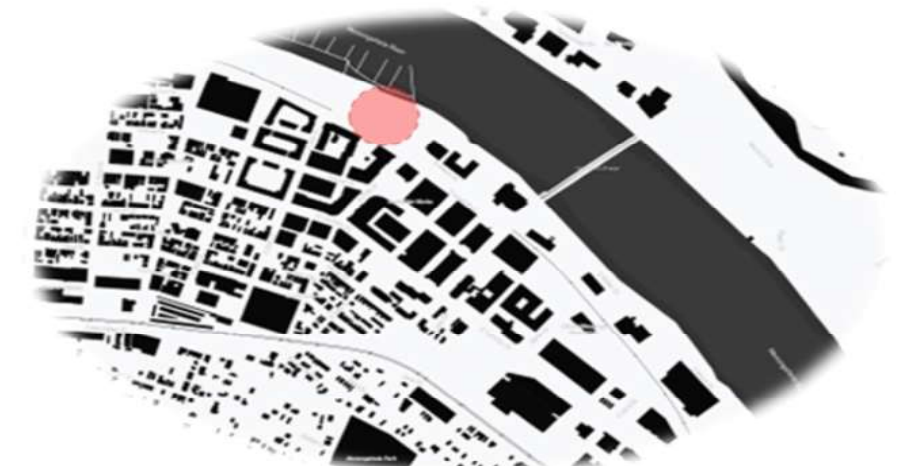
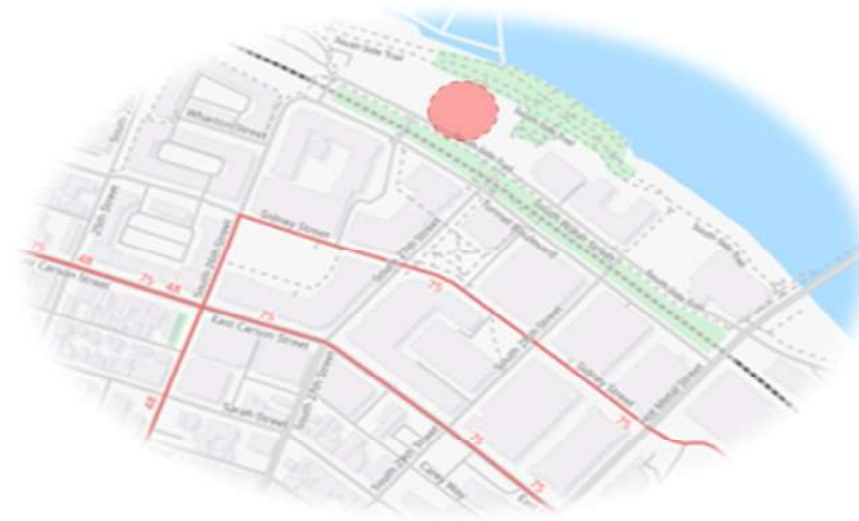
Boundary\_Pittsburg, PA  
 Lanes\_Pittsburg, PA  
 waterway\_Pittsburg, PA  
 natural\_Pittsburg, PA  
 highway\_Pittsburg, PA

# The City of Pittsburg



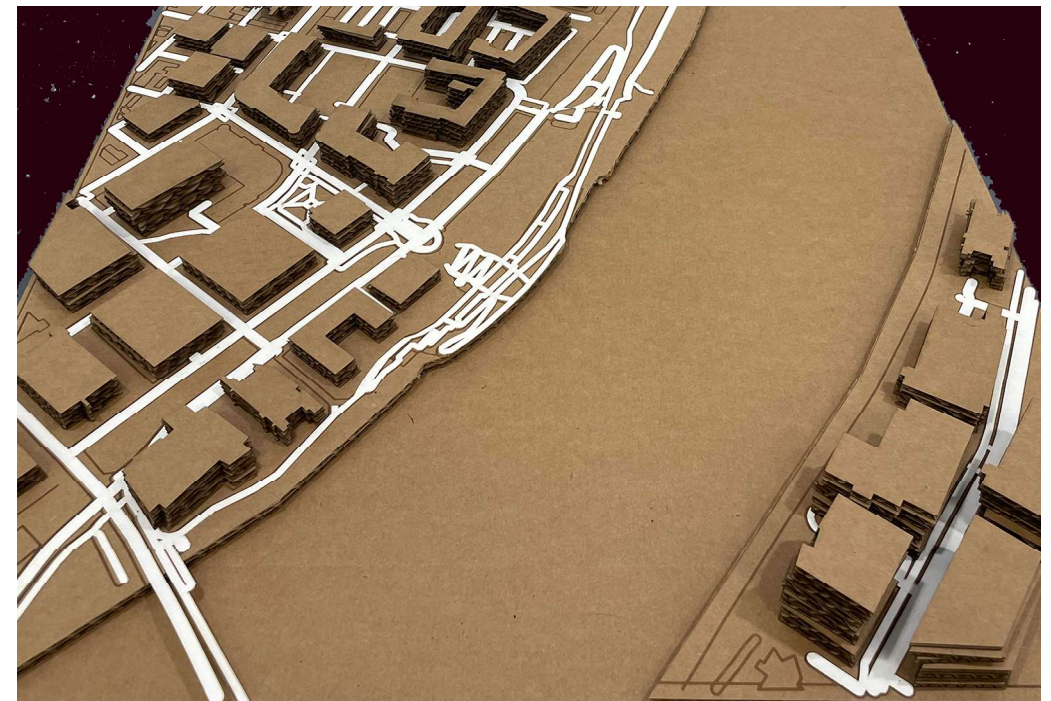
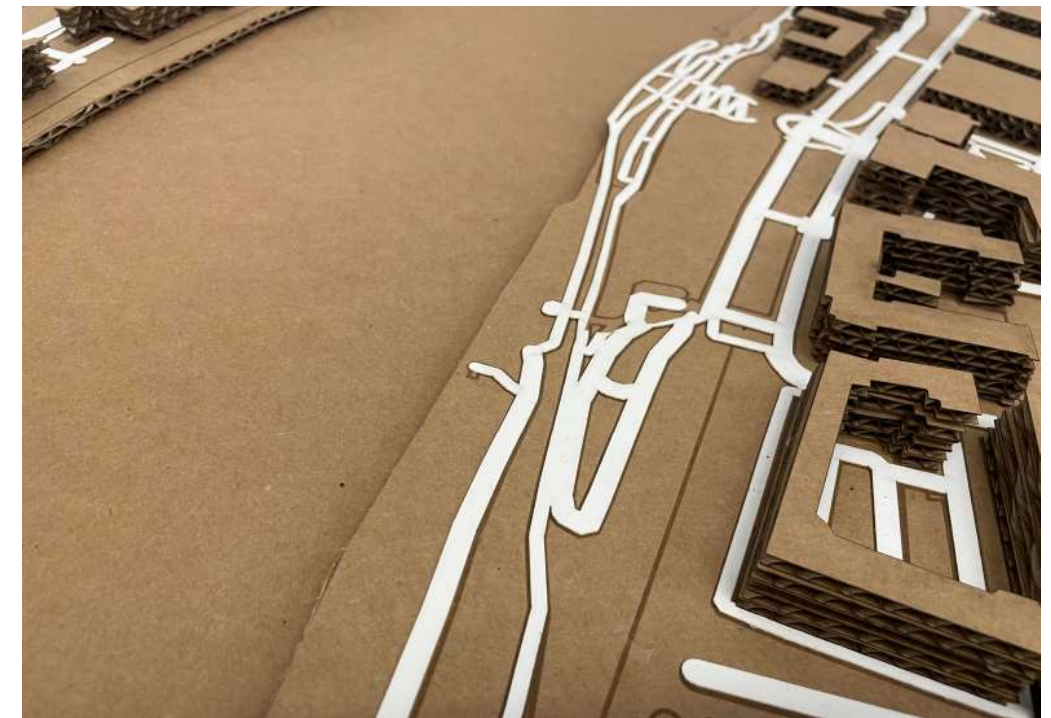
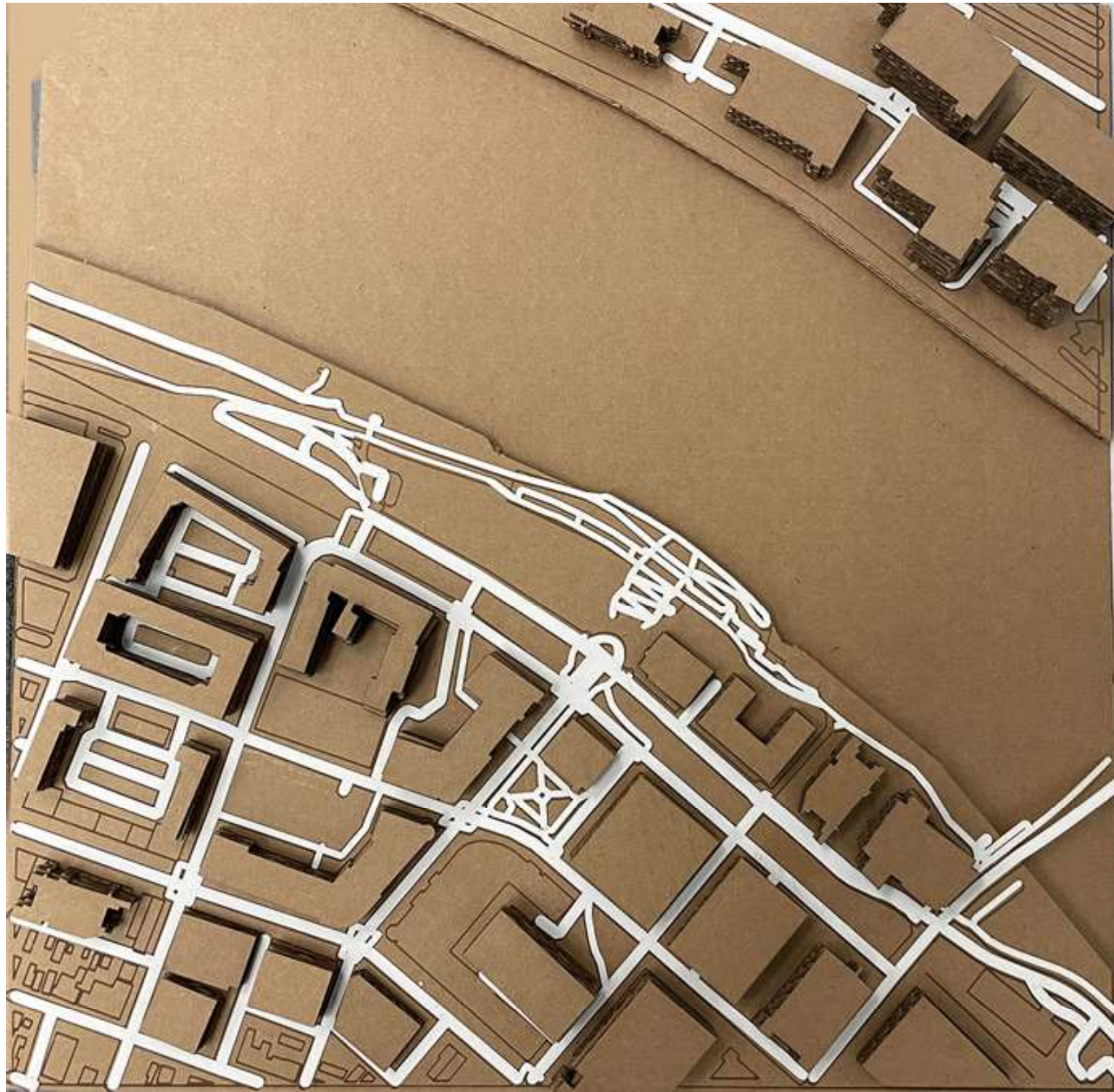
## The choice of the site

Pittsburgh's steel factories were strategically located along the Allegheny, Monongahela, and Ohio rivers. Pittsburgh's steel factories lined the Allegheny, Monongahela, and Ohio rivers. **The South Side Works**, a former steel production area along the river now undergoing renewal, is an ideal site for this project due to its historical significance and traces of its industrial past.



Pittsburgh's steel factories lined the three rivers.

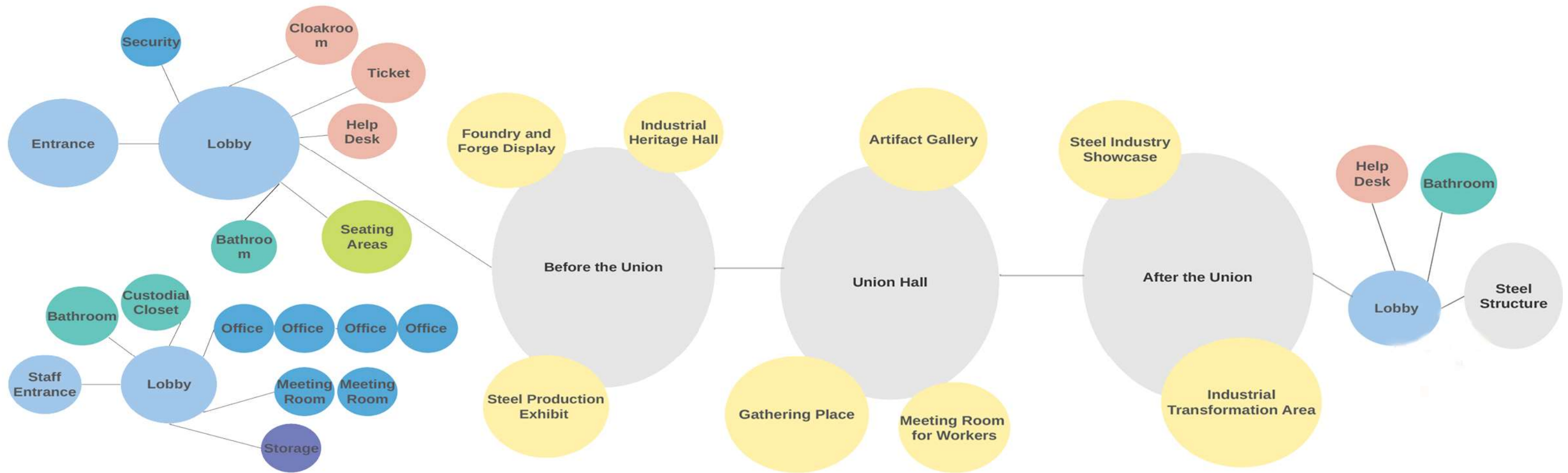
# Site Model



# Program

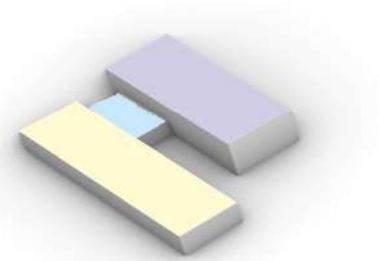
	Items	Component	Quantity	Sub-total Area	Total Area for Subcomponents	Total Area	Comments and Remarks	
Indoor Space	Entrance/Waiting Area, Services	Entry Lobby and Waiting Area	1	400	400		30 person	
		Information Desk	1	100	100			
		Ticketing	1	150	150			
		Security Office	1	90	90		connected to the entrance	
		Large Steel Exhibit	1	100	100		in the lobby	
		Public Toilet (M/F)	2	150	300		4 person each	
		Lounge	1	400	400		20 person	
						1540		
	Administration	Staff Offices	3	300	900			
		Storage	1	200	200			
		Toilet (M/F)	2	70	140			
		Meeting Room	1	400	400			
						1640		
	Steel Production Exhibition	Pre Union	Cast Hall					Main Area/Connected to the entrance
			Blast Furnance	1	1900	1900		A towering structure where raw materials are smelted into molten iron
Rolling Mills			1	200	200			
Forging Equipment			1	300	300		Forging Process and forging equipment	
Ancillary Equipment			1	300	300		Smaller equipment and tools that were crucial to the steelmaking process	
Workers' Tools			2	500	300			
History Gallery			2	600	1200		To educate visitor about the production process	
						4200		
"Union Hall"		Union Hall	1	900	900		Transitional Space	
		Gallery	1	200	200		Evolution of Safety Equipment	
					1100			
Post Union	Gallery of Innovation and Technology	1	300	300		Showcase the evolution of steel production technologies over time		
	Environmental Impact Exhibition	1	300	300		Environmental impact of steel production		
						600		
End of the Visit	Gift Shop	1	500	500				
	Cafe	1	1000	500				
	Public Toilet(M/F)	2	300	600				
	Rest Areas	1	500	500				
	Steel Column	2	100	200		Expressive steel structure at the end of the visit		
	Courtyard	1	3200	3200		Courtyard at the end of the visit		
						2300	Courtyard not included in the total area	
2. Outdoor Space	Exhibition	Sculpture Exhibition	3	200	600		Artistic Use of Steel	
	Rest Areas	Seating Areas	1	800	800		Outdoor seating areas with shading	
						1400		
						4552		
						11380		
						15932		

# Bubble Diagram

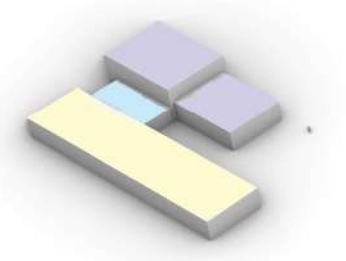


# Massing Study

- Post Union ("New")
- Union Hall
- Pre Union ("Old")



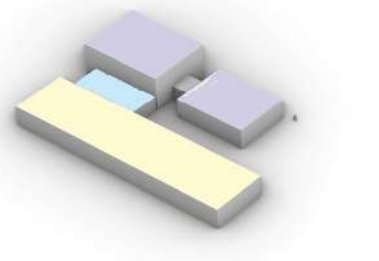
The building is divided into three sections: pre-union, union hall, and post-union. The union hall acts as a transitional space between them.



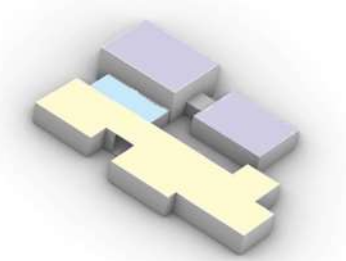
To create a distinct ambiance from the lobby, the pre-union gallery was separated.



The black massing shows a closed-off, inward atmosphere from the pre-union days of the steel museum. The white massing represents openness from the post-union era. The



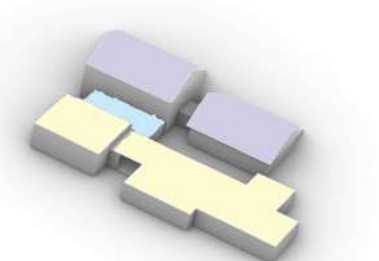
A knuckle space was designed to connect the lobby with the pre-union gallery.



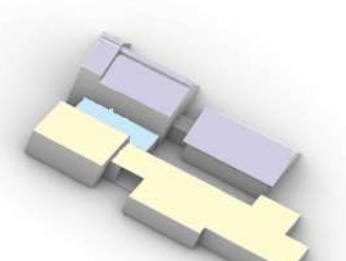
The development and definition of the post-union section were guided by its intended functions, which include creating a more open steel production space for the post-union era, as well as incorporating a café, gift shop, and lobby.



The second model was built upon the first version, with the area designated for the blast furnace having a raised section

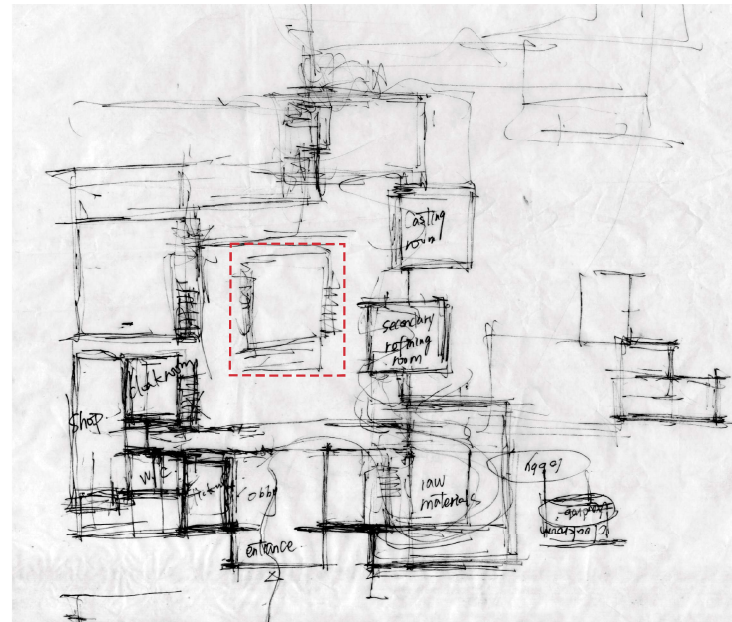


The pre-union section adopts the architectural shape reminiscent of 19th-century steel factory spaces.



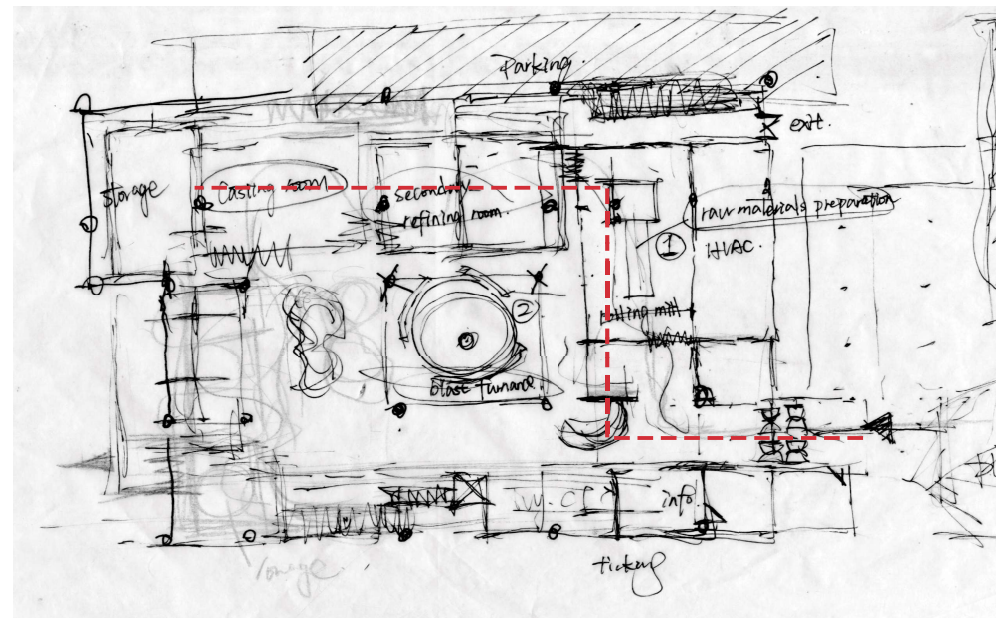
The part where the blast furnace was located was elevated and stand out and grew out of the massing.

# The Iteration of Floor Plan

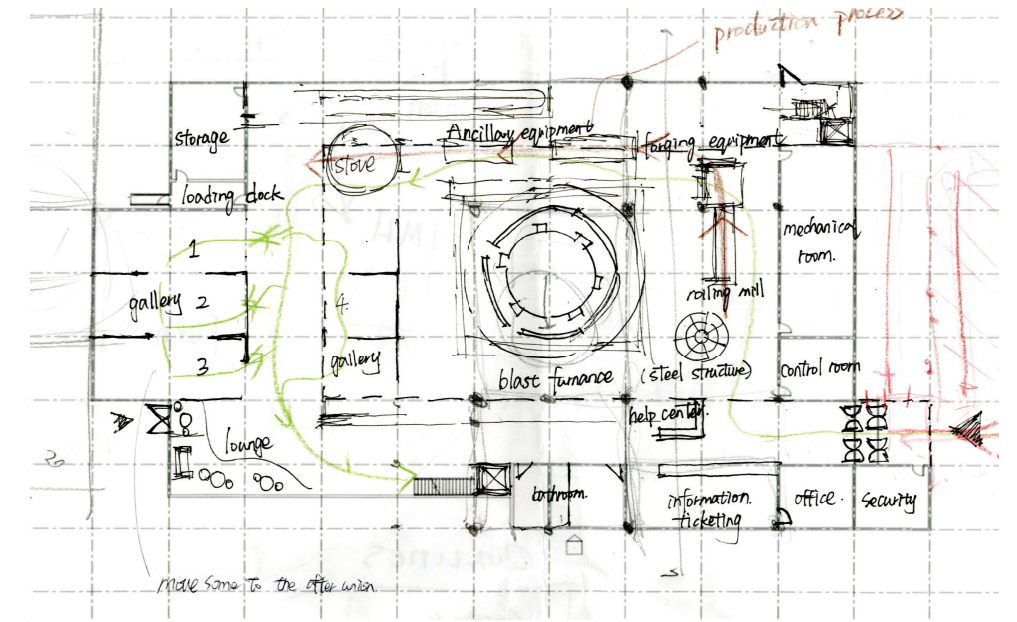


This picture shows the **initial draft** of the floor plan.

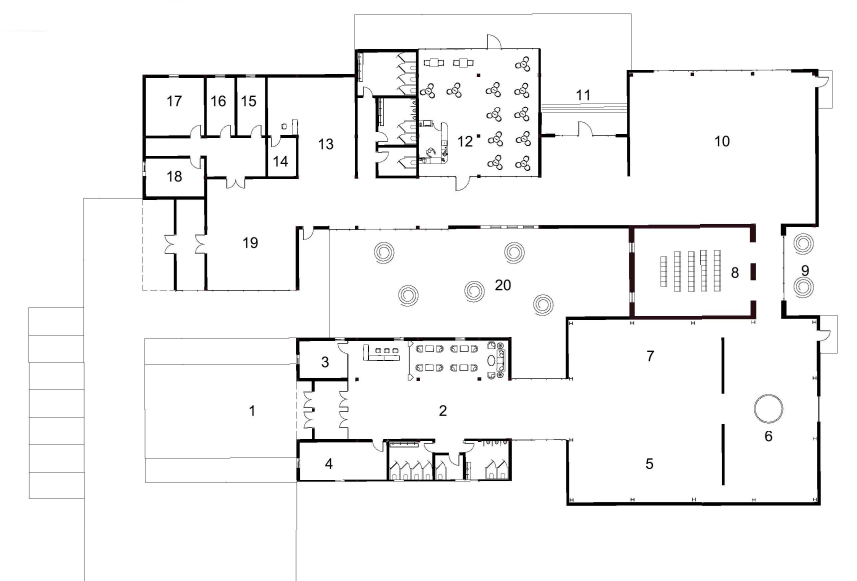
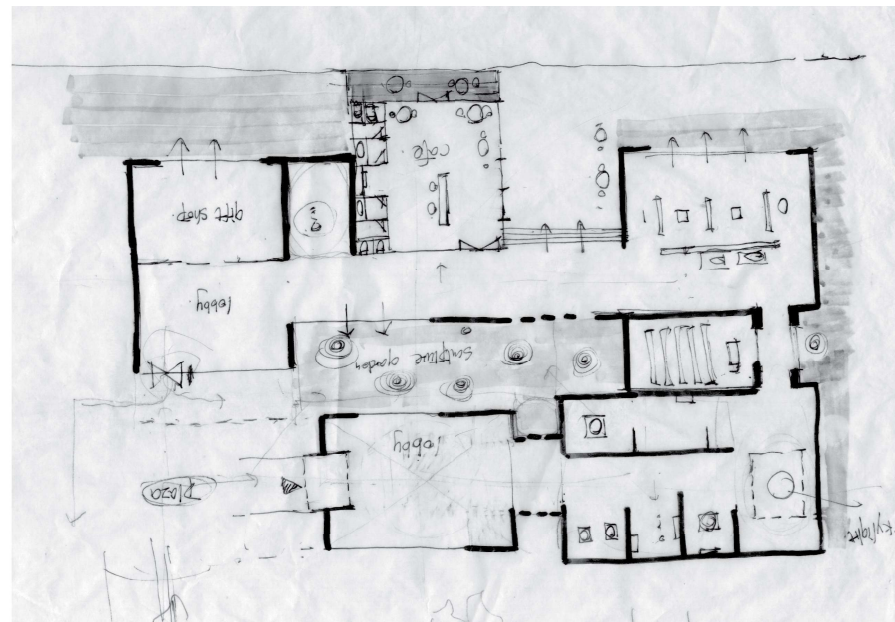
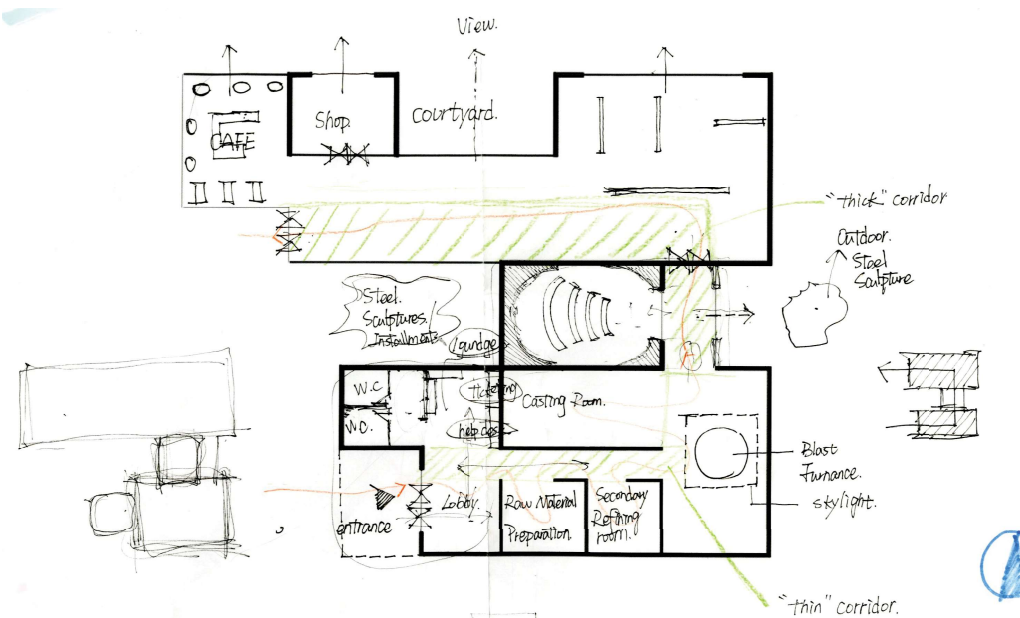
After researching the steel production process during the pre-union era, it was determined that **the furnace should be centrally positioned within both the route and the gallery space**. Additionally, it was discovered that three primary processes are involved in steel production: raw material preparation, secondary refining, and casting. As a result, three distinct rooms have been designed to accommodate these



This version of the plan was developed based on the previous version, with the **furnace positioned at the center of the gallery space** and the dimensions of the gallery space more clearly defined.



In this version, I continued to refine the layout by **further designing the furnace display area and the service space**, which includes ticketing, offices, and storage facilities. Additionally, I hand-drew lines to illustrate the flow within the space. Then I realized that this version presents a significant issue: the furnace is isolated from a series of display rooms. This could result in visitors potentially skipping over the most important object in the museum.



In this revised version, major changes were made.

Taking into account the elongated **shape of the site** and the conceptual divisions (pre-union, union hall, and post-union), the floor plan now consists of **three sections**. the post -union part faces the river and is open to the view.

In this iteration, a knuckle space was incorporated to link the lobby with the pre-union gallery. Additionally, a sculpture garden was introduced, serving as the culmination of the visitor's journey. The width of the hallway was adjusted to ensure that visitors encounter distinct atmospheres as they transition between different spaces.

The floor plan was finalized with several modifications. The office space is now separated from the main gallery area. Furthermore, adjustments were made to the layout of the indoor space within the pre-union gallery. An opening was strategically designed to allow natural light in from behind of the furnance, serving both as a source of illumination and as a guide for visitors upon entering the building.



- 1 Entrance
- 2 Lobby
- 3 Security
- 4 Office
- 5 Exhibition
- 6 Blast Furnace
- 7 Exhibition
- 8 Union Hall
- 9 Steel Sculpture
- 10 "Post Union" Gallery
- 11 Yard
- 12 Cafe
- 13 Gift Shop
- 14 Storage
- 15 Office
- 16 Office
- 17 Meeting Room
- 18 Office
- 19 Lobby
- 20 Sculpture Garden





Post Union ("New")



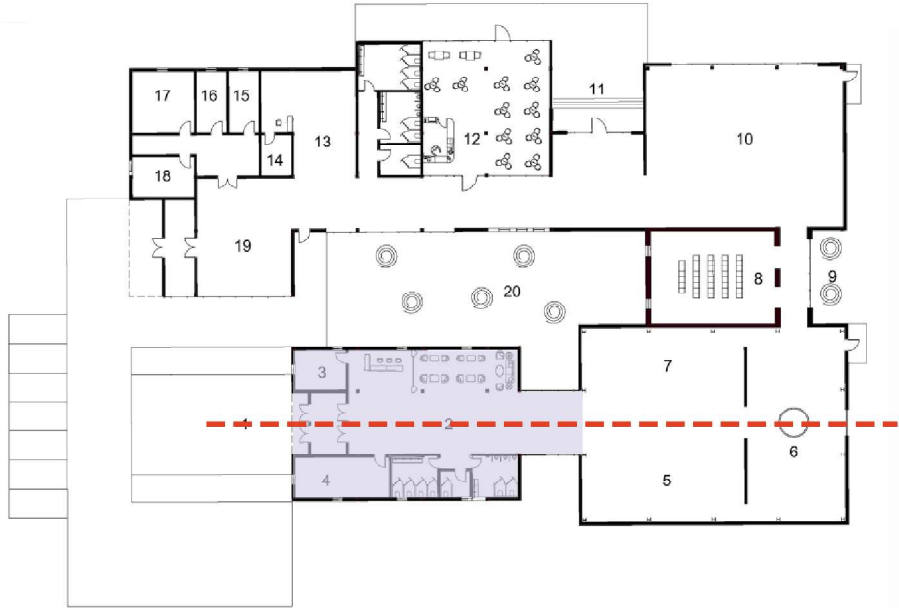
Union Hall



Pre Union ("Old")



# Sequential Spaces-Lobby

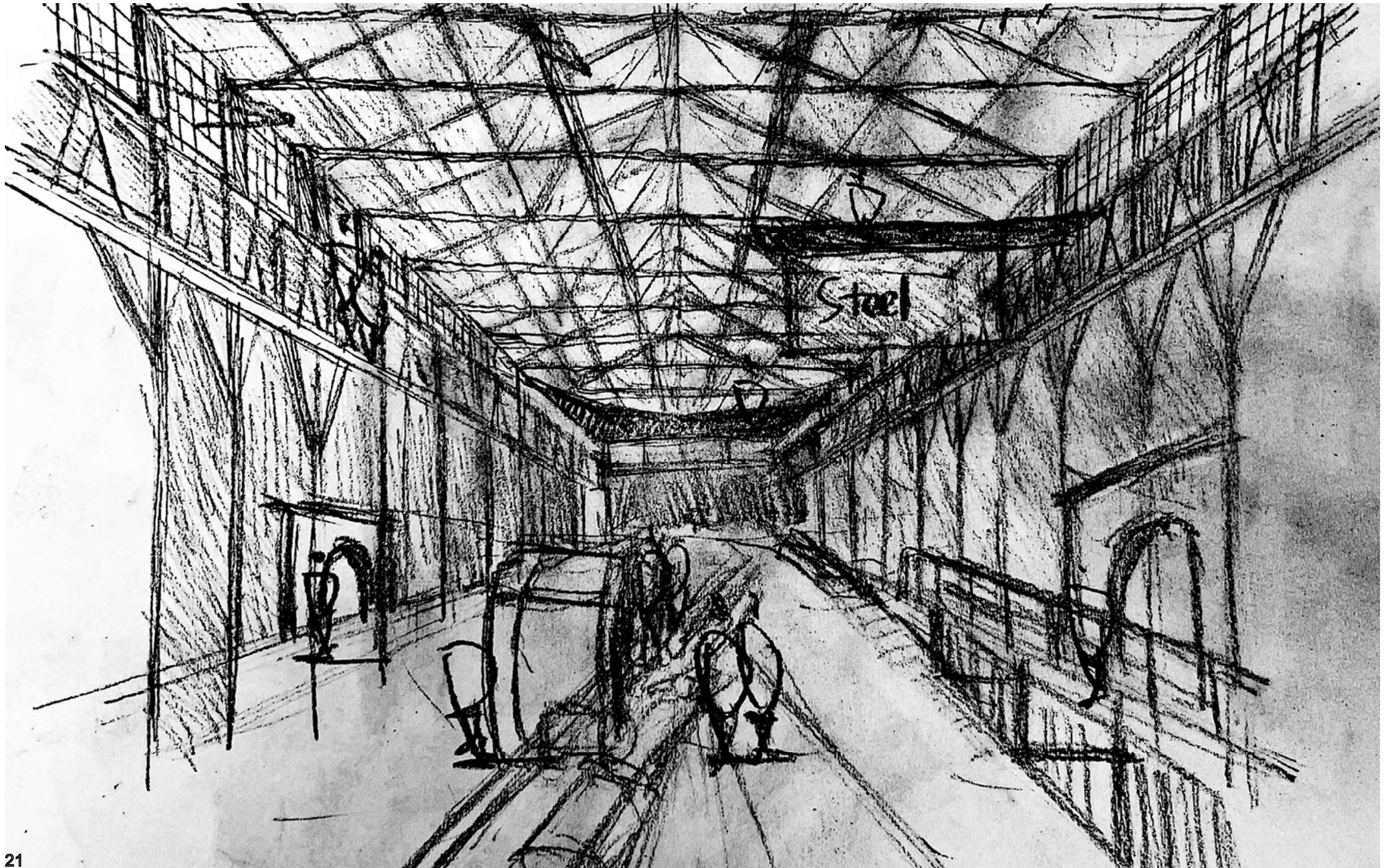






# Pre-Union Steel Production Space





Stable Diffusion Generation- Pre Union Atmosphere









“Union Hall”

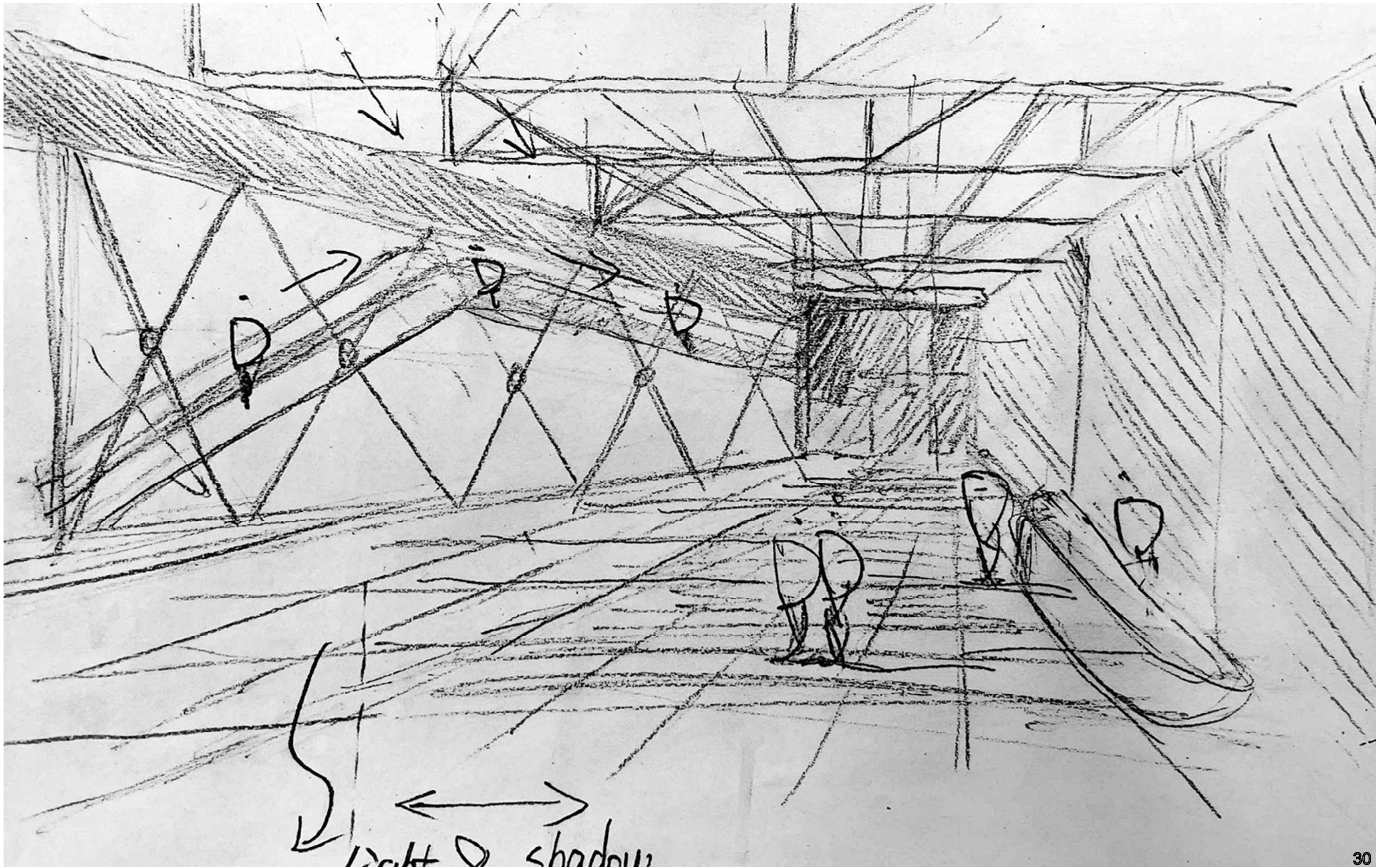






# Post Union Steel Production Space















East Elevation



East Section



South Elevation



South Section

## Material Selection: Corten Steel

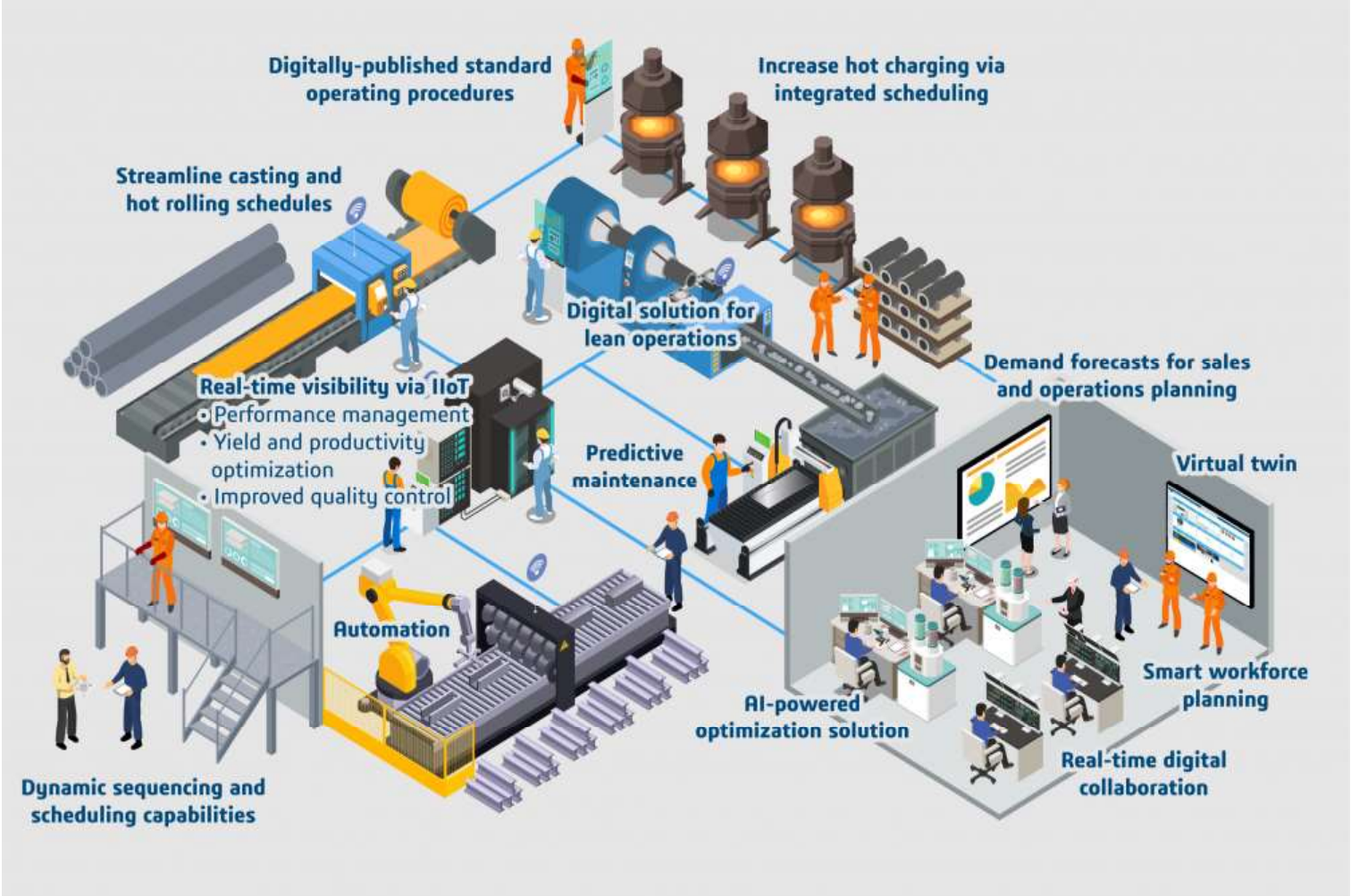
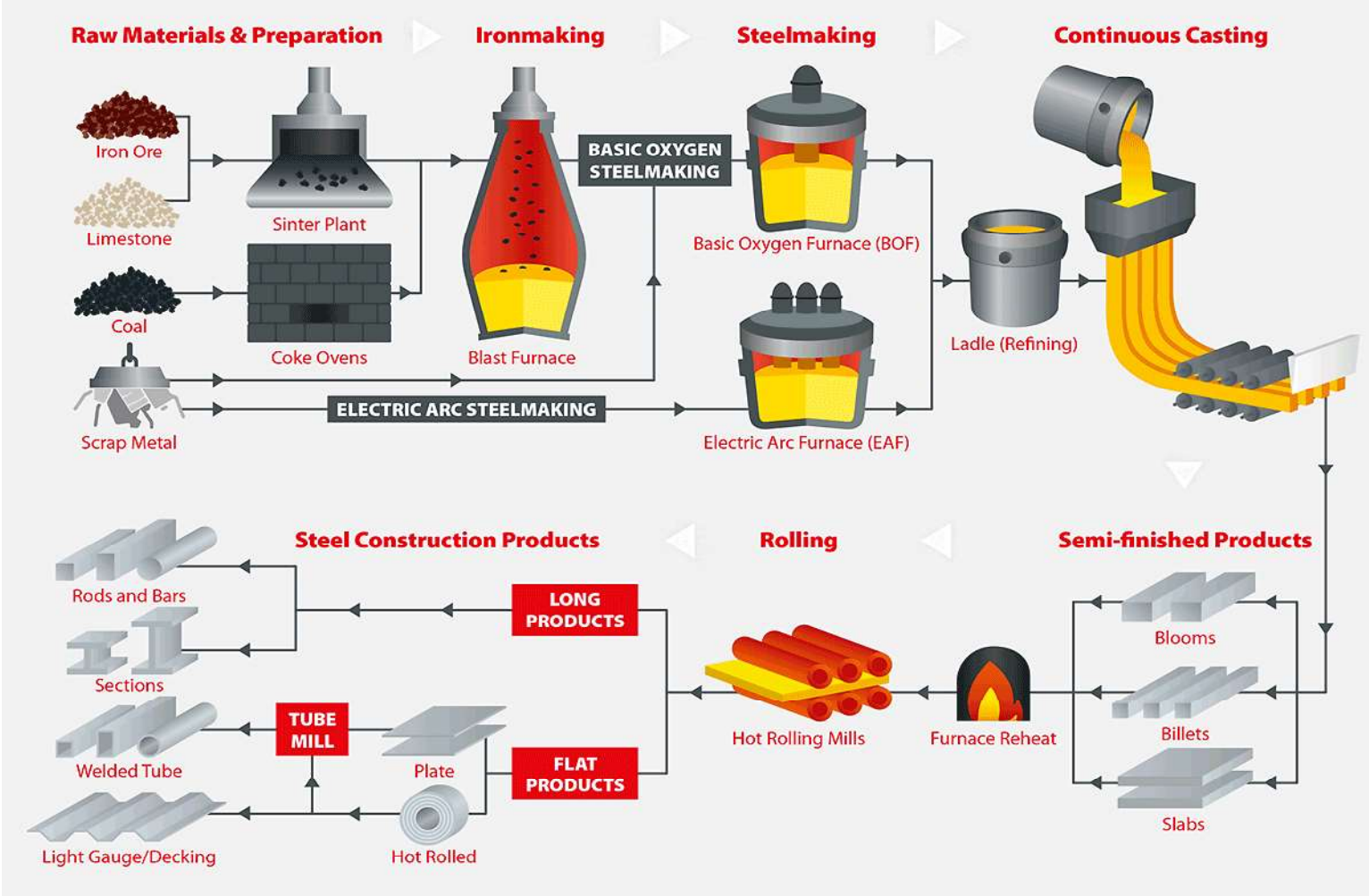


Corten steel, or weathering steel, is strong due to its high tensile strength and natural corrosion resistance. It forms a protective rust layer that prevents further corrosion.

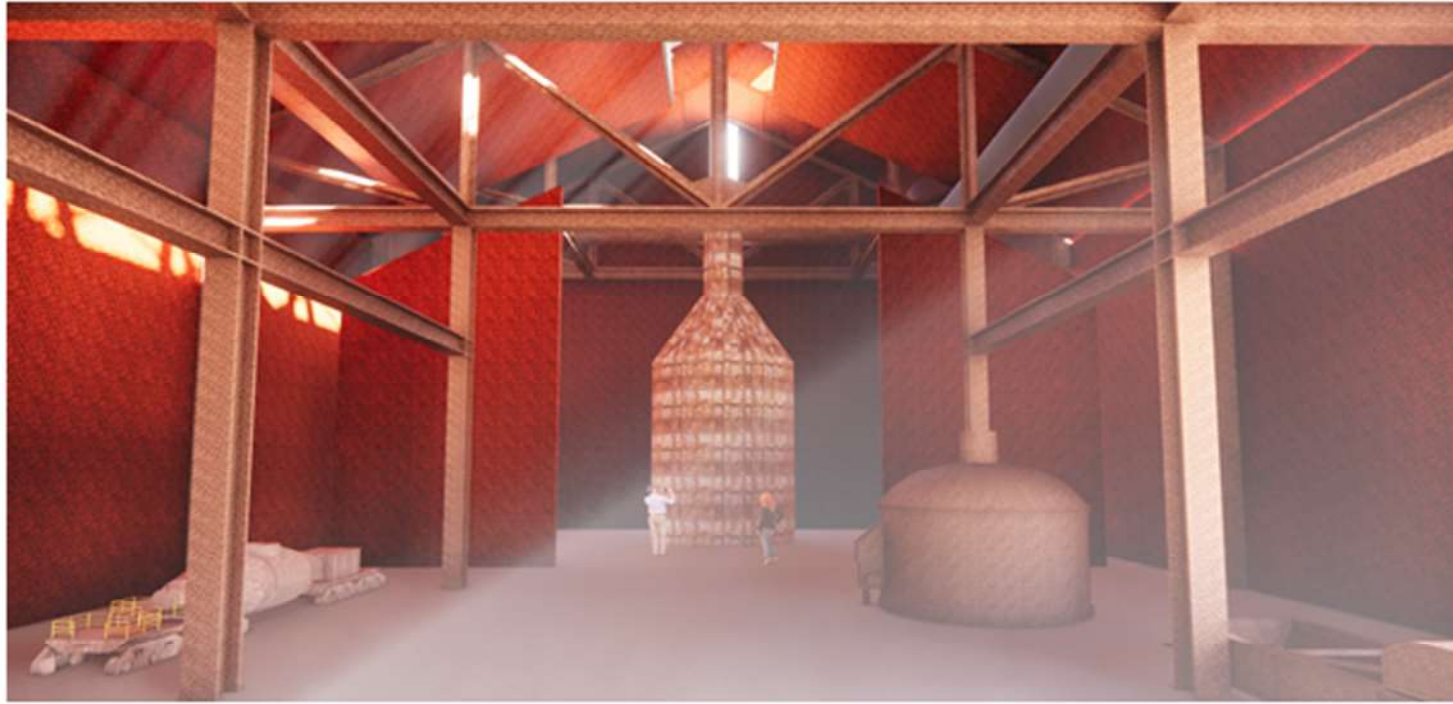
Rick Joy uses Corten steel for its weather resistance and unique aesthetic. Successful examples include the Desert Nomad House.

Using corten steel panels for the facade of the pre-union part of the museum achieves the desired fusion of timeless rustic charm with sleek modern design.

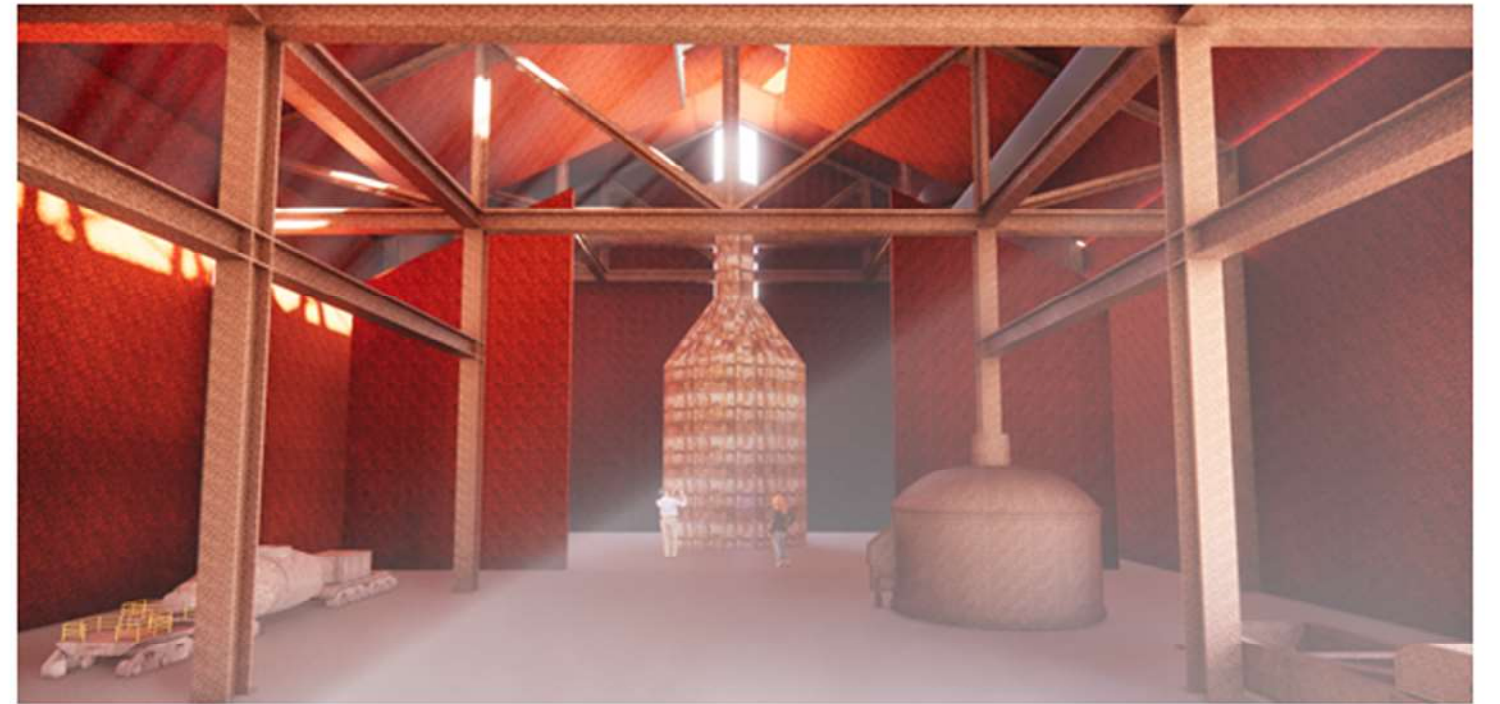
# Steel Production Technology



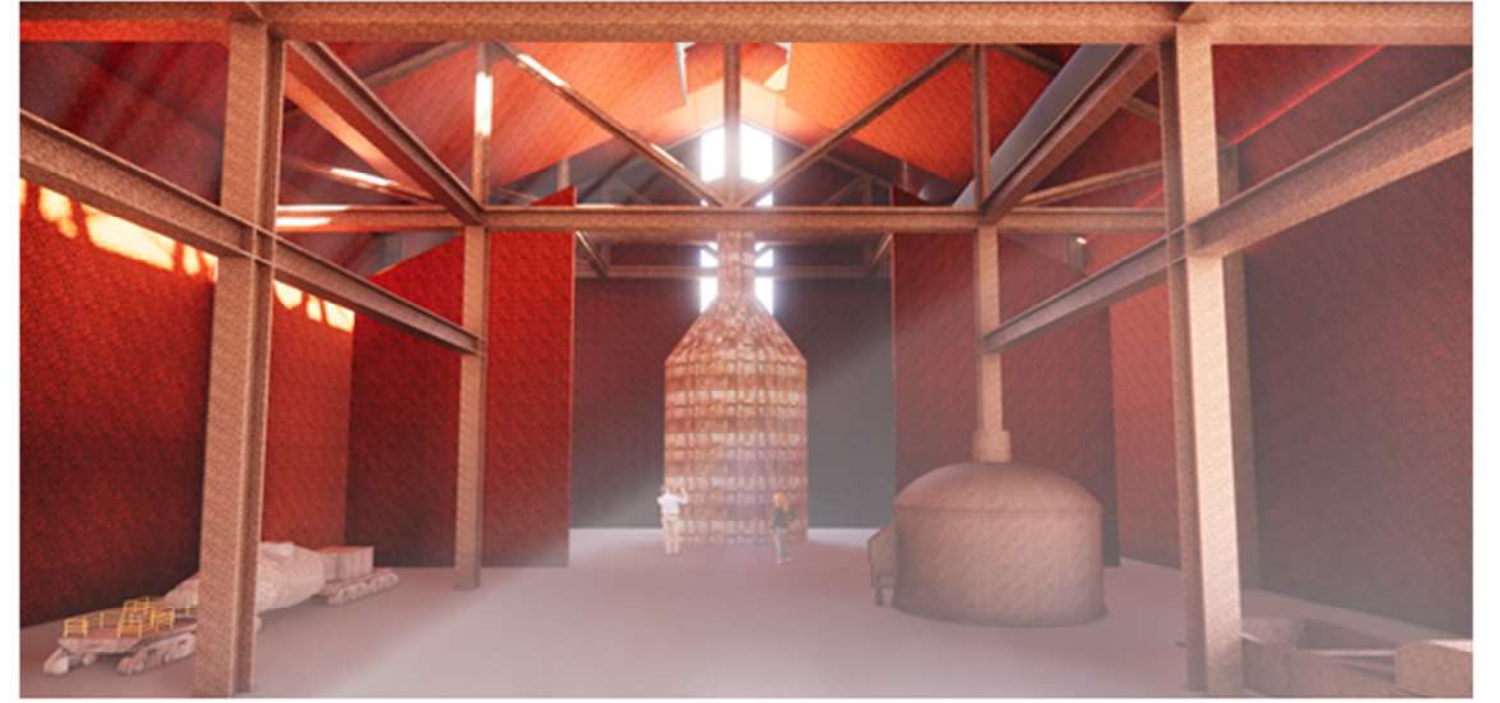
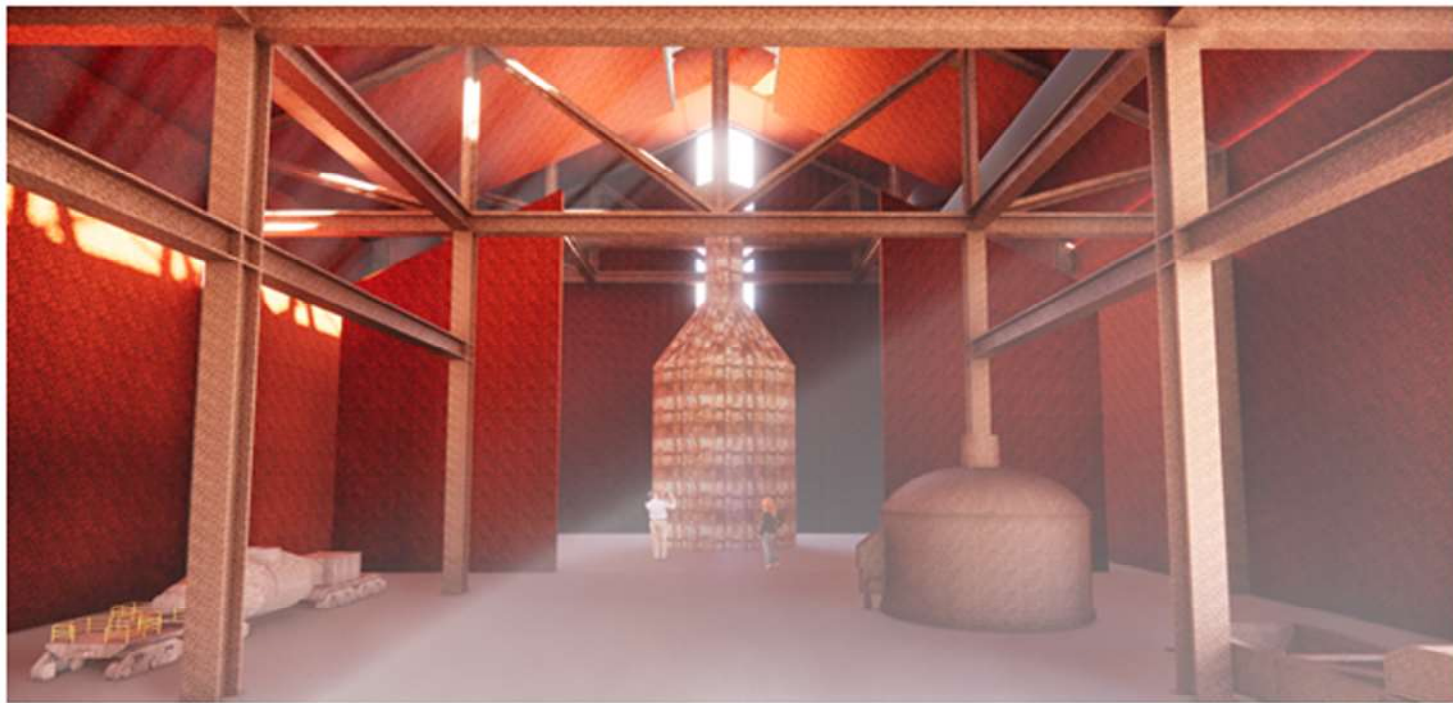
# The Width of the Opening



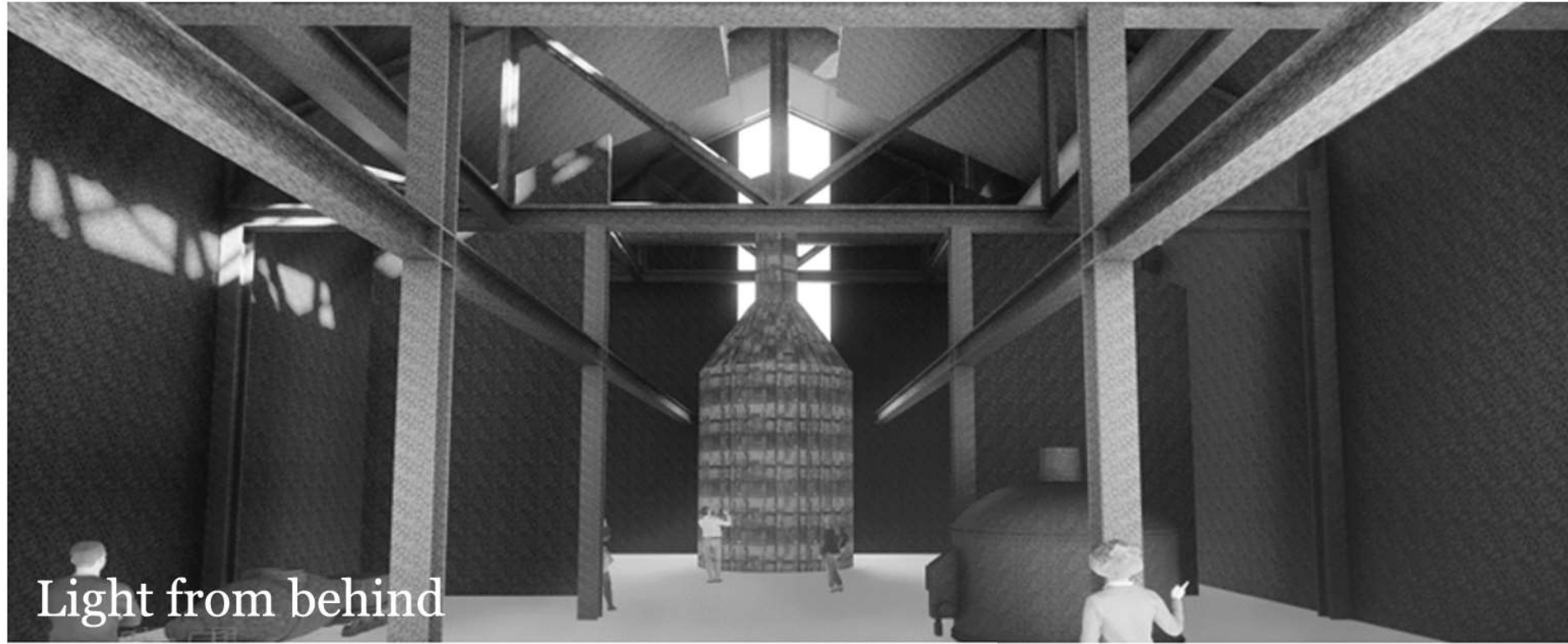
3.2 feet  
6.5 feet



5 feet  
8 feet



# A Study of the Light Near the Furnance



# Conclusion

By showcasing the sequential spaces in this building, this thesis seeks to explore how the sequence of space, along with materials, steel construction, light, and scale, shape architectural spaces and atmosphere in the building, revealing dimensions beyond themselves.

Throughout the thesis journey, I learned some major things:

Firstly, the importance of continually asking questions during the design process. I have learned to consistently inquire myself about design ideas and decisions: What does this museum want to be? What purpose does each room serve? Which specific materials align with the overarching narrative? Additionally, conducting thorough studies and comparisons before making decisions has become integral to my approach.

Secondly, I came to understand that everything within the building must revolve around the central proposition of my thesis during its development. After establishing the core concept of constructing two distinct steel production spaces to unveil the harsh working conditions of 18th-century steelworkers and contrasting the pre-union and post-union eras, I realized the significance of staying true to this driving idea when making design decisions.

What's more, I learned how to further develop the thesis by envisioning walking through the building and contemplating aspects such as scale, lighting, and materials to enhance visitors' experiences. Revisiting previous work has proven useful in refining the design as well.

Moving forward, I recognize the importance of prioritizing time management, particularly when undertaking significant projects with lengthy timelines. It is crucial to remain anchored to the core proposition and to conscientiously consider every decision made during the design process.



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