SMART SHARED MOBILITY
RAILWAY STATION DESIGN

2024/2025 Complex Project
Qianchen YAN 6029957
A010 Research Plan
Milan Central Railway Station

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students
Qianchen Yan

chair
Kees Kaan

CP coordinator
Manuela Triggianese

lab coordinator
Hrvoje Smidihen

group tutors
Olindo Caso
Maruli Heijman

email
infocpstudios@gmail.com

Instagram
https://www.instagram.com/
cp.complexprojects/

website
https://www.tudelft.nl/bk/over-faculteit/
afdelingen/architecture/organisatie/disciplines/
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facebook
https://www.facebook.com/CP_Complex-
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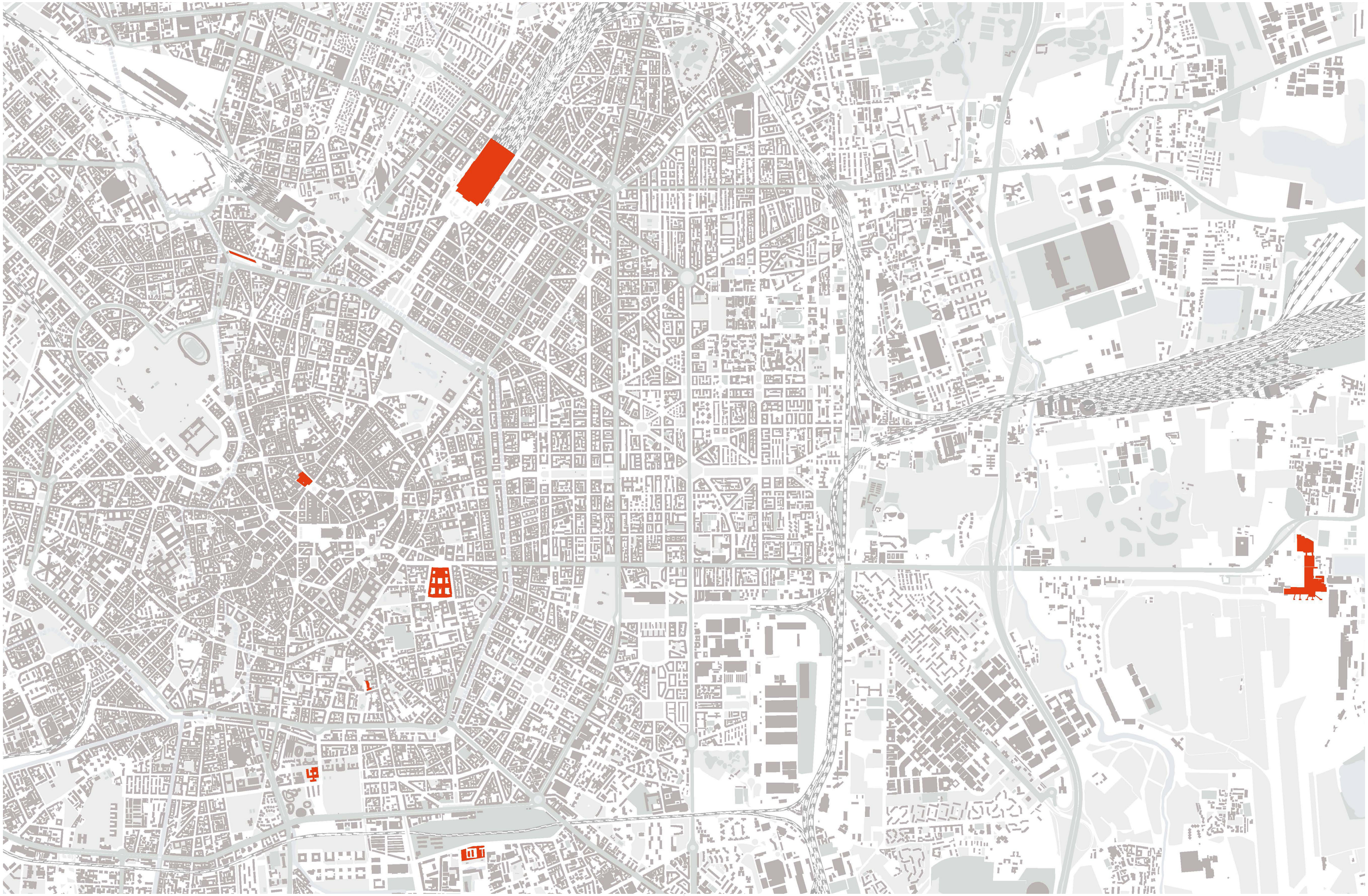
Bodies and Building Milan
Material



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INTRODUCTION

01

1.1 Thesis Topic

Train stations have long served as gateways to cities, often shaping the first impression visitors have of a place. Over nearly two centuries of development, advancements in technology and the diversification of travel modes have transformed train stations from simple, single-function facilities into sophisticated, multimodal hubs. Today, they are no longer just points of entry and departure for trains but integrated complexes that seamlessly connect various modes of transportation, including metros, buses, and taxis. Moreover, modern train stations have expanded their role by incorporating extensive commercial and public spaces. These areas offer visitors places for shopping, leisure, and social interaction, establishing train stations as vital and multifunctional public spaces at the heart of urban life.

This thesis focuses on how train station design should adapt to the rapid advancements in smart technologies and the growing prevalence of shared mobility (Figure1). Traditional train station designs, often rooted in the past social context, may be no longer suitable for the demands of the modern era. Therefore, the goal of this train station design is to transform it into an smart shared mobility hub, which will effectively integrate various modes of transport, optimize travel efficiency, and provide seamless connectivity. Beyond serving as a transit point, the station will also function as a vibrant public space, offering services and activities that cater to both travelers and local residents, making it both a transportation node and a dynamic urban destination.

Figure 1: The vision for the future Milan Central Railway Station

1.2 Problem Statement

Milan is a city characterized by high mobility, with approximately 5.3 million trips taking place daily between the city and its surrounding areas. Of these, around 850,000 people enter Milan, while 270,000 leave (EU Urban Mobility Observatory 2018). In terms of transportation modes, 57% of travelers utilize public transit, including trains and airplanes, while 40% opt for private transportation, comprising private cars (30%), motorcycles (7%), and bicycles (3%).

Milan residents show a stronger preference for private transportation compared to those in other major cities. This inclination is largely driven by ongoing issues within the public transit system, including staff strikes, train delays, and cancellations. Moreover, overcrowding at train stations during peak hours, alongside some aging station facilities due to early construction. As a result, Milan's private car ownership rate remains notably high (Figure 2), exceeding that of other European metropolises such as Paris, Berlin, and London, and even doubling London's rate (Eurostat 2023).

The heavy reliance on private transportation in Milan has resulted in significant energy and environmental challenges. The widespread use of private cars exacerbates traffic congestion, leading to increased time and energy waste. Noise pollution from car horns negatively impacts residents' mental health, while the extensive use of surface parking occupies valuable urban space. Additionally, high levels of vehicle emissions, coupled with poor air circulation, have made Milan one of the European cities with the highest concentrations of particulate matter (European Environment Agency 2024), creating serious air quality issues.

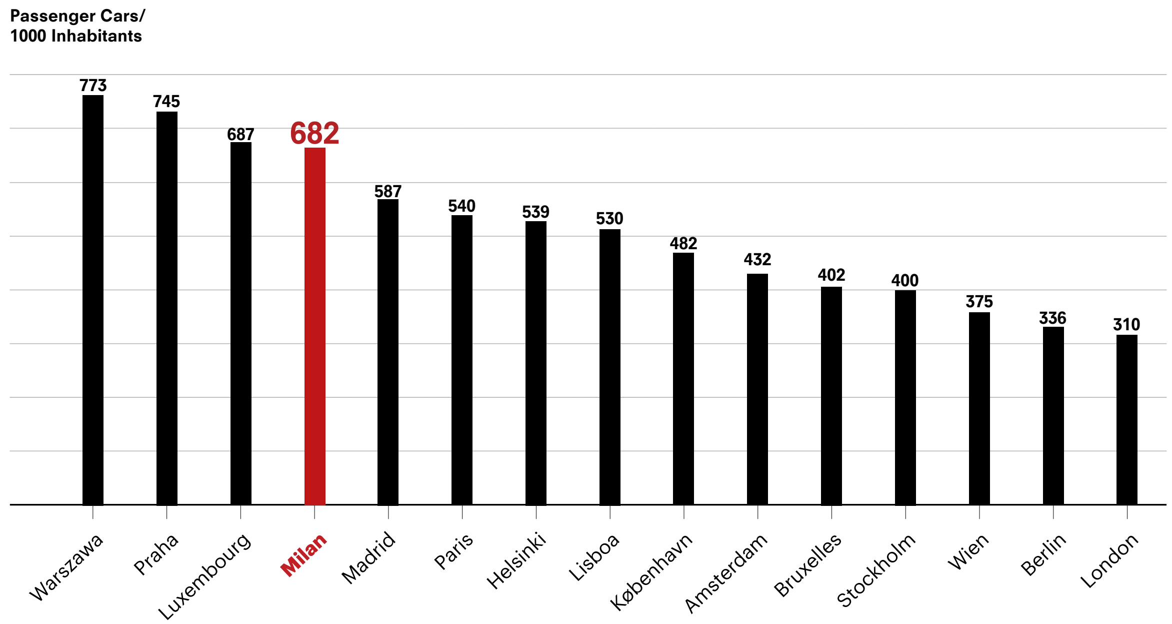


Figure 2: High Rate of Car Ownership in Milan

Facing Milan's severe traffic conditions, the municipal government is actively promoting smart shared mobility (EU Urban Mobility Observatory, 2024). Looking back at the urban transportation development since 1881 (Figure 3): in 1893, Milan opened its first tram line; in 1905, buses were introduced; later, electric trains gradually replaced steam trains. In 1966, Milan established its first metro line. Since 2015, shared mobility options such as bike-sharing and car-sharing have been gradually introduced, with multiple stations set up across the city (Chitti, 2020).

Today, Milan's transportation network has evolved into a diverse system comprising trains, metro, trams, buses, road infrastructure, and micro-mobility options. However, in contrast to the rapid development of the transportation system, Milan Central Station, built in 1931, has largely retainedits original state, with only limited updates to its facilities. As a key hub for various transportation modes in the city, Milan Central Station urgently needs renovation to better support the future development of smart and shared mobility solutions.

Therefore, my research question is:

How can Milan Central Station become a transportation hub, better support the development of smart shared mobilities in the future?

1. Definition: What is smart shared mobility?
2. Function: How can railway station design optimize space and function to support future smart shared mobility?
3. Circulation: How should passenger flow be planned to improve efficicency?
4. Construction: How to enable railway stations to reserve flexible space and structure for future long-term development and emergencies through scalable design?
5. Form: How can the new project express Milan's identity through its exterior façade and internal platform design?

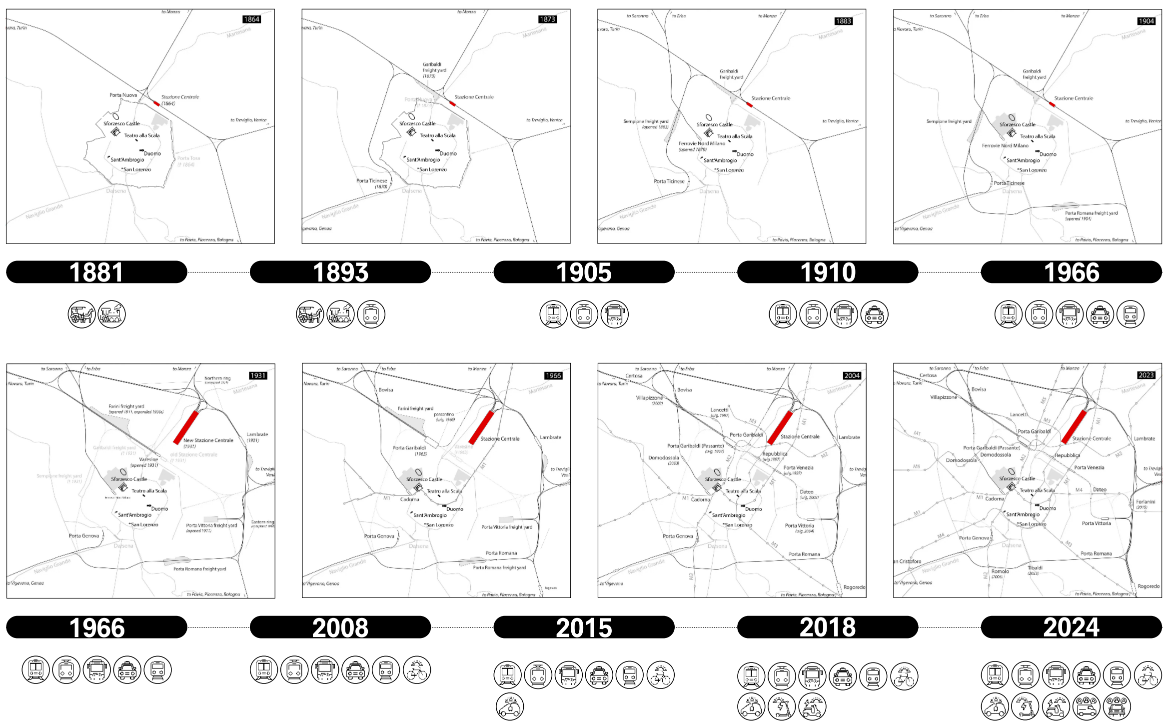


Figure 3: Urban Transportation Development since 1881

1.3 Research Question

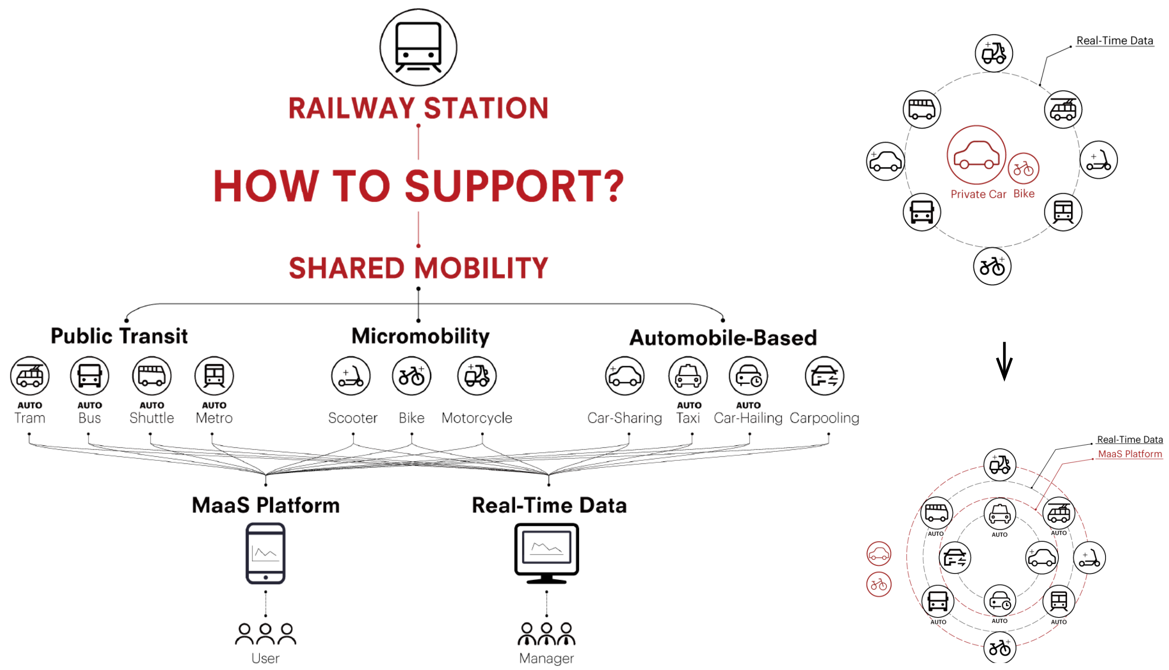


Figure 4: Milan's transportation system in the future

Shared mobility, as defined by Shared-Use Mobility Center, is classified into four primary categories: public transit (including trams, buses, and metros), micromobility (including scooters, bicycles, and motorcycles)and automobile-based services (including car-sharing services and on-demand options like taxis and car-hailing) (Julia Parzen 2015). These initiatives aim to reduce dependence on private cars and ease urban traffic congestion.

Smart mobility encompasses three key aspects:
Autonomous electric vehicles: The introduction of fleets of driverless, shared autonomous vehicles enhances an efficient and high-capacity public transport network. (Yap 2016) Additionally, the widespread adoption of smart charging facilities makes the transportation system more convenient. (Martinez and Viegas 2017)

Real-time data analytics for management: For administrators, a centralized data control center can be designed to monitor and analyze real-time data from all mobilities and hub facilities. This helps optimize traffic flow, allocate resources efficiently, and improve passenger services.

User-centric MaaS systems: For users, Mobility as a Service (MaaS) platforms integrate multiple transportation options into a single app, enabling seamless trip planning, booking, and payment.(Sofia 2022)

In conclusion, Milan's current transportation system is dominated by private cars, with other modes of transport independently operated by their respective providers, lacking effective coordination. However, in the future, Milan's transportation system is expected to evolve into one centered around shared mobility, interconnected through an integrated smart system and centrally managed by a unified control center, creating a more efficient, smart, and sustainable transportation network (Figure 4).Ultimately, my design ambition is to transform Milan Central Station into a smart shared mobility hub to support this vision (Figure 5).

Figure 5: Ambition

RESEARCH FRAMEWORK

02

2.1 Theoretical Framework:

Background: This study first explores the evolution of European train station design along a historical timeline, analyzing it in conjunction with changes in urban transportation development. This perspective provides valuable insights into the role of train stations within the city and their potential future directions. By reviewing the dynamic interaction between mobilities and architectural design, the research offers both historical and contemporary foundations for re-evaluating and redesigning train stations.

Problem Statement: Most major train stations in Europe were designed within the historical context of their construction, primarily serving the railway system and transportation needs of that era. For example, Milan Central Station, built in 1931, lacks seamless integration with other mobilitie, like taxi,car-hailing and shared micromobilities . As a result, a vast amount of surrounding land has been allocated to parking lots and traffic infrastructure, creating a space that is busy yet inefficient for pedestrian movement. With the rapid development of smart shared mobility, Milan Central Station now faces an urgent need for modernization—both to accommodate the future trends of smart shared mobilities development and to optimize urban land use efficiency.

Concept: The design of future train stations must be guided by two fundamental principles: Shared Mobility and Smart Mobility, which will significantly influence architectural planning and spatial organization. Integrating shared mobility requires dedicated spaces for shared transportation services, ensuring seamless vehicle access and efficient transfers. Minimizing walking distances between different mobility options and equipping stations with well-designed shared service facilities will enhance user convenience and accessibility. Simultaneously, smart parking solutions will play a crucial role in optimizing station functionality. The implementation of smart mechanized automated parking systems will reduce parking time while minimizing the spatial footprint of human-vehicle interactions. Additionally, the use of modular and prefabricated technologies will allow for a flexible and standardized parking space design, maximizing spatial efficiency and unlocking new possibilities for architectural layout and long-term adaptability.

Hypothesis: If future railway stations are designed as smart shared mobility hubs, where all transportation modes and processes are managed by a unified control center, they will function as highly efficient, integrated mobility nodes. Such a design would seamlessly connect various transportation modes, minimizing transfer times, reducing walking distances, and significantly improving transfer efficiency. Additionally, as key urban public spaces, these stations would optimize surrounding land use, creating more green areas and pedestrian-friendly spaces. This transformation would not only enhance urban livability but also enrich user experiences and improve service quality, making railway stations more than just transit points but vibrant, multifunctional hubs of urban life.

Design Outline:

1. Project Vision & Objectives: Based on the findings of this study, this project proposes the redesign of Milan Central Station into a future-oriented shared mobility hub. The primary objective is to establish the station as a gateway to the city, offering smart shared mobility services while embracing modernity and sustainability. This transformation aims to enhance Milan's urban image and functional value by creating an integrated, future-proof transportation hub that caters to evolving mobility demands.

2. Flow Optimization: To improve connectivity and user experience, the project will integrate advanced smart technologies, including smart mechanized automated parking systems, ensuring seamless connections between shared mobility options. This approach will optimize transfer efficiency, minimize walking distances, and enhance the overall passenger experience, making transportation more efficient, convenient, and accessible.

3. Functional Design: The redesigned Milan Central Station will serve as a multi-functional public space, fostering social interaction, economic activity, and technological innovation. It will feature event and community gathering areas to host cultural and social activities, enhancing public engagement. Additionally, dynamic commercial spaces will be integrated to generate economic benefits, making the station a lively urban hub rather than just a transit point. To embrace emerging mobility trends, the design will incorporate an interactive smart mobility experience zone, where passengers can engage with real-time digital transportation insights and services. To ensure seamless operation and enhanced user interaction, a centralized intelligent transportation control center will be established, improving efficiency, coordination, and responsiveness across various transportation modes. This holistic approach will transform the station into a highly functional, user-centered, and future-ready mobility hub.

4. Structural Sustainability & Green Energy: A modular and prefabricated structural design will be adopted to ensure adaptability to fluctuating passenger flows while allowing for future expansion. To enhance sustainability, the project will integrate green building technologies, such as low-carbon energy solutions (e.g., photovoltaic panels and water-source heat pumps) and an energy consumption monitoring system. These measures will minimize the station's carbon footprint and support Milan's broader environmental goals.

5. Architectural Form: The architectural design will preserve the cultural significance of Milan Central Station while modernizing its functionality. The façade and platform interiors will incorporate iconic historical elements and materials, maintaining its identity as a Milanese landmark. Meanwhile, the interior design will focus on spatial experience and placemaking, ensuring that the station is not just a transit hub but also a vibrant center of urban life, offering passengers a rich and memorable waiting experience.

2.2 Relevance:

Based on their environment and key mobility-related attributes, Mobility Hubs can be categorized into three types: Gateway Hub, Center Hub, and Corner Hub (SHOW Project, 2024). Milan Central Station fully meets the requirement for the largest-scale Gateway Hub. The requirements include its location in a high-density population area, less than three kilometers from the city center, serving as a connection point for multiple transportation networks, and its status as a significant city landmark with symbolic importance to Milan's residents.

Within the city's transportation grid, Milan Central Station's primary role is to connect various mobility hubs and act as the smart central control center for shared transportation and multimodal integration (Figure 6). With Milan Central Station at its core, the city's multi-level shared mobility hubs radiate outward, forming a hierarchical shared mobility network (Jean et al., 2020). These hubs of different scales complement each other, collectively creating an ecosystem for smart shared mobility that enhances system efficiency and promotes sustainable development.

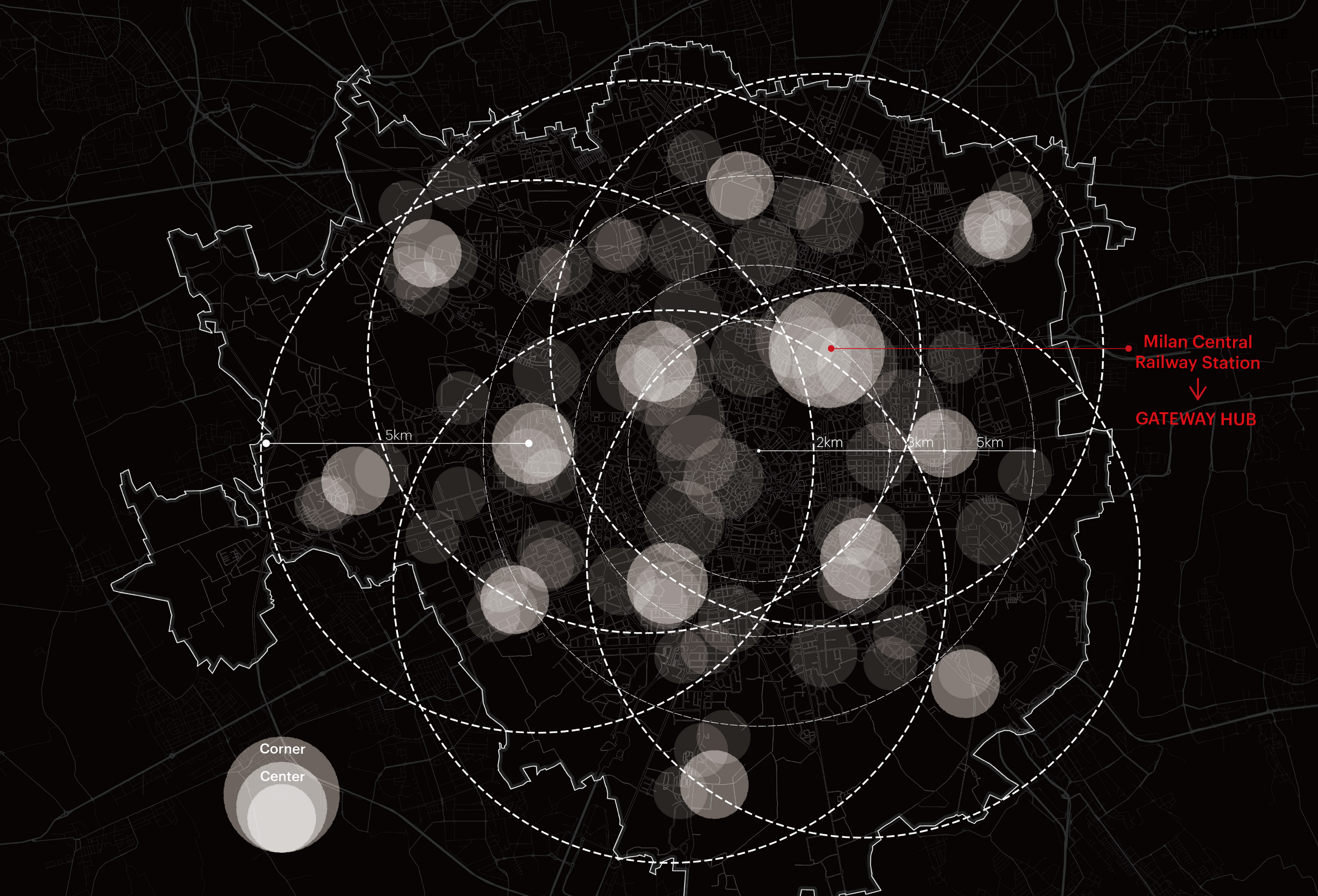


Figure 6: Ecosystem of Smart Shared Mobility Hub in Future Milan

RESEARCH METHODS

03

3.1 Client

3.1.1 Review of Government Documents-Stakeholders

I reviewed official documents to gain a comprehensive understanding of the station's operations and the organizational framework of Milan's traffic management system. Based on the operational model of a future smart shared mobility hub, I identified four key stakeholder groups (Figure 7):

Station Management: Responsible for the overall operation and maintenance of the station.

Vendors: Managing commercial activities and services within the station.

Mobility Operators: Overseeing the operation of various shared mobilities.

Data Department: A government entity tasked with intelligent system management and data-driven control.

3.1.2 Interviews-Users:

I conducted interviews targeting three key user groups: travelers, commuters, and city dwellers. Each group provided insights into their primary needs and perceptions of the station.

3.2 Program

Based on the operational model of a future smart shared mobility hub, I conducted case studies on three types of architectural projects:

3.2.1 Case Studies:

3.2.1.1 Railway Stations

I selected nine major European stations built between 1854 and 2016, including five terminal stations and four through stations. My study focused on:

1. Circulation Design: Examining how these stations connect various mobilities. (Figure 8)
2. The spatial location of various modes of transportation (Figure 9).
3. Functional Benchmark: Dividing spaces into two categories (Figure 10):
(1) User-Oriented Spaces: Areas for visitors (e.g., commercial spaces, services, restaurants) and employees (e.g., offices).
(2) Mobility Spaces: Spaces dedicated to various mobilities, including the railway.

This analysis provided a benchmark for the functional area distribution and circulation strategies to guide my design project.

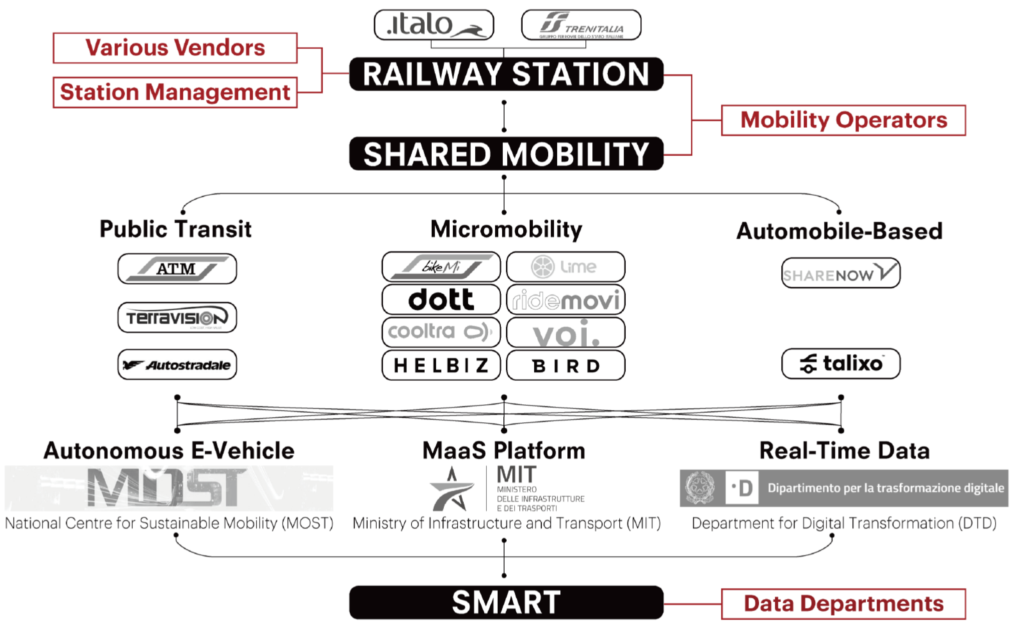


Figure 7: Four Key Stakeholder Groups

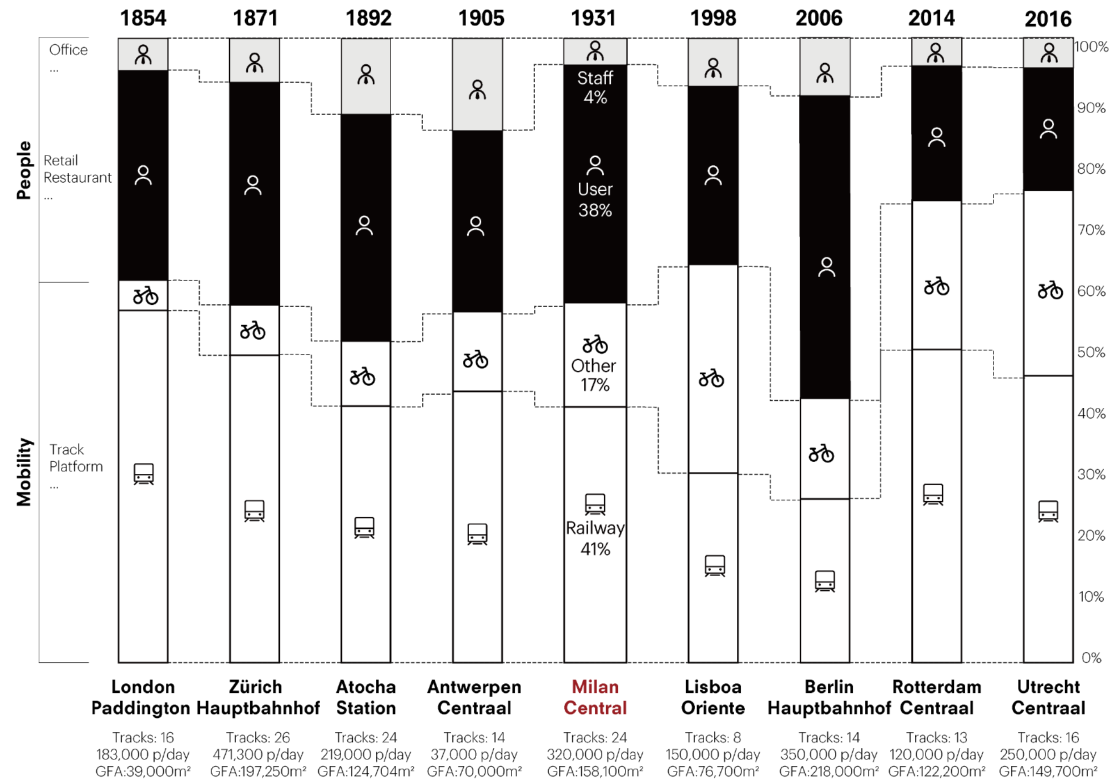


Figure 10: Functional Benchmark of Railway Stations

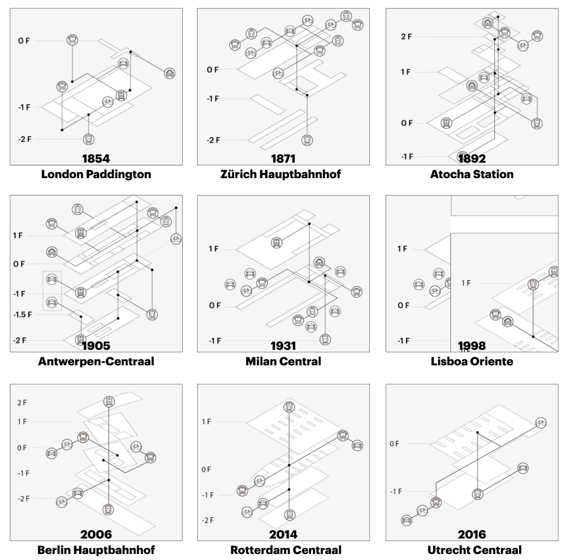


Figure 8 : Circulation Design of Railway Stations

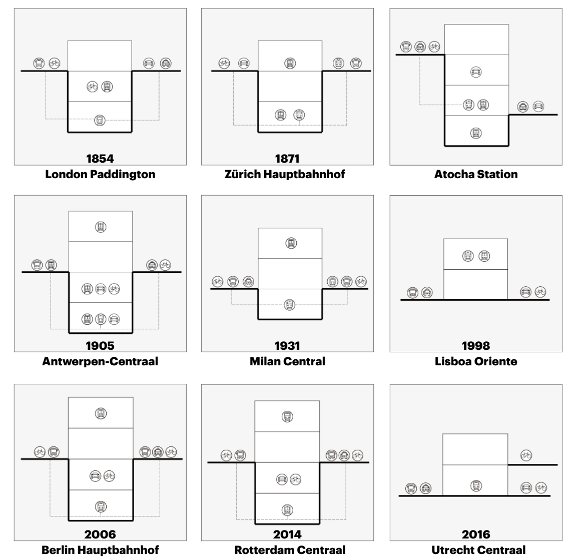


Figure 9: Spatial Location of Various Mobilities

3.2.1.2 Mobility Hubs

Existing mobility hubs vary significantly in form and function.There are seven-story buildings as well as single-story low houses. Their spatial distribution and area allocation depend heavily on their core purpose:

1. Mobility-Focused Hubs: Prioritize efficiency, with a larger proportion of space dedicated to mobility systems.
2. Human-Centric Hubs: Focus on visitor services, allocating more space for user-oriented functions.(Figure 11)

Given Milan Central Station's geographic and functional context, its design must balance these two priorities. It should ensure efficient circulation while maintaining versatile, user-friendly spaces for a wide range of activities.

3.2.1.3 Control Centers

To enhance the functionality of a smart control system within the hub, I studied case studies of railway control centers and air traffic control centers. The focus was on:

1. Spatial Layout: Understanding the logical arrangement of circulation areas, employee offices, and the main control center.
2. Space Requirements: Establishing a relationship between the number of employees and the required building area .

This research provided a benchmark for determining the spatial distribution and area requirements of a smart control center, ensuring it efficiently supports the operation of the mobility hub (Figure 12).

3.2.2 Data Analysis:

The project began by identifying the types of mobilitie involved, including trains, trams, buses, cars, and micromobility, and determining their required spatial dimensions. Next, passenger flow data and the corresponding number of motorized and non-motorized parking spaces at several major train stations were analyzed as benchmarks to estimate the project's specific capacity and spatial requirements (Figure 13).

3.2.3 Literature Review:

I reviewed studies on shared mobility systems to understand their operational models, spatial requirements, and modular design parameters. This informed the functional and flexible design of mobility facilities.

3.3 Site

Field Trip and Mapping: ArcGIS was utilized to analyze Milan's population density distribution and public transportation network. Additionally, the field study examined the architectural layout and functional distribution around the station, with a focus on pedestrian perspectives and walking trajectories. Circulation patterns of various mobilities around the station were also observed to inform the core design phase.

Railway Station	Hamburg Hauptbahnhof	Munchen Hauptbahnhof	Milan Central Station	Berlin Hauptbahnhof	Gare de Lyon	Amsterdam Centraal	Antwerp Central Station
Railway Station	550,000	450,000	320,000	300,000	270,000	250,000	150,000
Parking Capacity (Spaces)	1,800	1,000	?	900	1,100	500	750

Railway Station	Milan Central Station	Amsterdam Centraal	Utrecht Centraal Station	Rotterdam Centraal Station
Railway Station	320,000	250,000	207,360	104,840
Bicycle Parking Capacity	?	7,000	12,500	5,190

Figure 13: Data Analysis- Mobility Capacity Estimate

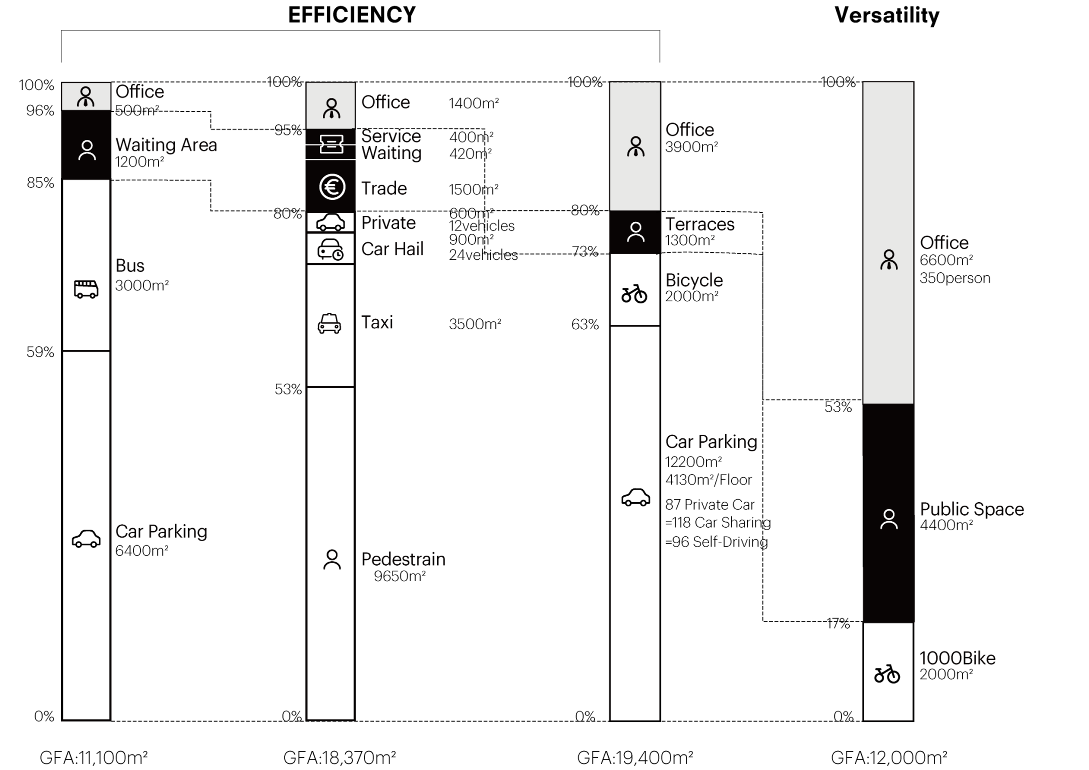


Figure 11: Functional Benchmark of Mobility Hubs

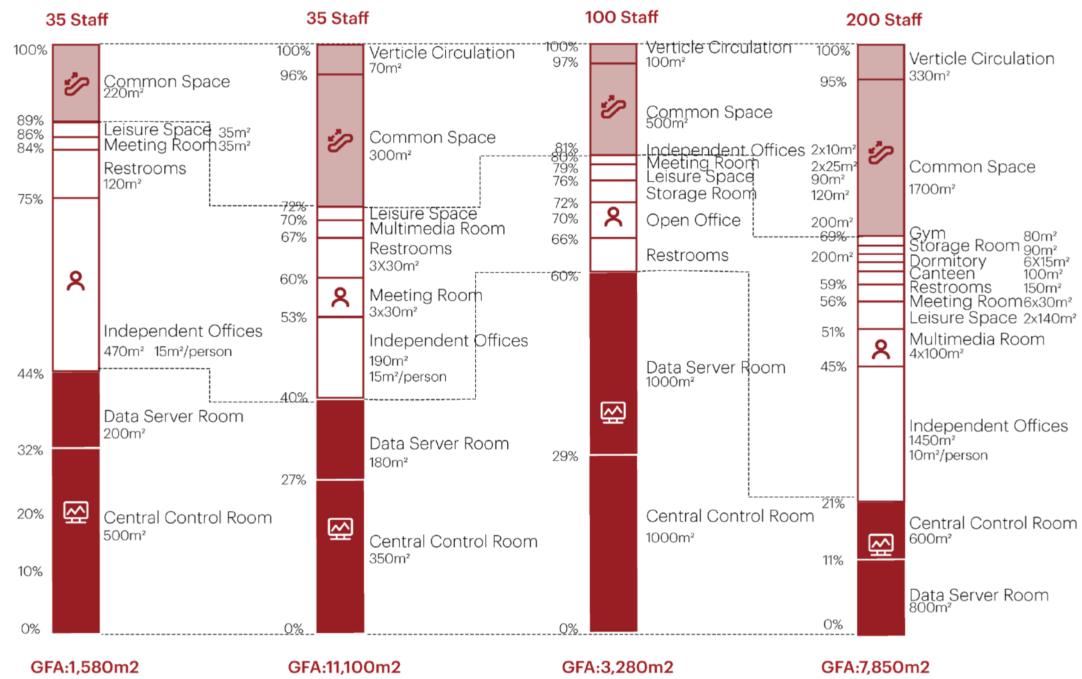


Figure 12: Functional Benchmark of Control Centers

CONCLUSION

04

4.1 Client

The design of the project must address the varied expectations of stakeholders and visitors to create a successful and well-rounded solution. Stakeholders, including vendors, station management, mobility operators, and the data department, each have distinct priorities. Vendors seek well-designed commercial facilities to attract high foot traffic, while station management emphasizes energy-efficient and sustainable systems to reduce operational costs. Mobility operators require efficient circulation to facilitate the seamless dispatch of shared mobility services and boost revenue, and the data department demands a well-equipped control center to support intelligent management systems (Figure 14).

At the same time, visitors bring their own needs: commuters prioritize high transfer efficiency and minimal walking distances, travelers desire iconic design elements that reflect Milan's identity and cultural significance, and city dwellers look for versatile public spaces and diverse commercial services that enrich urban life (Figure 15).

Together, these diverse needs shape the project's core requirements: versatile functionality through multifunctional public areas that integrate entertainment, retail, dining, and services; circulation efficiency via optimized transfer routes to minimize walking distances between two mobilitis within the project; sustainability by reusing materials from the old Milan train station and incorporating modular, prefabricated structures; and an iconic architectural presence with a striking façade and platform interiors that establish the station as a landmark and a memorable first impression of Milan (Figure 16).

4.2 Program

4.2.1 Fuction:

The project transforms Milan Central Station by introducing a smart control center to manage all shared mobility systems in Milan and integrating mobility spaces within the building. Unlike the current layout, where other modes of transportation are disconnected and located outdoors, this design evolves Milan Central Station from a traditional railway station into a smart shared mobility hub, seamlessly connecting various transportation modes under one roof and enhancing both functionality and user experience.(Figure 17)

To be more detailed, the smart control center was determined based on previous case studies, accommodating 150 staff members within 6,100 square meters. The staff area includes additional communal spaces for employees. Visitor spaces reallocate some retail areas to create more entertainment and common spaces, offering diverse tech-driven cultural experiences and enriching public space variety.

The shared mobility section was calculated using previously collected data (Figure 18). Compared to the current Milan Central Station, the design reduces space allocated for shuttles, taxis, private cars, and bikes, while significantly expanding areas for shared cars and micromobility.

For the railway component, the current platforms at Milan Central Station, all 350 meters long, are inefficiently utilized, as half of them serve regional trains, which are only 150 meters in length.So the project proposes optimizing platform sizes by separating regional and high-speed train areas.

In summary, the integration of the smart center, staff spaces, visitor areas, shared mobility zones, and optimized railway infrastructure transforms the station into a smart shared mobility hub, combining efficiency, functionality, and enhanced user experience (Figure 19).

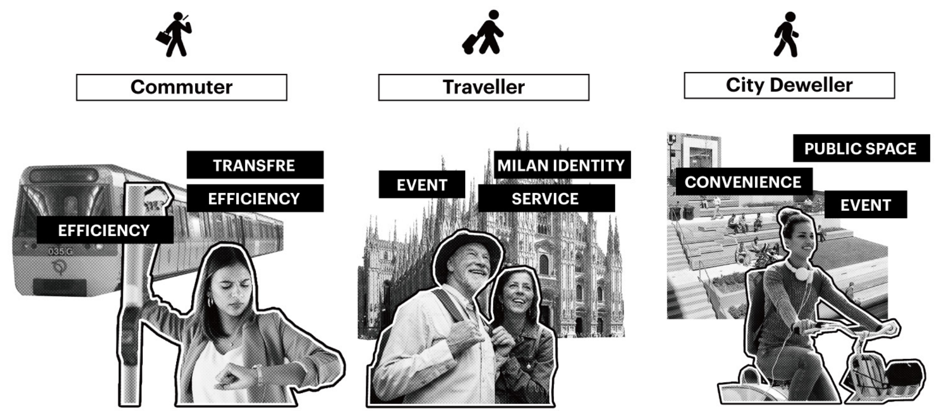


Figure 14: Stakeholder Expectations

Figure 15: Visitor Expectations

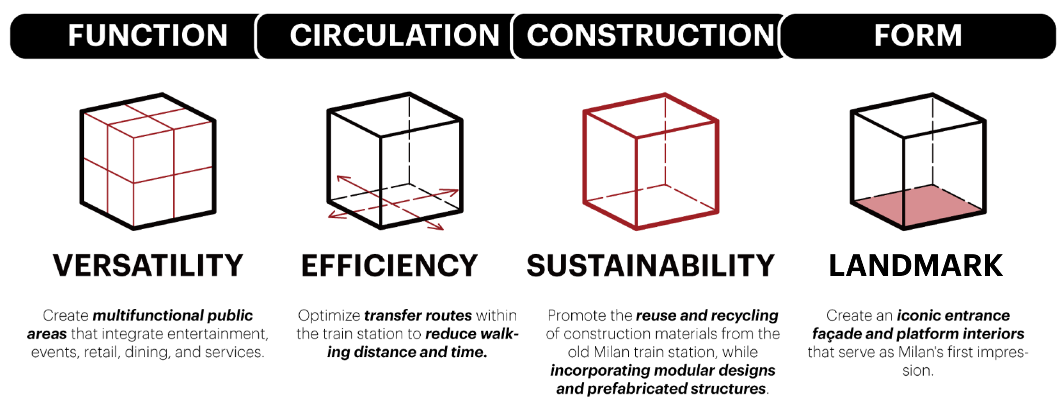


Figure 16: Client Requirements

Mobility	Dimensions (L×W×H, m)	Type	Name	Frequency	Number of Vehicles	Platform Area (m^2)	Parking Area (m^2)
Train	150×3×4	Regional			12 Trains	900m^2 per track	900m^2 per track
	350×3×4	High-speed			12 Trains	500m^2 per track	500m^2 per track
Tram	30×2.5×3.4		5;9;10	Every 10 minutes		90m^2 per track	90m^2 per track
Bus	15×2.5×3.2	Airport Shuttle	Malpensa	Every 30 minutes	5 Shuttles	45m^2 per shuttle.	90m^2 per shuttle.
			Linate	Every 30 minutes	3 Shuttles		
			Bergamo	Every 30 minutes	4 Shuttles		
	12×2.5×3.2	Bus (Through)	42;87;90;91;92	Every 10-15 minutes		30m^2 per bus	30m^2 per bus
Car	5 × 1.8 × 1.5	Taxi				15m^2 per car.	15m^2 per car.
		Car Hail			Every 24 Cars		
		Shared Car			500 Cars		22.5m^2 per car.
		Private Car			100 Cars		
Micromobility	1.8 × 0.5× 1.2	Rent Bike			1500 Bikes		2.15m^2 per bike
		Shared Bike			1500 Bikes		
		Shared Scotter			500 Scotters		
		Shared Motorcycles			500 Motorcycles		

Figure 18: Mobility Area Estimate

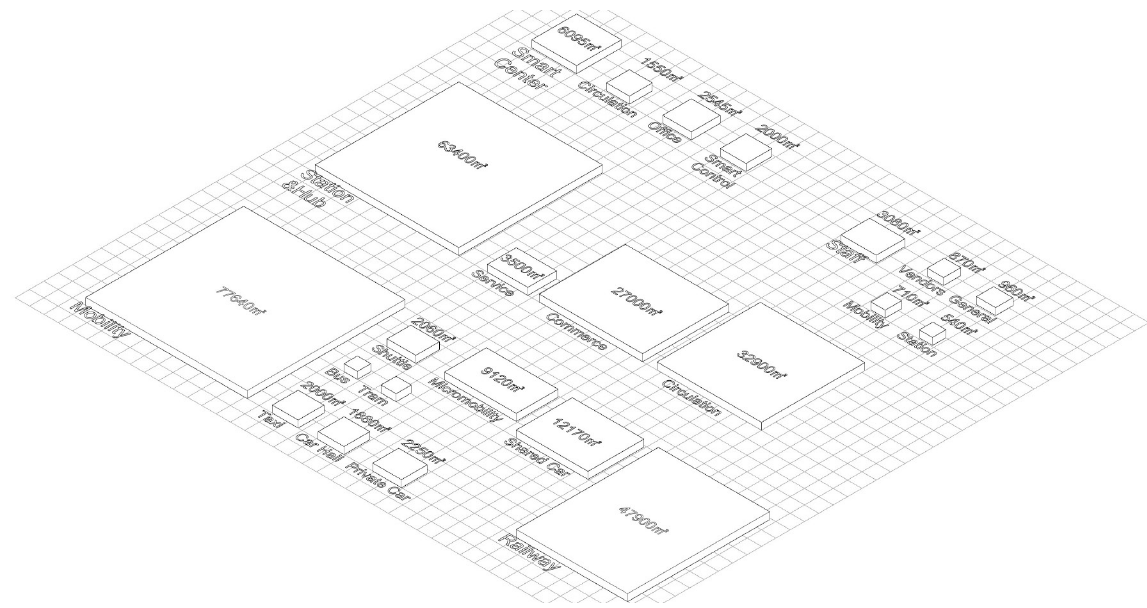


Figure 19: Visualization of the Area Size

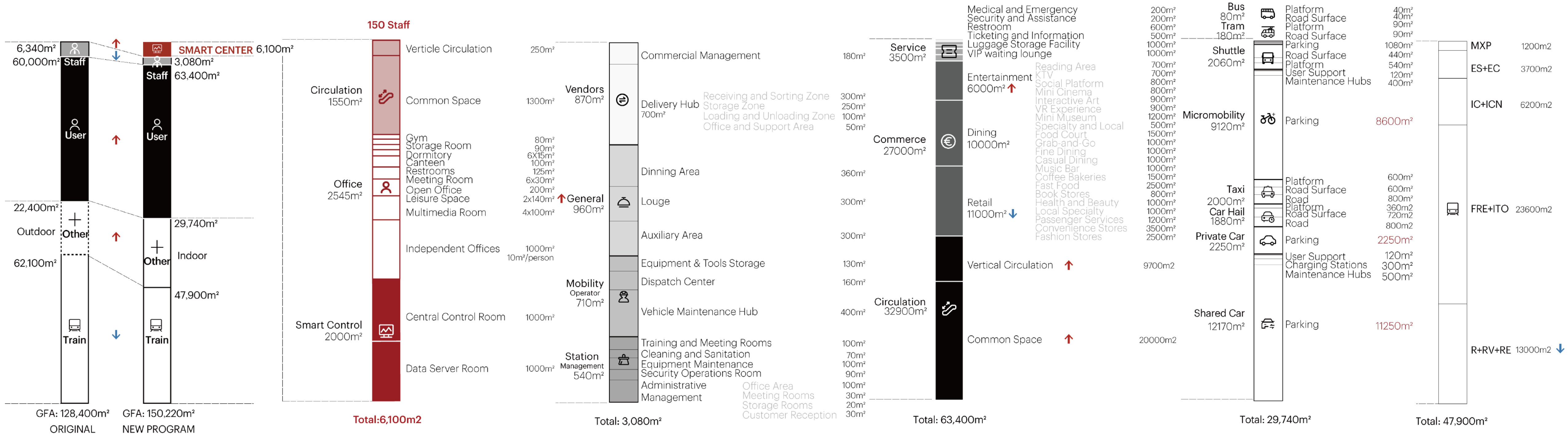


Figure 17: Project Functional Bars

4.2.2 Relationship:

The hub's user-focused areas combine open public spaces for activities and linear spaces for efficient pedestrian flow. It serves as a central facility for all shared mobility services, not just a railway station. Staff roles are clearly defined: vendors handle commercial services, station management ensures environment, and mobility operators manage vehicle dispatch,all with dedicated communal spaces. The smart control center operates separately with restricted access for security and efficiency (Figure 20).

4.2.3 Circulation:

Commuters prioritize efficiency, using express routes to quickly reach train platforms. Travelers explore diverse transport options while enjoying the station's commercial and public spaces. For city dwellers, the hub functions as a public space for leisure, shopping, and convenient shared mobility. Staff have separate workspaces and entrances, ensuring operational efficiency (Figure 21).

4.2.4 Material Group Lens

Our group strategy spans urban, building, and detail levels. At the urban scale, primary materials must be sourced within a 10 kg CO2transport cost, with at least 30% recycled content.The project's main materials—concrete, marble, and steel—are locally available in Lombardy, with low-carbon train transport emitting up to 5.6 kg CO2 (Figure 22).

At the building level, the strategy emphasizes innovatively repurposing materials from the existing building in the new design to preserve its historical significance . The station's massive scale incorporates substantial amounts of marble, steel, and concrete, which will be creatively reused in various ways. For concrete,some original commemorative architectural elements can be integrated into the central areas of the new design. Historic marble will be reimagined as focal points in key spaces such as the entrance, main hall, and public plazas. Steel will be reused in structural frames, façades, roofing, and decorative furniture.

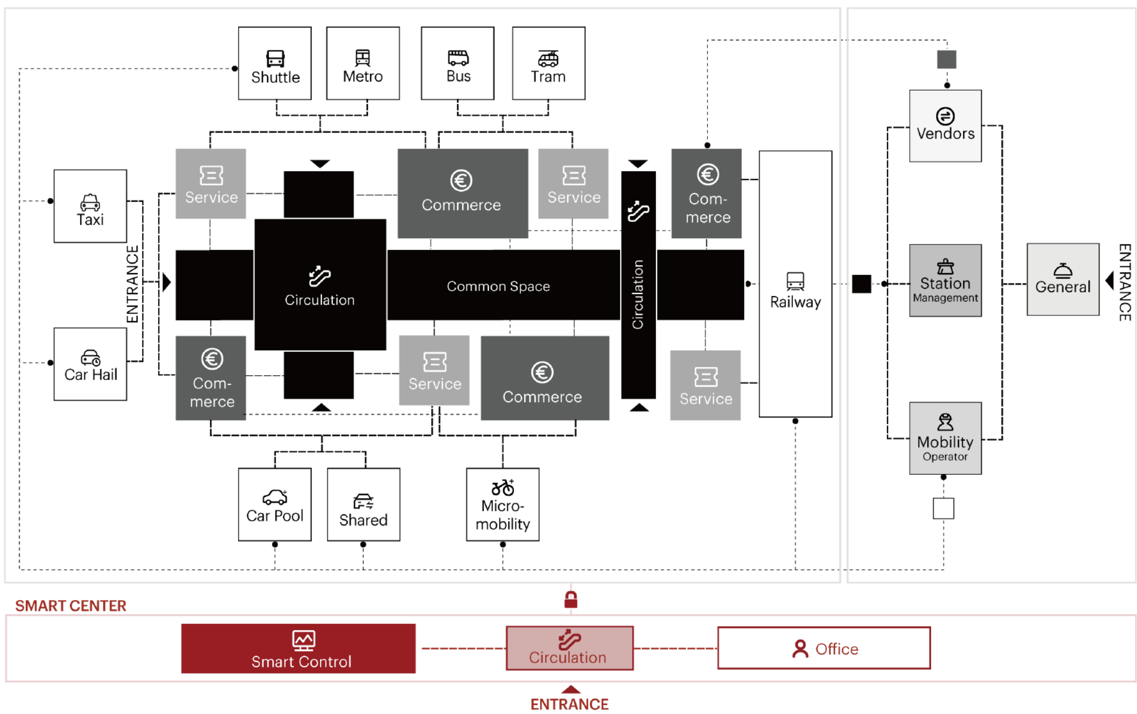


Figure 20: Project Functional Relationship

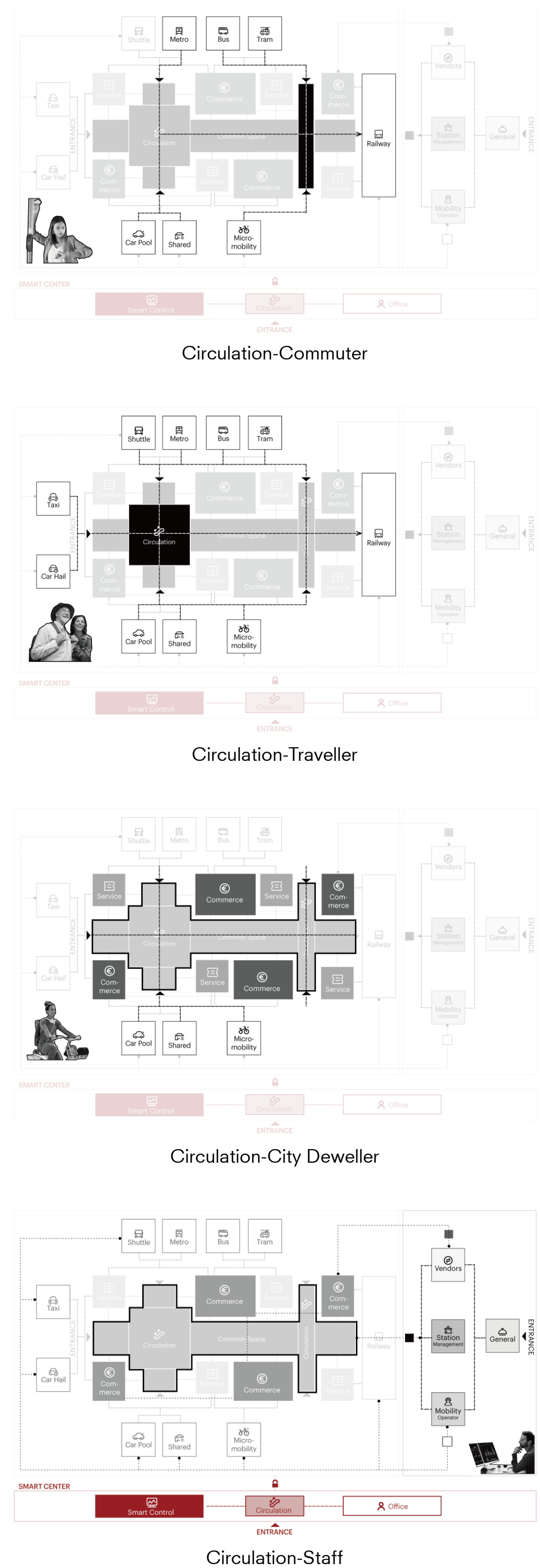


Figure 21: Project Circulation

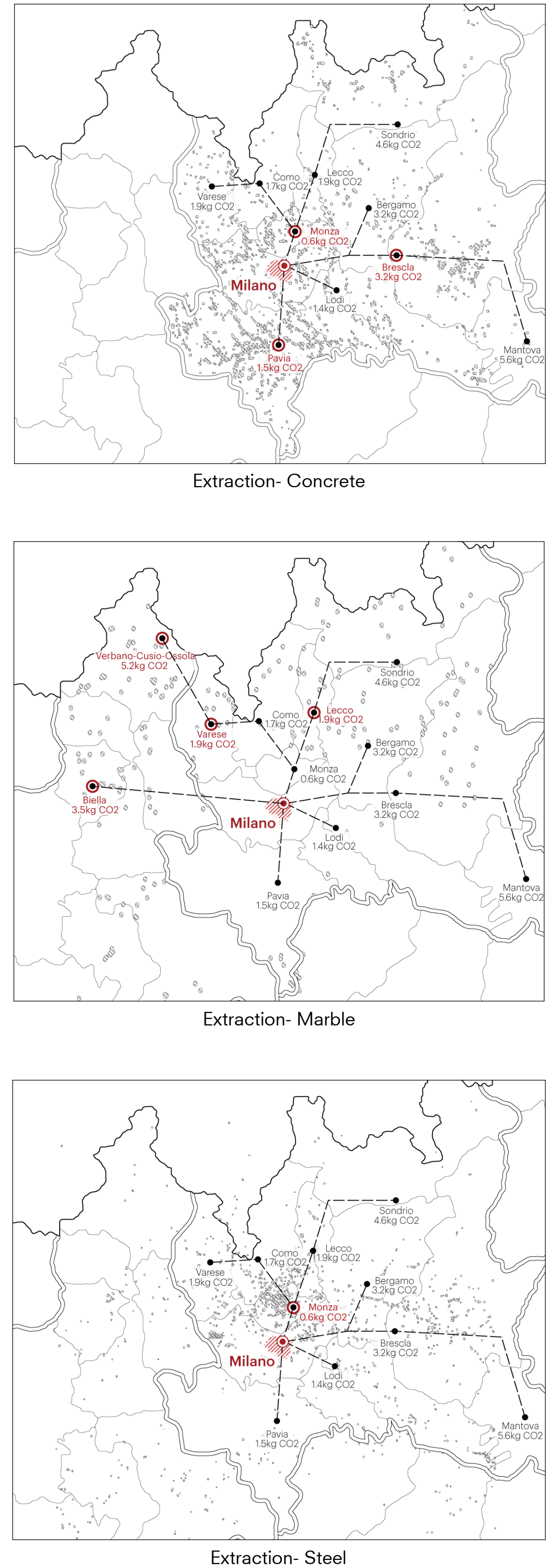
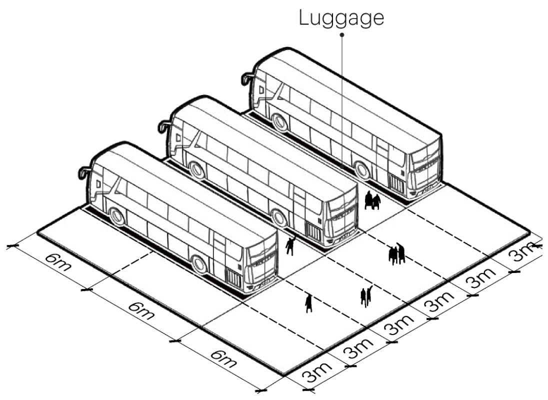
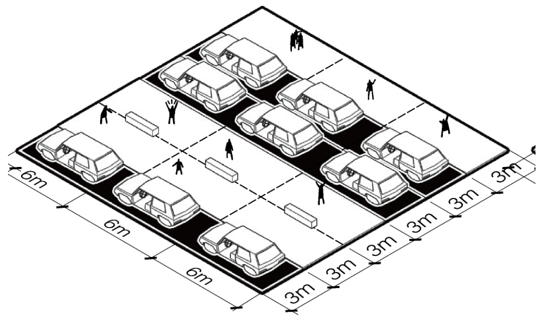


Figure 22: Material Extraction

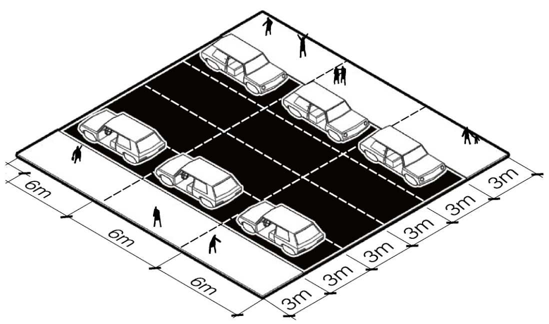
At the detailed scale, at least 50% of the building's structural and non-structural components must be designed for easy disassembly or repurposing. As mentioned earlier, the shared mobility areas, with relatively fixed dimensions and capacities, lend themselves well to modular design. For airport shuttles, taxis, and car-hailing operations, a modular unit of 6m x 6m is sufficient to accommodate their required transportation and platform functions (Figure 23). For shared mobility and shared car parking, such a module can house up to 137 bicycles or 12 cars . However, with the implementation of intelligent automated parking systems, a space of 18m x 18m x 6m can accommodate over three times as many vehicles. This system effectively separates pedestrian and vehicle circulation, enhances overall space efficiency, and creates more possibilities for architectural layout and design (Figure 24). What's more, modular design offers high adaptability, allowing for adjustments to meet future needs.



Airport Shuttle

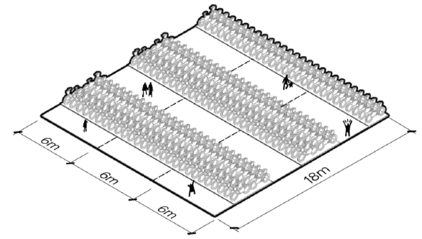


Taxi

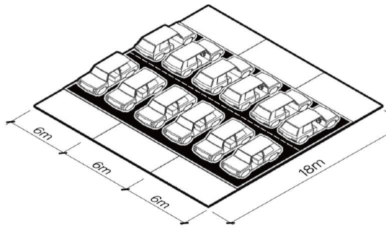


Car Hailing

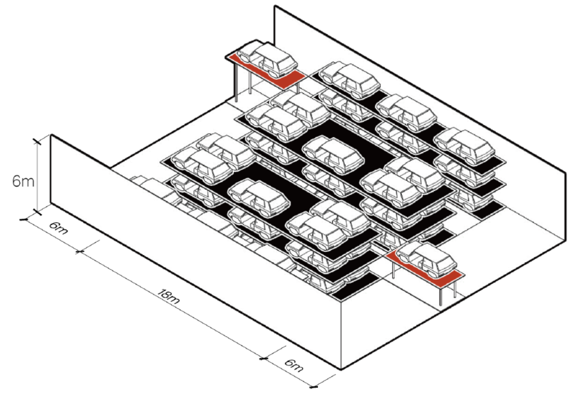
Figure 23: Modular Design



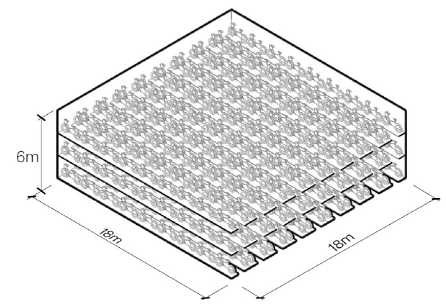
Shared Micromobility Parking
137 Bikes



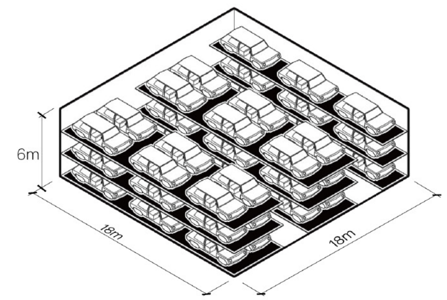
Shared Car Parking
12 Cars



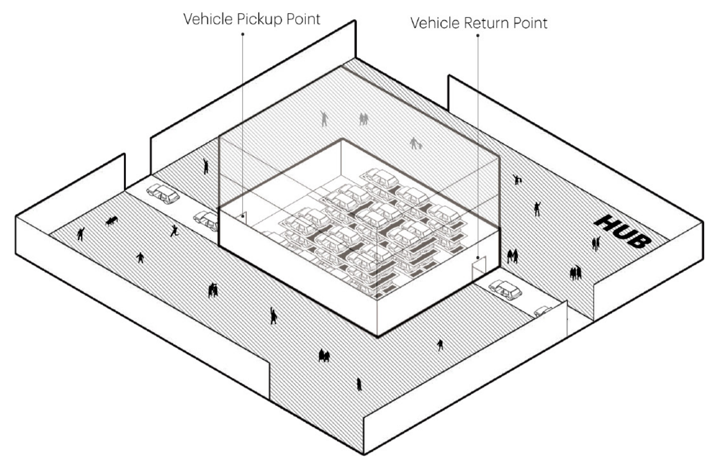
Smart Auto-Shared Car Parking System



Smart Auto-Micromobility Parking
3x162 Bikes



Smart Auto-Shared Car Parking
3x15 Cars



Smart Auto-Shared Car Parking System can simplify traffic flowlines and unlock greater possibilities for spatial utilization.

Figure 24: Modular Design of Shared Cars and Bikes

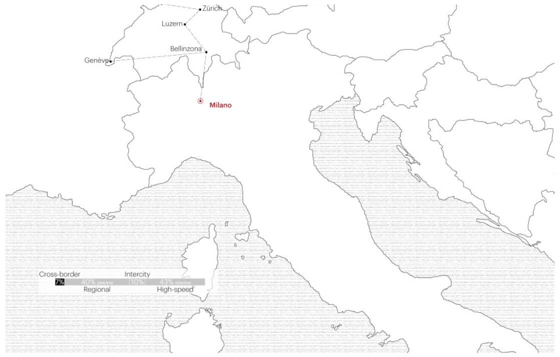
4.3 SITE

I analyzed the site at XL, L, and M scales. At the XL scale, the focus was on Milan's regional, national, and international railway connections. As the largest city in Lombardy, Milan serves as the anchor of the regional rail network. As a gateway to Italy, it drives national high-speed domestic transport. And as a bridge to Europe, it ensures efficient international connectivity. Consequently, the station handles approximately 320,000 passengers daily, with around 500 trains in operation, reflecting the significant demand for both commuting and travel (Figure 25).

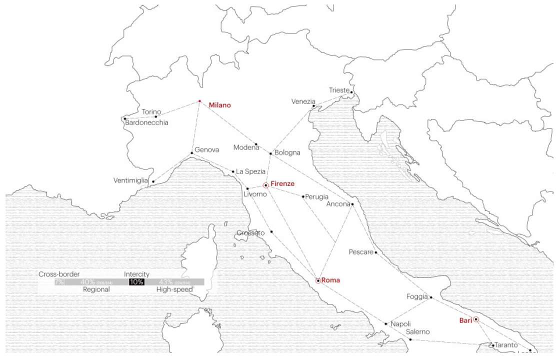
So, according to CoMoUK's classification method, future urban hubs can be categorized into three types based on their site and key mobility attributes: gateway hubs, center hubs, and corner hubs (Figure 26). Milan Central Station perfectly fits the characteristics of the largest gateway hub, given its location in a high-density urban area, its role as a major intersection of multiple transportation networks, its proximity to the city center (within three kilometers), and its status as an iconic landmark in Milan (Figure 27). This project can serve as the city's smart control center for shared mobilities and intermodal connectivity, acting as the core link between all hubs. Imagine if Hubs of different scales will complement one another, forming a multi-layered shared mobility network in Milan.

	Gateway Hub	Center Hub	Corner Hub
Size	Large	Medium	Small
Number in the city	1-2	2-5	Several
Radiation range (km)	10-15	4-6	2-3
Mobility involved	**5-6**	3-4	1-2
Distance from City Center (km)	**0-3**	2-5	4-10
Population Density	**High**	High	Medium
Location	In the center of the urban core	Residential and commercial districts	Near residential areas
Role	Connecting all kinds of hubs	Connects corner and gateway hubs	Facilitates first/last hops
Purpose	Serve as the city's central control center for shared transportation and intermodal connectivity	Meet demand in high-traffic zones and serve as secondary hubs for medium-range transportation	Provide local accessibility to shared transportation for residents and short trips
Features	Extensive mobility options, extra amenities, WiFi, vehicle repair stations, etc.	Versatile mobility options, rideshare points, farevending,neighborhood maps, etc.	Limited transportation modes, parking and bikestorage, etc.

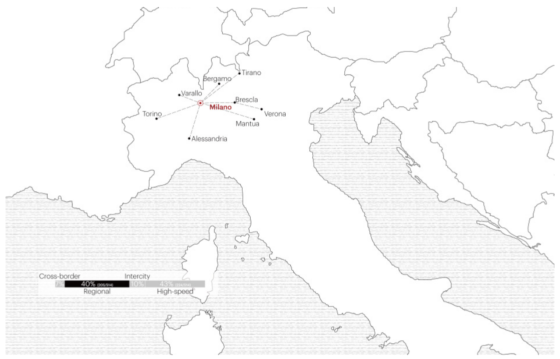
Figure 26: Types of Mobility Hubs



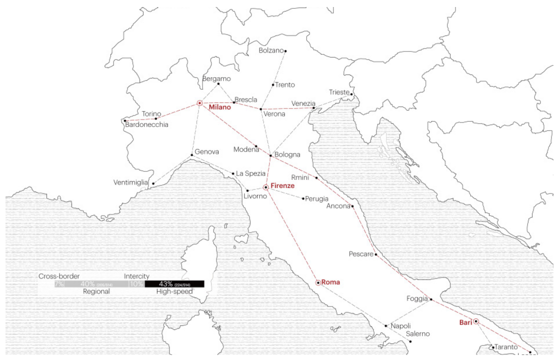
Cross-Border



Domestic



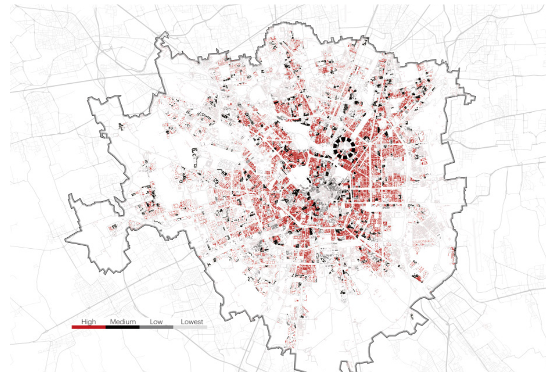
Lombardia



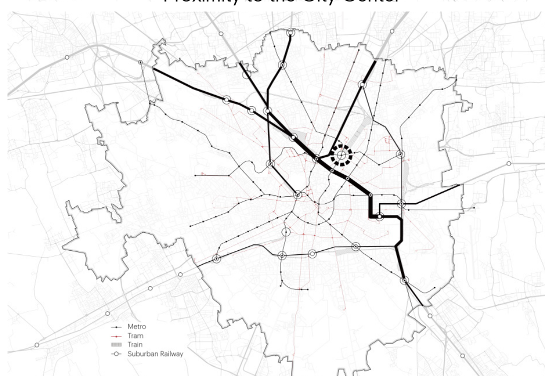
Domestic-High Speed

Figure 25: Modular Design of Shared Cars and Bikes

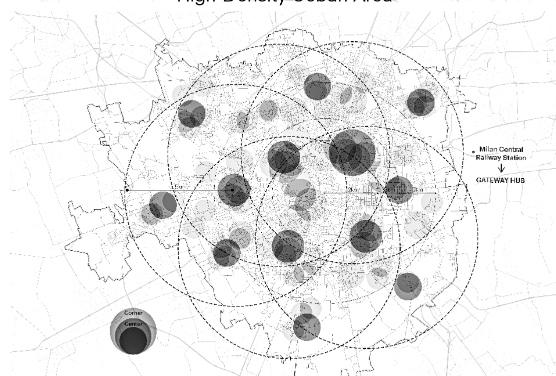
Proximity to the City Center



High-Density Ueban Area



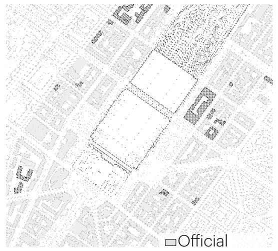
Major Intersection of Multiple Transportation Networks

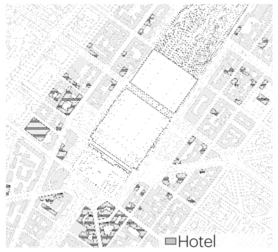


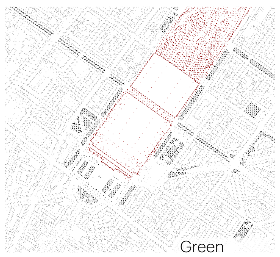
A Multi-Layered Shared Mobility Network in Milan

Figure 27: Milan Centrale Railway Station-Gateway Hub

At the M-scale, I analyzed the site's current conditions in detail. Surrounding land use includes a mix of hotels, commercial spaces, government offices, and cultural or office facilities (Figure 28). Transportation analysis covered public transit (metro, tram, bus) (Figure 29), micromobility (bike parking and paths) (Figure 30), and automobile-based systems (traffic flow, taxi pickup points, parking, gas/charging stations, and peak-hour congestion) (Figure 31). Environmental factors such as the wind rose, sun path (Figure 32), and key viewpoints were also studied. Notably, the southwest view from the station overlooks the main road, while the west side offers a striking view of high-rise buildings (Figure 33). I also analyzed external perspectives of Milan Central Station, emphasizing its urban prominence (Figure 34).







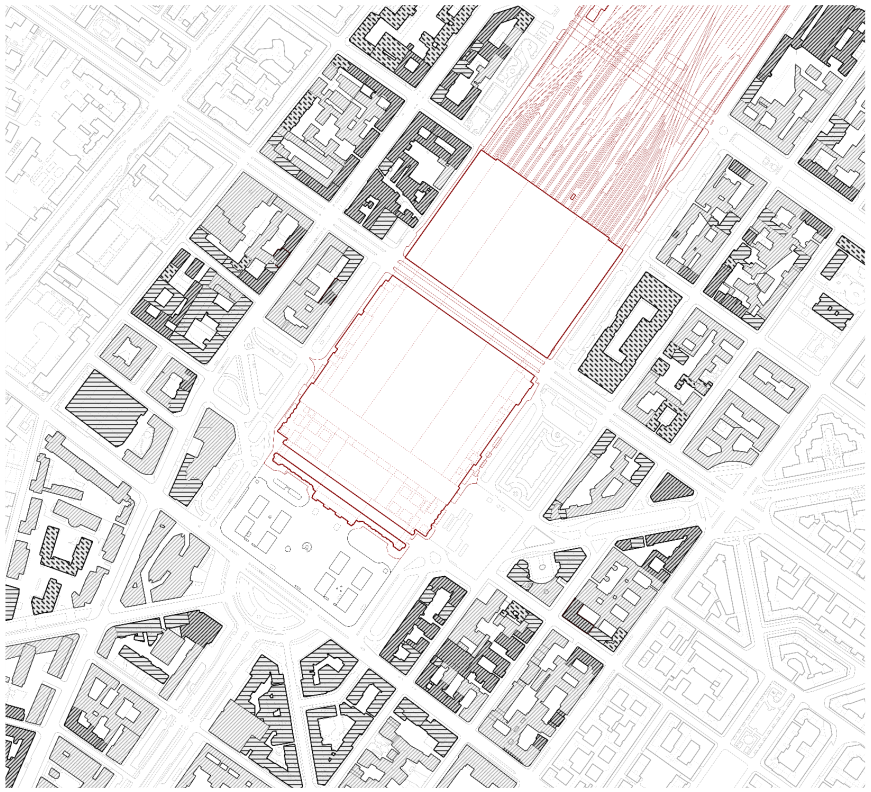
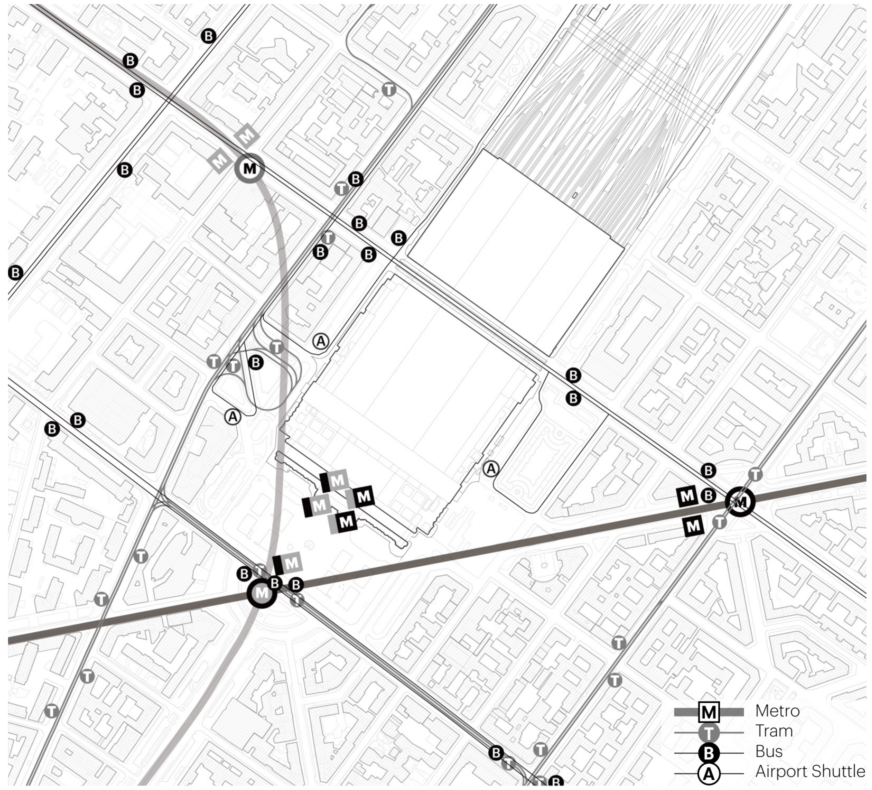
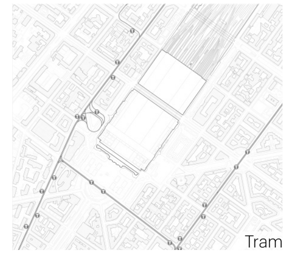


Figure 28: People- Landuse





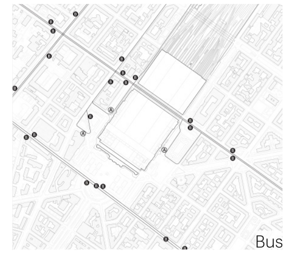


Figure 29: Traffic- Public Transit

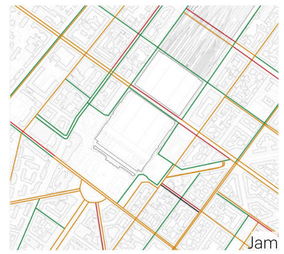
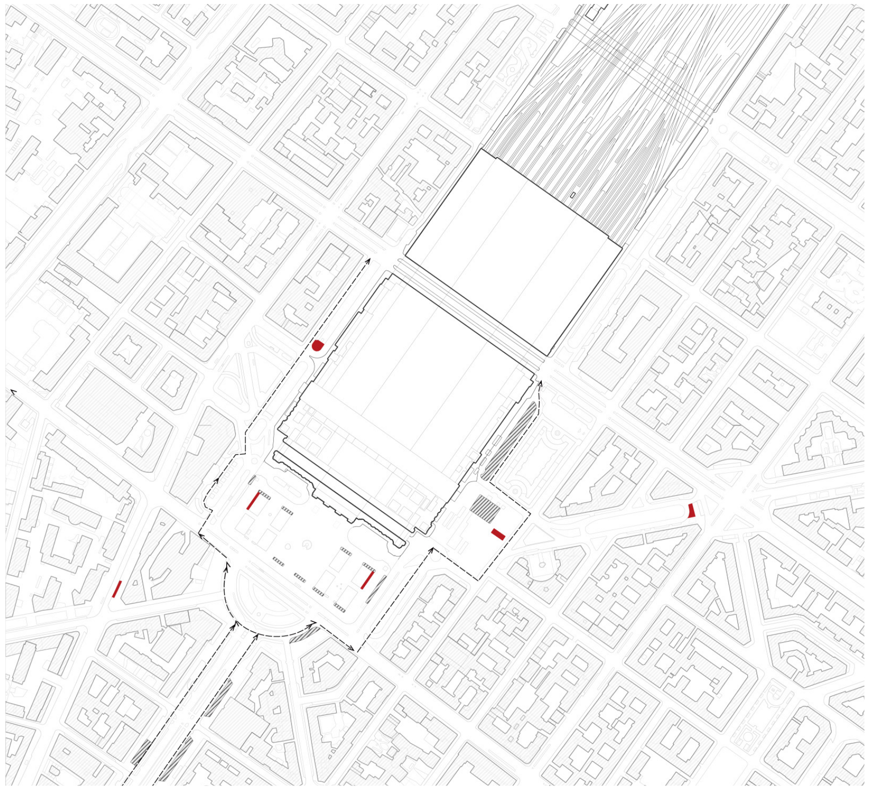
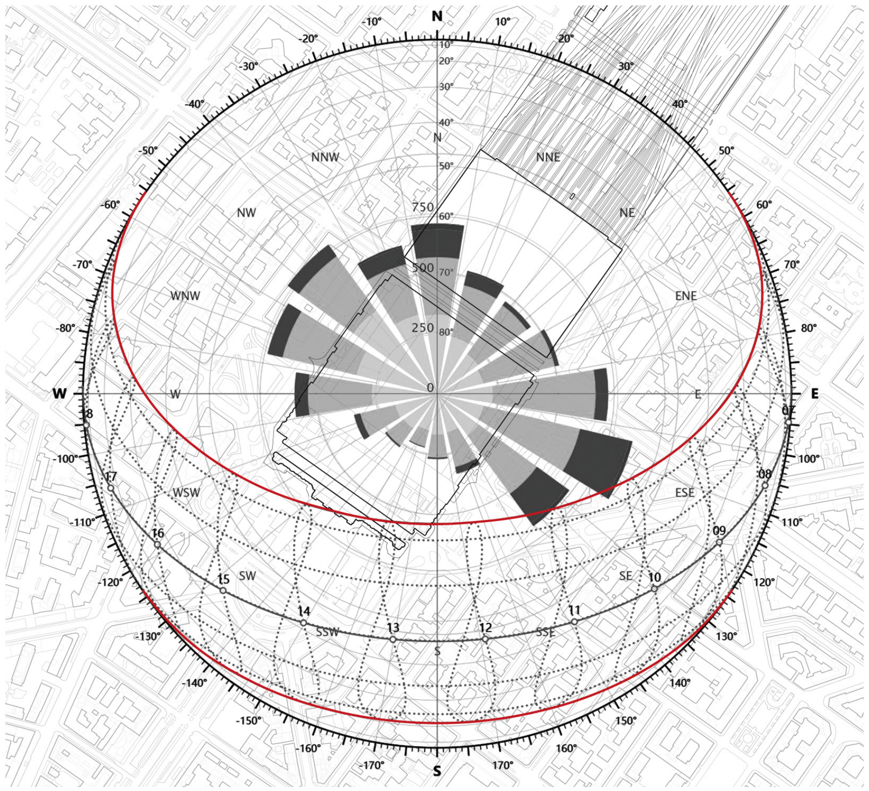


Figure 31: Traffic- Automobile-Based



Shared
Private

Figure 30: Traffic- Micromobility



2-5 km/h
5-10 km/h
10-20 km/h
20-30 km/h

Figure 32: Environment- Wind Rose And Sun Path

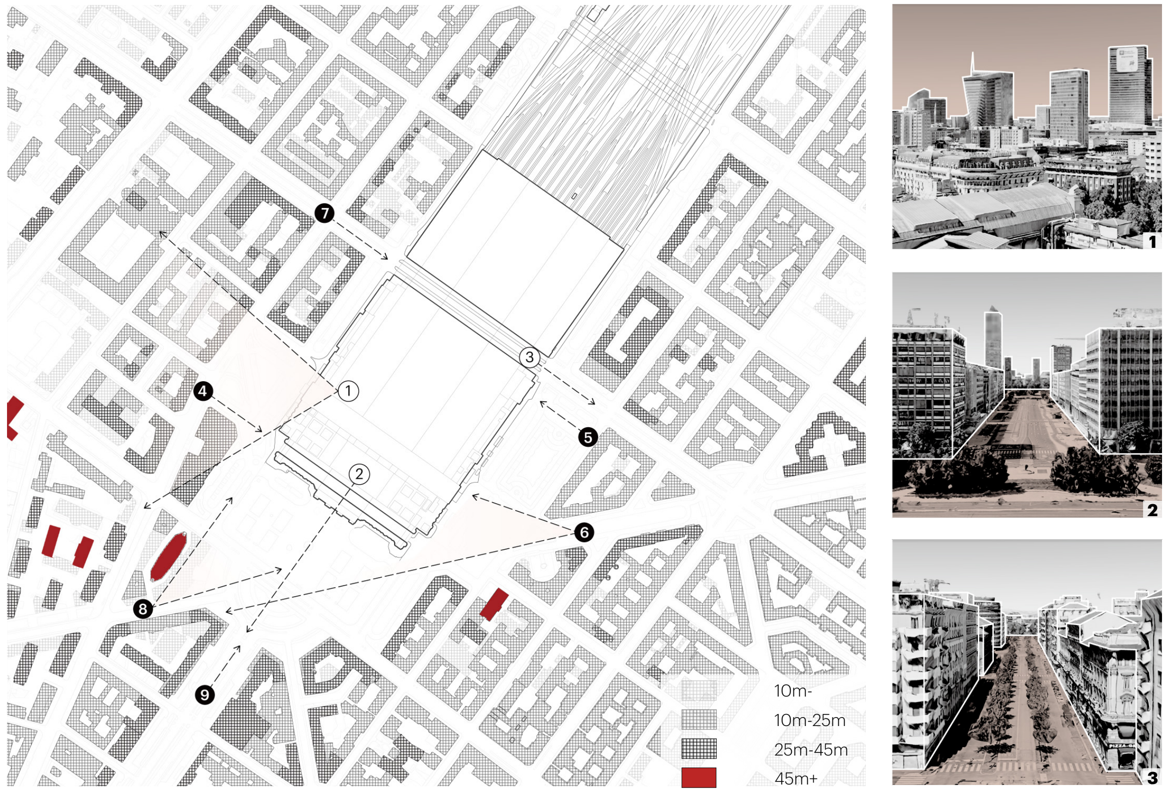


Figure 33: Environment- Building Height/ Key Inside Views

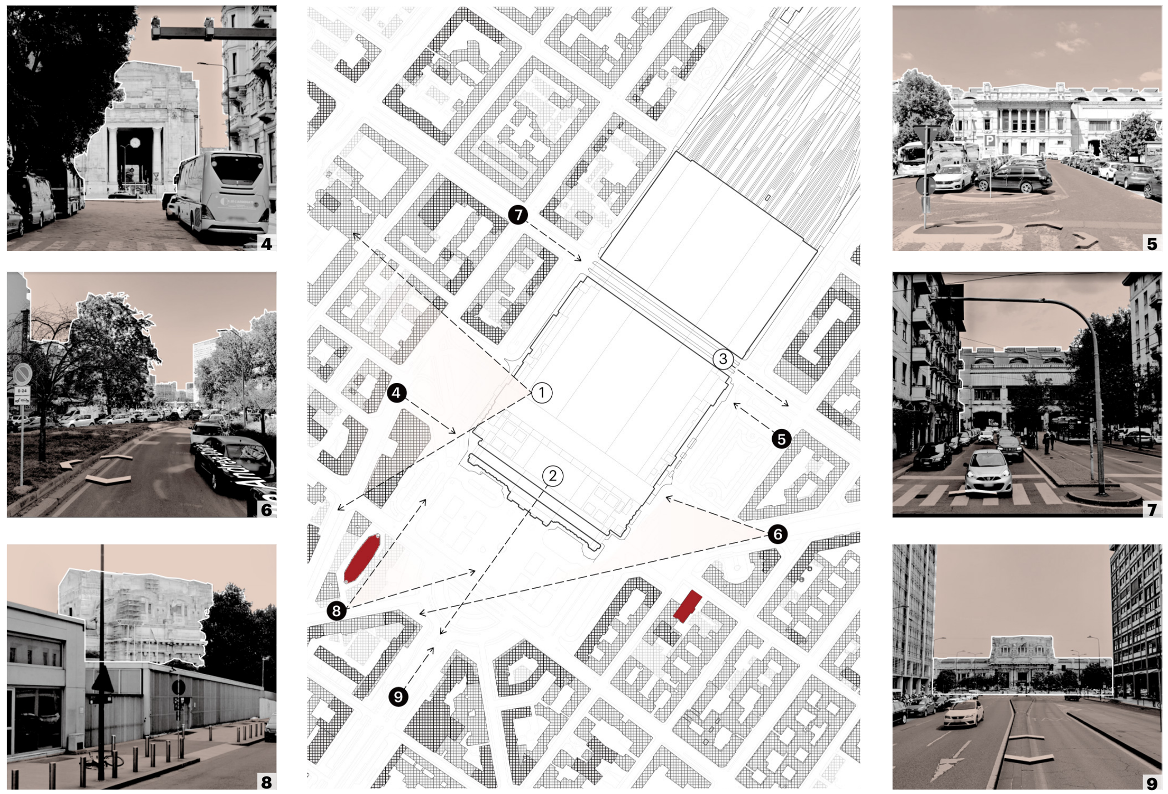


Figure 34: People- Key Outside Views

My site ambition is as follows:
Environment: Design passive energy-saving buildings to reduce energy consumption while harmonizing with the surrounding architecture and maximizing scenic views.
Community: Activate and enhance the utilization of surrounding architectural functions, create an iconic urban landmark, and ensure clear sightlines.
Transportation: Optimize and integrate existing public transportation systems, while efficiently redesigning shared micromobility and automobile infrastructure (Figure 35).

Finally, my site covers 159,000 square meters, and based on prior analysis, I explored initial designs for site entrances. The southwest side serves as the primary micromobility and pedestrian entrance, given its bike lanes and location at the end of the city avenue. The northwest side is a hub for tram and bus stops, while the north is ideal for an airport shuttle entrance, aligning with the route to the airport. The east side is likely to become the main automobile entrance (Figure 36).

In terms of the massing study, fwirstly, based on the previous analysis, the spatial form and area of the railway part are relatively stable and account for a significant proportion of the total building area. Therefore, the massing was developed around the layout of the it, exploring three configurations: juxtaposition, split-level, and overlapping. Additional massing part, including the hub, shared mobility, and the smart control center, were added into it. After comparison, I prefer the platform overlapping configuration. This approach not only optimizes land use, creating more outdoor public spaces and green areas, but also centralizes the hub area, reducing walking distances between different mobilities within the building and thus improving transfer efficiency (Figure 37).

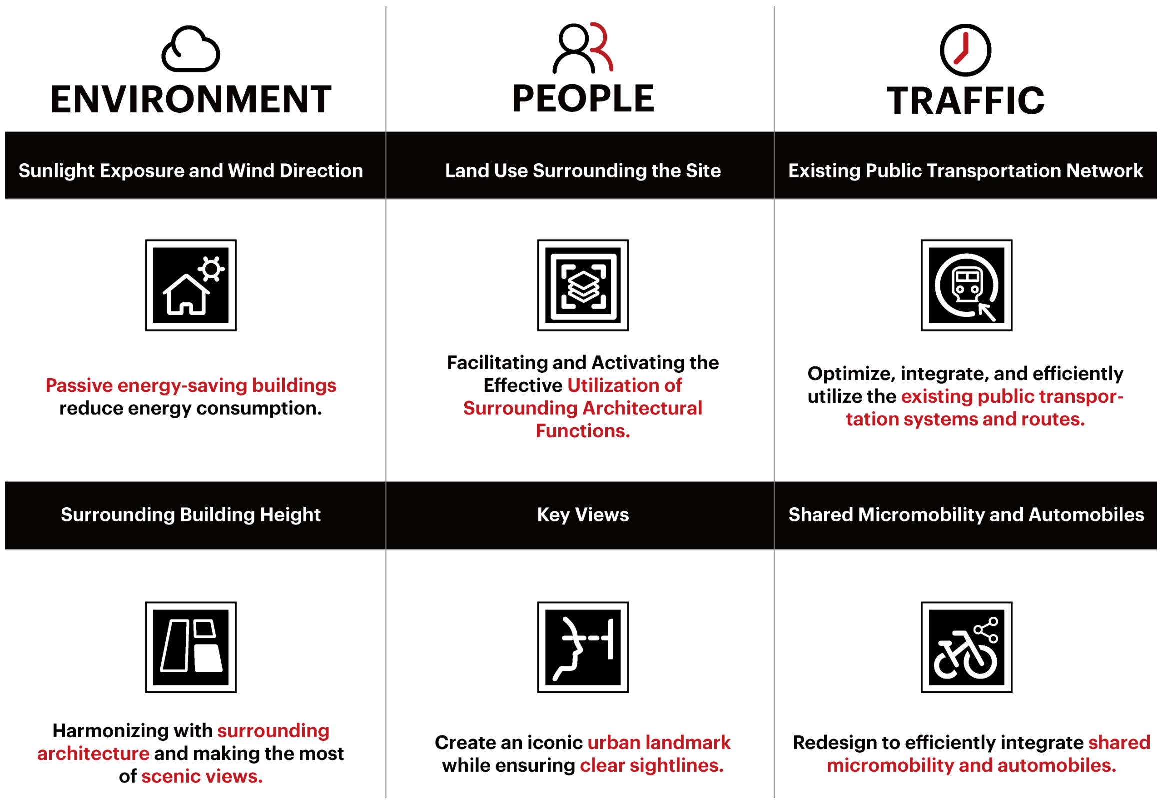


Figure 35: Site Ambition

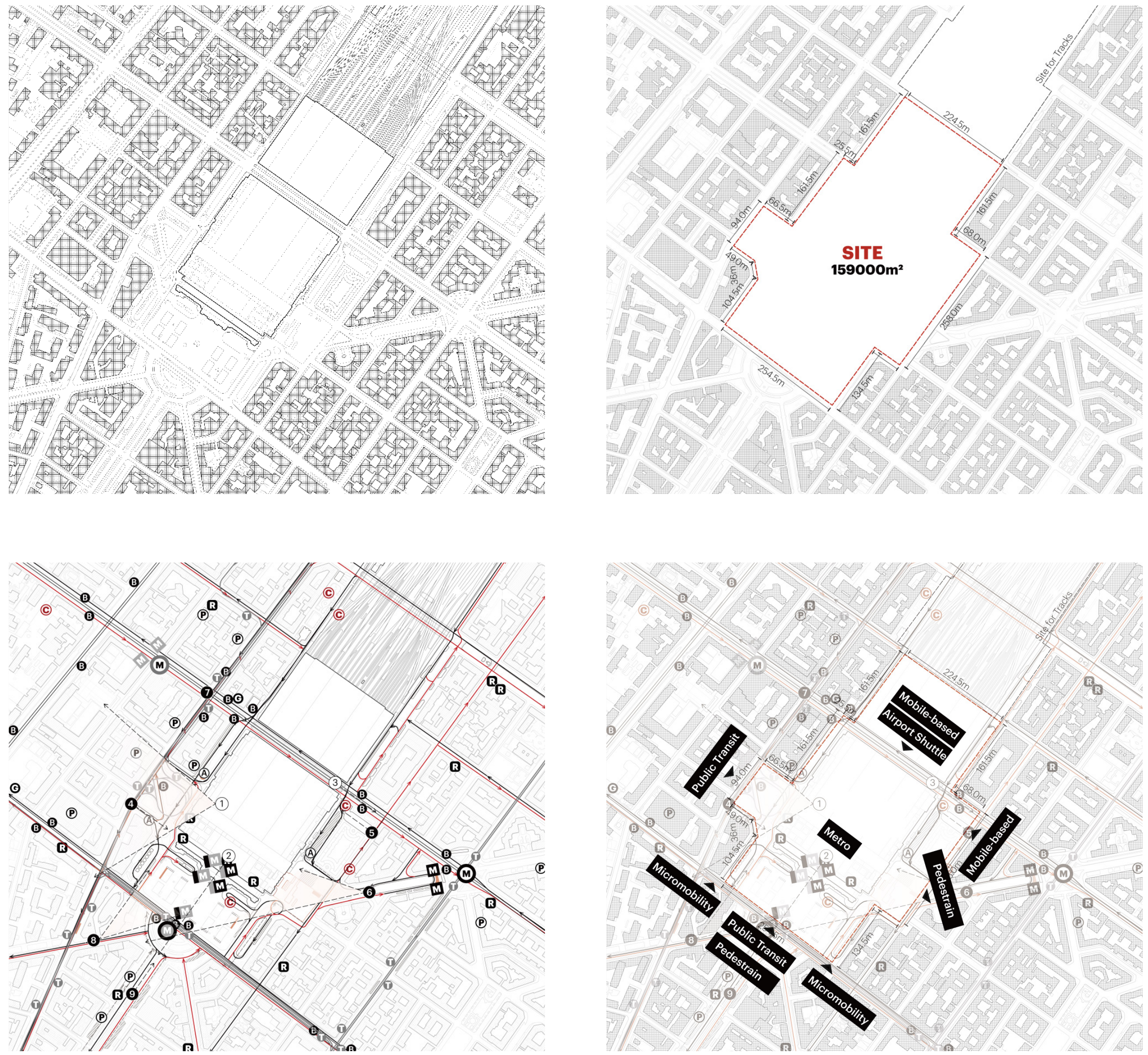


Figure 36: Site Conclusion

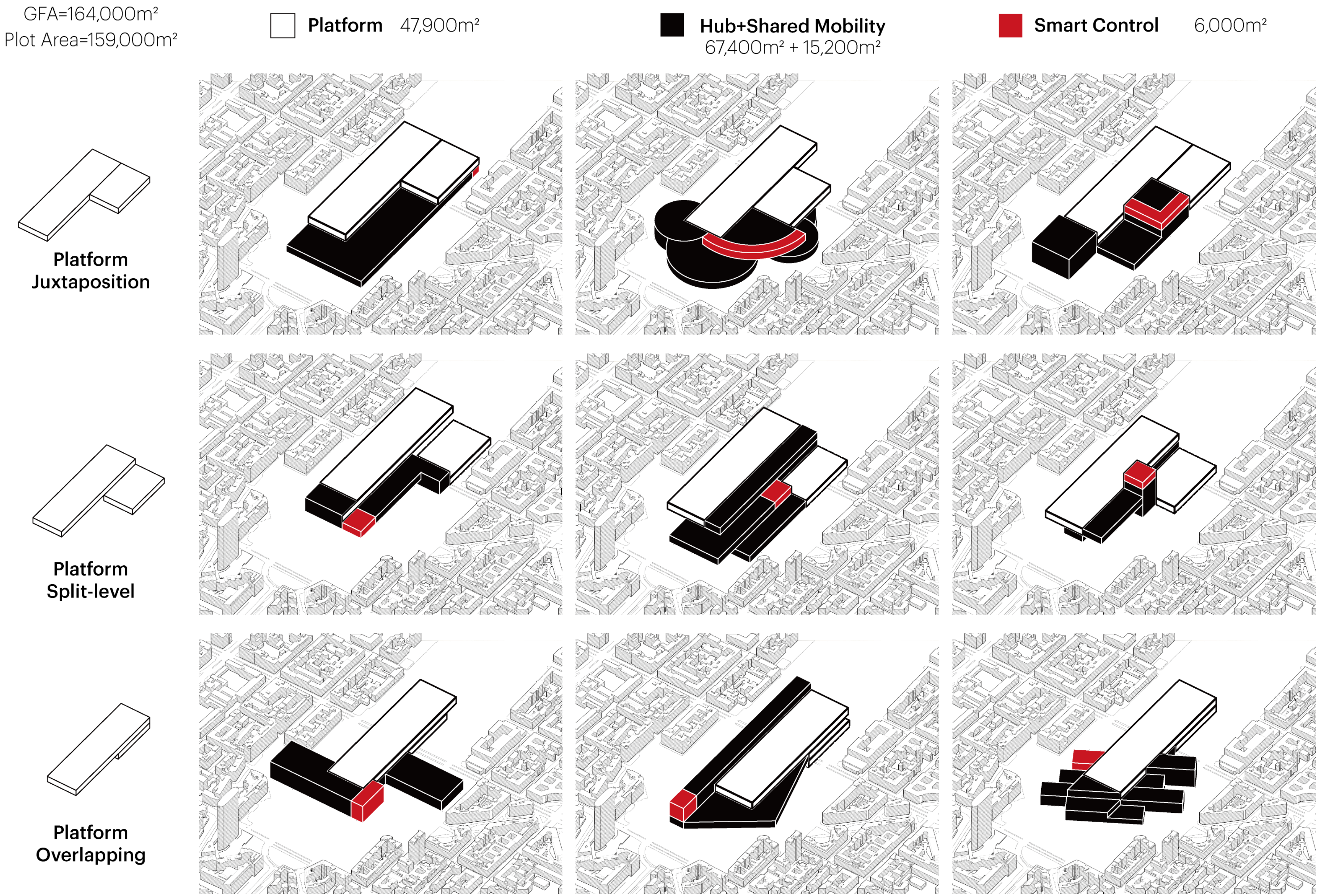
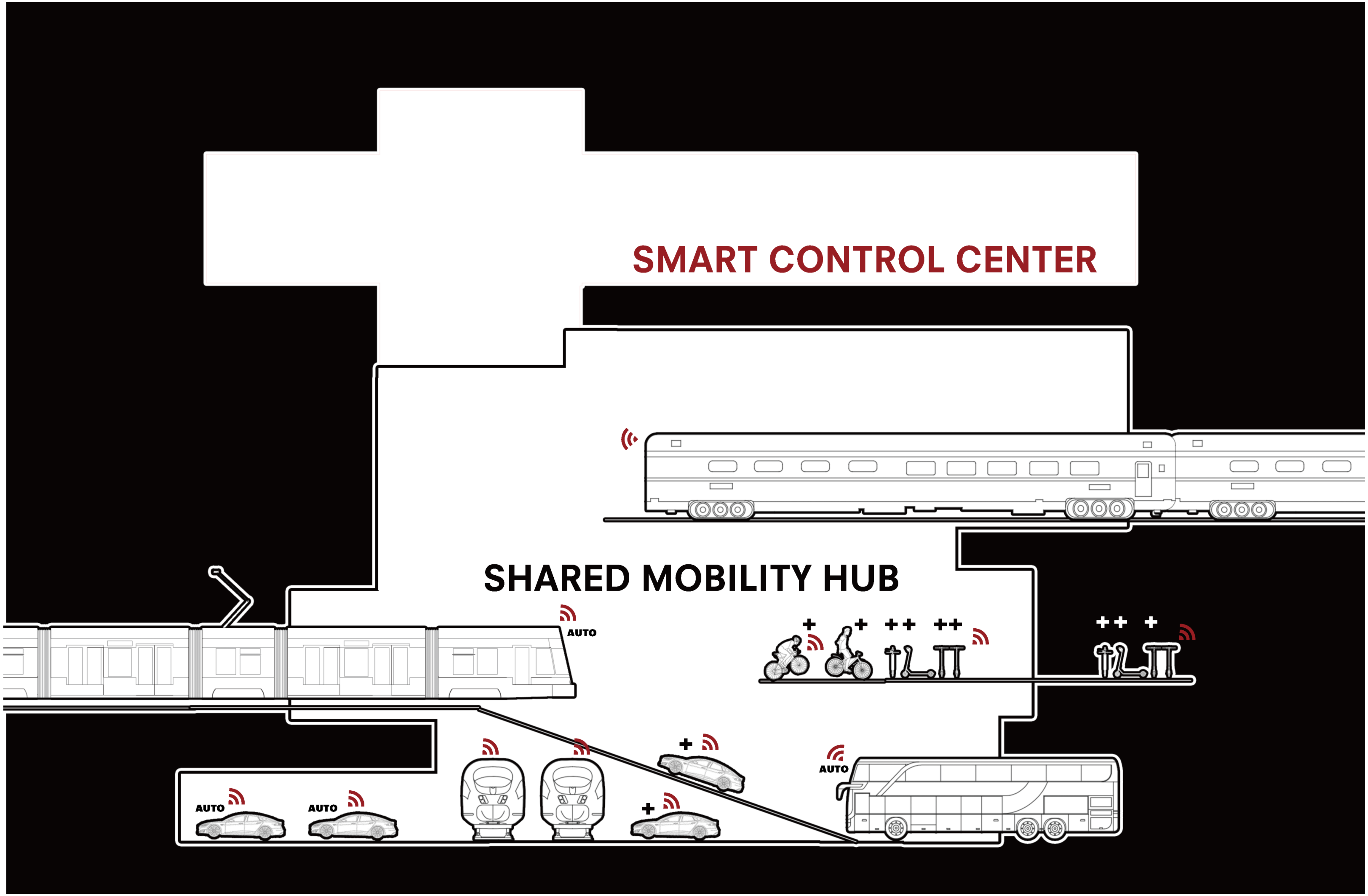


Figure 37: Massing Study


SMART CONTROL CENTER
SHARED MOBILITY HUB
AUTO
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