COMPLEX PROJECTS

TRACKS OF TRANSFORMATION

Redefining one of Berlins most historic U-Bahn stations
to accomodate to current and future needs.

Research plan & Design brief

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TU Delft

2024

COMPLEX PROJECTS
Bodies and Building Berlin
AR3CP100

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INTRODUCTION

01

Future S21 North-South connection as planned by the Berlin municipality

Development plan Urbane Mitte

1.1 Thesis Topic

Berlin is undergoing significant urban expansion, boasting a population of nearly 3.7 million inhabitants and standing as a prominent hub for innovative mobility solutions and the integration of diverse sustainable transportation options. Reflecting on the current state of innovation and digital connectivity within the transportation sector, it is challenging to conceive that merely four decades ago, during the era of the Berlin Wall, the city comprised two entirely segregated entities.

Presently, Berlin is intricately linked through an extensive rail network, primarily constituted by the pivotal rail systems of S-Bahn (Schnell-Bahn or Stadt-Bahn) and U-Bahn (Untergrundbahn). However, given the ongoing urban densification of this already populous metropolis, an expansion of this network is imperative. A noteworthy initiative in progress is the construction of a north-south connection, designated as the S21 LINK, bifurcating the existing S-Bahn ring. This new line, extending from the northern Westhafen/Gesundbrunnen to the southern Südkreuz Bhf, not only facilitates a more direct north-south linkage but also enhances connectivity between the S-Bahn network and the intricately woven U-Bahn network. This development necessitates the establishment of new stations at certain locations, with the historic site of the Gleisdreieck U-Bahn station serving as a prime candidate for the creation of a novel interconnection between these two networks through the introduction of a new station.

Moreover, the dynamics of the city's existing areas are undergoing transformations, leading to evolving station requirements or the imperative establishment of entirely new boarding points. This transformation is particularly evident in the Gleisdreieck area, where a high-density urban development plan, known as "Urbane Mitte am Gleisdreieck," has been in the pipeline since 2005. Envisaged to accommodate extensive office structures generating 3000 new jobs in the region, the plan encompasses not only office spaces but also residential constructions and further development of local businesses and tenants, with special emphasis on fostering art and culture.

The existing station, confined to serving the U-bahn in an east-west corridor, is inadequately equipped to meet the escalating demands brought about by this growth. Consequently, the burgeoning urban development mandates the establishment of a new station with broader connections to the entirety of Berlin, reaching both northern and southern districts. The additional S-Bahn station at Gleisdreieck is poised to become a pivotal node on the north-south axis of the S- and U-bahn systems. Preliminary studies for the Urbane Mitte development plan have already considered the requirements of this new station, projecting an anticipated passenger flow of 20,000 individuals per day upon the realization of the planned development.

By incorporating a new S-Bahn station into the existing U-bahn station at Gleisdreieck, endeavors are underway to meet the evolving transportation needs of the Gleisdreieck area and align with the future developments outlined in Urbane Mitte am Gleisdreieck.

Future densification of Berlin
requires a growth resistant trainstation

Planned North-South Line
connection to enhance Berlins S-Bahn ring

Urbane Mitte development plan
will ensure a large influx of users into the area

1.2 Problem Statement

The proposal to establish a new S-Bahn station in the Gleisdreieck area presents several challenges requiring resolution. The addition of a new station to an existing one constitutes an inherently complex project. The current capacity of the existing U-Bahn station is not equipped to accommodate the anticipated influx of 20,000 passengers per day upon the realization of Urbane Mitte, let alone the future demands it is expected to face.

Therefore the problem statement reads as follows: "Berlins trainstations are ageing and no longer meet our current or future needs."

Furthermore, various issues must be addressed in the design of a new station:

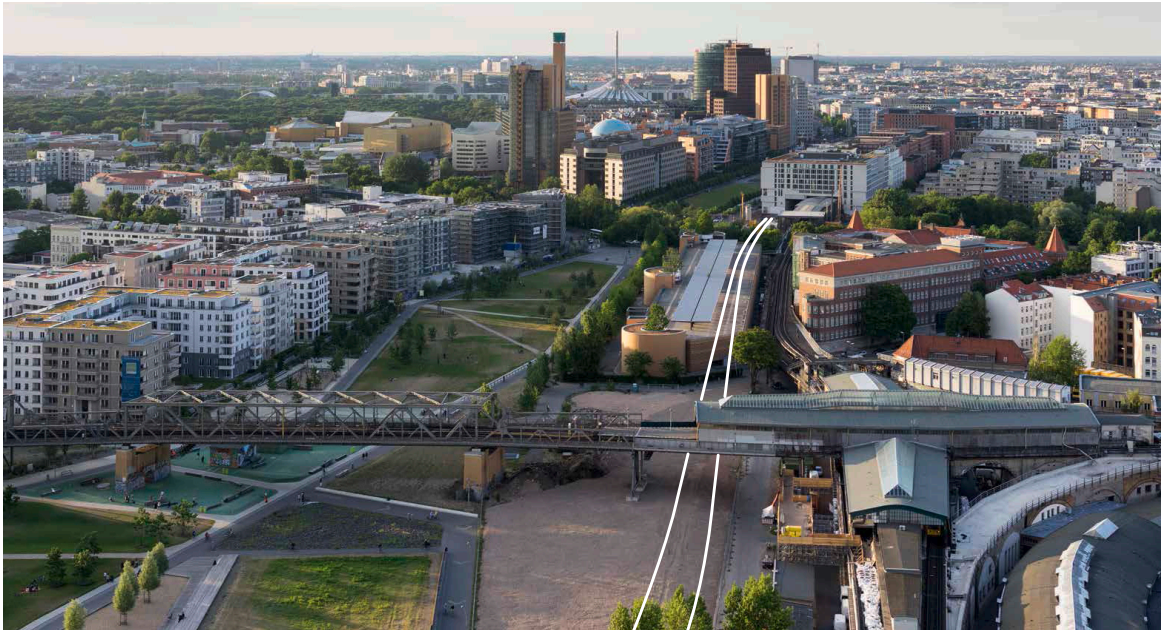
Navigating the incorporation of a north-south line into an east-west route (Infrastructure):
Given the pre-existing planned layout, the location of the new S21 line has already been designated, imposing constraints on potential future platform locations.

Adapting to changing population demands - increased congestion (Traffic):
With the implementation of the Urbane Mitte development plan, the area is poised to experience a substantial increase in visitors, necessitating a station designed to accommodate both current and future needs.

Diverse usage requirements with changing demographics (Program):
Beyond the primary function of the station, additional user requirements must be incorporated into the program to meet contemporary and future needs.

Construction adjacent to a popular park (Connection):
Park Am Gleisdreieck holds significance for the immediate community and serves as a recreational area. The station must seamlessly integrate with the park, enhancing rather than hindering access to the park and reinforcing connections with the surrounding neighborhood.

Construction adjacent to an existing station (Connection and Heritage):
The existing U-Bahn station Gleisdreieck carries monumental importance as Berlin's inaugural U-Bahn station. Consequently, efforts should prioritize the preservation of this historic structure, implementing alterations only where essential for the overall functioning of the combined S-Bahn and U-Bahn station. The manner in which



1.3 Research Question

While the identified problem statements may initially appear to constrict the design framework, considerable room for discussion remains. This research project, however, will center its focus on the new S-Bahn station, its future requirements, its integration with the surroundings, and, given its adjacency to an existing station, how this new structure will engage with the old. My investigation delves into the communication between the old and the new. The overarching question is as follows:

“How can we design resilient and adaptable train stations in the current Berlin situation to foster future mobility?”

The assignment will result in a design proposal for an S-Bahn extension to the existing U-Bahn station “Gleisdreieck” which will provide an important role in connecting the S-Bahn ring network with the U-Bahn network, while at the same time taking into account Gleisdreiecks history and preserving it.

RESEARCH FRAMEWORK

02

2.1 Theoretical framework

The theoretical framework will delineate the overarching themes of heritage, existing context, and future developments, encompassing the temporal progression from the past (was), through the present (is), to the prospective (then). This approach is crucial for elucidating the relevance of these themes in terms of how the new station can proffer novel opportunities for the existing station, the new station, and the forthcoming Urbane Mitte development. Moreover, this framework will serve as a guiding structure for informed decision-making throughout the course of both the research and the subsequent design phases of the new train station.

The Research:
The research consists of three categories: site, program and client. The conclusions from these three categories form the design brief. The design phase can then begin based on this design brief. Regarding the site, the first study assesses the viability of the chosen site for the design brief in relation to existing and future infrastructure and densification developments. It then examines the history of the area and the station, highlighting key events. After the historical investigation, the current situation is addressed, including an analysis of the existing infrastructure, surrounding functions, access roads and sightlines. For the program, the aim is to get a realistic picture of the project's requirements through reference analysis. This is achieved through benchmarking, comparing reference projects to draw conclusions about one's own program. Examples of drawing conclusions from reference projects include the number of daily users at a station, GFA, or additional features present in their programs. Finally, a research is conducted to identify the clients who will be involved in this project, analyzing their profiles and roles within the project. Based on these three categories, conclusions can then be drawn in the form of a design brief.

Ambition:
By taking a holistic approach to the design process, I want to create a new extention to the existing station that is both respectful of the past and responsive to the needs of the present and future.

To achieve this the research is structured in the following way:

Site | Current & Historic context
Studying the history of the existing station and its surrounding area to identify key architectural features and design elements that should be preserved.

Program | Current & Future needs
Explore innovative design solutions that incorporate modern materials and technologies to create a station that is both functional and aesthetically pleasing.

Client | Clients & Stakeholders
Research what stakeholders have influence on the design, who will own the building as well as the who will be using the building.

Material | Environment & Materiality
Taking into account the environmental impact of the new station and exploring ways to minimize its carbon footprint while still meeting the

2.2 Relevance

By investigating how we currently utilize our train stations, measuring this information against our future needs, answers can emerge that will enhance the train stations of the future. These improvements will impact how we design and ultimately use our train stations, thereby influencing the social scale. Additionally, this research will create an exemplary case for the professional context, serving as a reference or inclusion in the existing portfolios of train station or railway companies. On a scientific level, the approach to the design challenge is crucial. Designing a complex project requires a systematic approach that can be beneficial for other scientific projects.

RESEARCH METHODS

03

3.1 Program

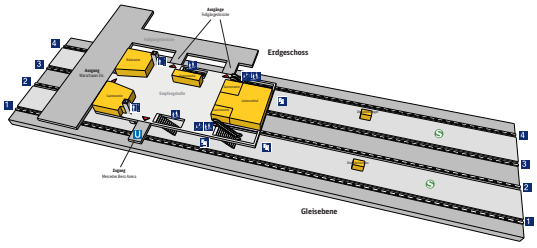
To formulate a comprehensive program, an initial step involves analyzing existing stations. These stations must possess relevant value for the prospective station under construction, enabling precise assessments across various aspects. To gain a broader understanding, it is also beneficial to explore references that deviate from the norm, thus eliminating the applicability of certain aspects to the new station. References will undergo scrutiny on various dimensions, beginning with an analysis of the station type—whether international, intercity, or regionally oriented.

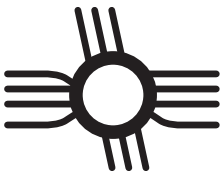
This classification is quickly linked to the types of trains stopping at the station. For instance, an international train is unlikely to halt at a regional station. This typological delineation significantly influences the program, as different train types necessitate varying platform lengths, exemplifying the pivotal role of typology in program formulation.

Additionally, the scale of the reference project is charted and juxtaposed with the project area. This comparison visually conveys the scale relationship between the project locations, aiding a more accurate assessment of the realism of the integrated program. The daily passenger count at the station is also relevant for scale and station throughput. In conjunction with station type, train type, and the consequent program requirements, this figure is pivotal in determining the circulation space needed in the new station.

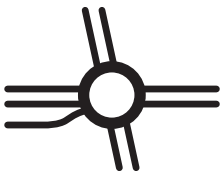
The entire program is subsequently scrutinized for functional use, culminating in a verifiable program bar. This program bar, benchmarked against other reference projects, facilitates drawing conclusions for the configuration of the program bar for the new station.

Special features of reference projects that may be applicable or comparable to the new station are also considered. For instance, the analysis of the Warschauer Strasse reference project, while potentially less intriguing programmatically, holds significant value in elucidating the connection between an existing U-Bahn station and a subsequently appended S-Bahn station. This qualitative exploration seeks answers to pertinent questions such as, “How does this intermediary space function? Does it effectively serve its purpose, and if not, what are the underlying reasons?” Such inquiries are imperative for the design of the new station, given its analogous situation.

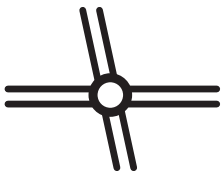




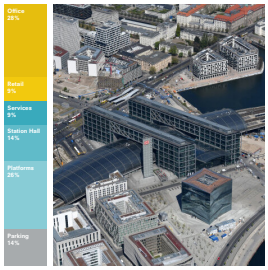
International station
Large size
International trains
Many transport options



Intercity station
Medium size
Intercity trains
Multiple transport options

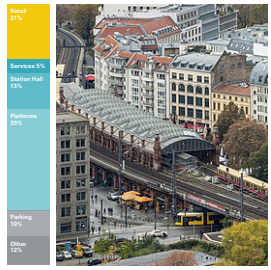


Regional station
Small size
Regional trains
Some transport options



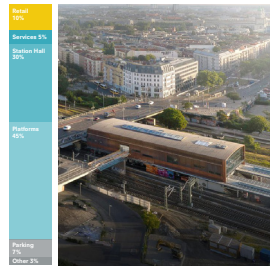
Berlin Hauptbahnhof
175.000 m²

Kind:	International station
Site:	60.000 m²
Passengers:	350.000 /day
Tracks	12
Location	Berlin, DE



Hackescher Markt
15.500 m²

Kind:	Regional station
Site:	10.900 m²
Passengers:	230.000 /day
Tracks	2
Location	Berlin, DE

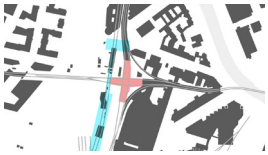


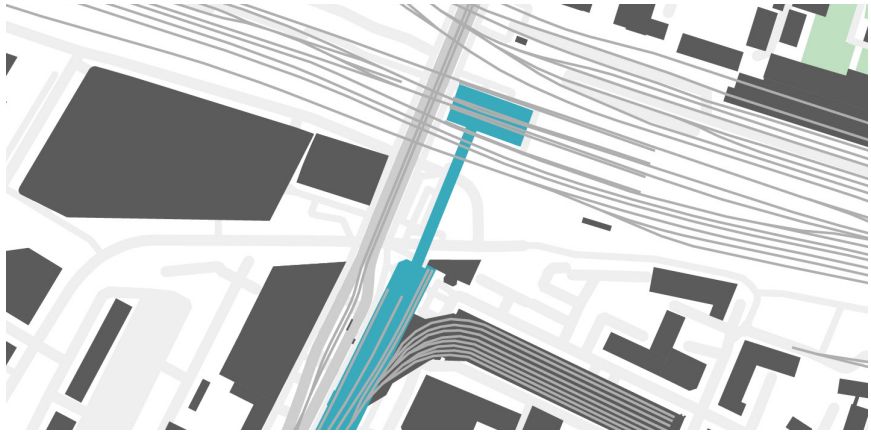
Warschauer Straße
11.000 m²

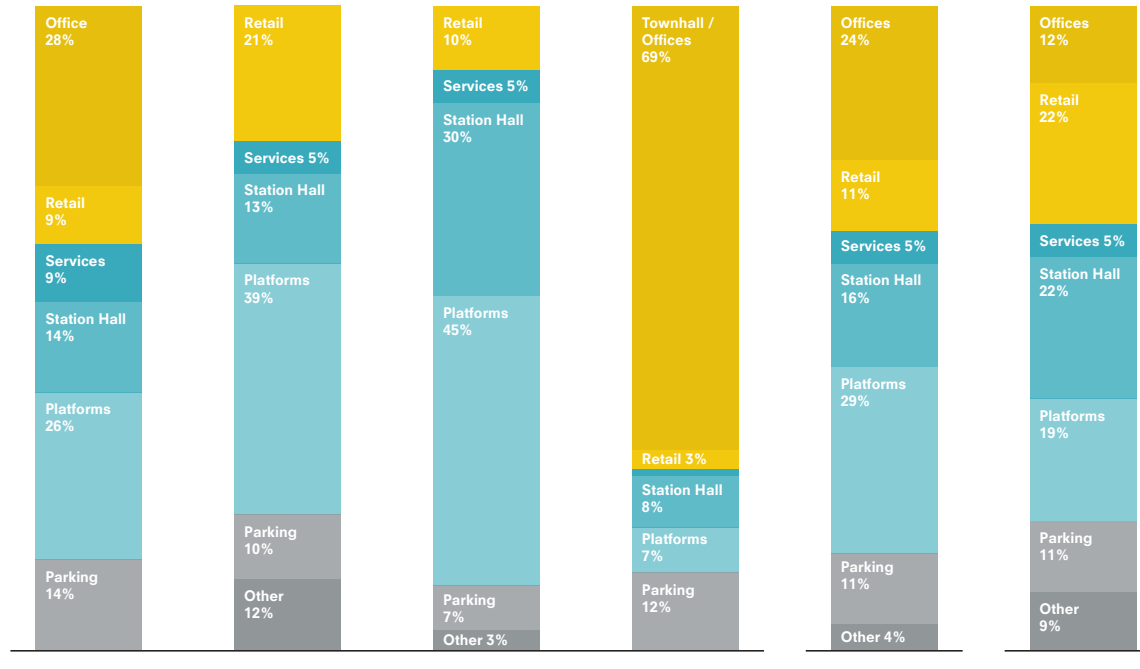
Kind:	Regional station
Site:	8.800 m²
Passengers:	85.000 /day
Tracks	6
Location	Berlin, DE

Delft Station / Townhall
28.320 m²

Kind:	Regional station
Site:	9.800 m²
Passengers:	31.700 /day
Tracks	4
Location	Delft, NL







3.2 Client

The client component can be subdivided into several distinct categories, encompassing both end-users and stakeholders involved in project development. The client as end-users can be examined through three distinct lenses:

Pass-Through Travelers
Destination Travelers
Non-Travelers (Visitors and Locals)

Concurrently, the client as a part of project development can be further categorized into three distinct roles. These include:

The Initiator (the party with an interest in initiating the project)

The client (essential collaborator in sustaining the project, such as the owner of the rail and stations)

Funder (examining the financial dynamics within the project, potentially involving the territory owner or the railway company seeking profits from a new station).

3.2 Site

Determining the location necessitates an initial analysis of the pre-existing railway network or the comprehensive public transportation network of Berlin. This approach enables the extraction of the network's operational dynamics, leading to conclusions regarding potential bottlenecks. Exploring any ongoing development projects serves not only as an intriguing reference for identifying a location but also as a means to directly relate to one of these new project lines.

Furthermore, I investigate areas undergoing substantial transformations, where rapid utilization is anticipated, thereby necessitating adjustments or new stations to meet the emerging demand. This involves examining locations marked by extensive residential or office developments poised to bring about significant shifts in area utilization.

Pass-Through Travelers:

- Individuals using the station as a transfer point.
- Not staying in the station for an extended period.
- Often have connecting trains or transportation to catch.

Destination Travelers:

- Those whose final stop is the train station.
- Either arriving at or departing from the station.
- May have longer stays compared to pass-through travelers.

Non-Travelers (Visitors and Locals):

- People who visit the station for reasons other than travel.
- Includes tourists exploring the station's significance, locals using it as a meeting point, and those using its retail and dining options.

The new S21 connection from North to South is depicted in red, with the existing S-Bahn network highlighted in purple, accentuating the Ringbahn. In orange, a prospective development area is illustrated, signifying a potential location for a new or expanded station.

DESIGN BRIEF

04

4.1 Program

Based on the program study, several program conclusions can be drawn:

Station Type:
The station typelogy will be a consist of Regional characteristics, resulting in an S and U-Bahn station. The station will feature 2 S-Bahn platforms, with the potential for expansion to 4, while retaining the existing 4 U-Bahn platforms.

Train Types:
The new station will accommodate, S-Bahn, and U-Bahn trains while proactively preserving space for potential future integration of longer Intercity (IC) trains by having an extended platform of 175m instead of the required 160m which is usual to accomodate for the 140m long S-Bahn trains.

S-Bahn:
Kind: Train
Sort train: Urban rapid transit
Region: Berlin city ring and surrounding districts
Operator: Deutsche Bahn

U-Bahn:
Kind: Subway
Sort train: Urban rapid transit
Region: Berlin city center and surrounding districts
Operator: BVG (Berliner Verkehrsbetriebe)

By employing benchmarking and projecting reference projects onto the project location, it can be estimated that the new train station should have a Gross Floor Area (GFA) of 40,000m2, accommodated within a plot of 24,000m2. This calculation includes the existing U-Bahn station Gleisdreieck.

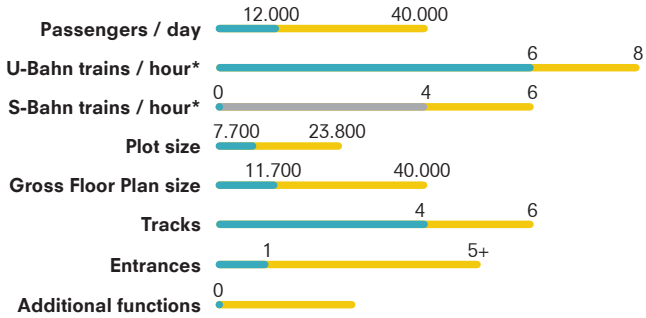
Passenger Volume:
Research from the Urbane Mitte development project estimates a minimum of 20,000 passengers using the adjacent station. However, based on benchmarking reference projects and future growth possibilities, this figure is conservatively set at 40,000 passengers per day to ensure future resilience.

General Program:
Drawing from benchmarking and program analysis of reference projects, an initial program organization can be outlined, providing an overview of the station's general program, including the existing U-Bahn station Gleisdreieck.

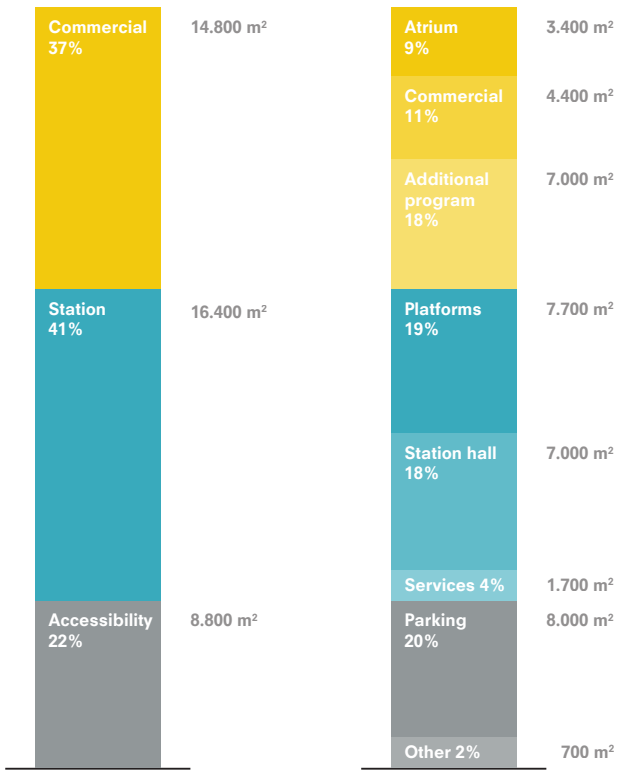
S-Bahn
New

U-Bahn
Existing

PROGRAM REQUIREMENTS



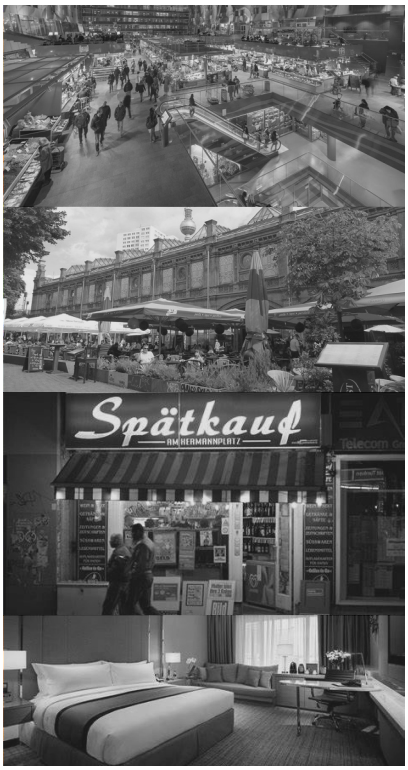
KEY SPACES

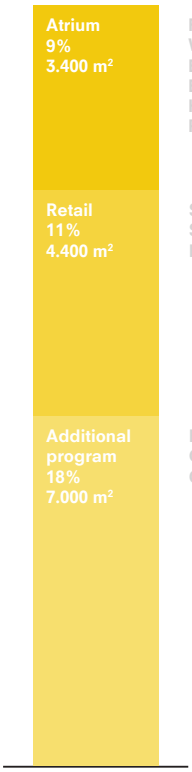


Program total
40.000 m²

4.1 Program

COMMERCIAL PROGRAM





Atrium 9% 3.400 m²	Foodcourt	400 m²
	Workshop	400 m²
	Expo entrance	100 m²
	Event space	300 m²
	Hospitality	1000 m²
	Public facilities	80 m²
Retail 11% 4.400 m²	Shops	600 m²
	Supermarket	700 m²
	Hospitality	1000 m²
Additional program 18% 7.000 m²	Hotel	4000 m²
	Offices	2000 m²
	Club	500 m²

Commercial program
14.800 m²

STATION PROGRAM

Platforms 19% 7.700 m²	Tracks	3000 m²
	Platforms	2400 m²
	Platform shops	240 m²
	Trainline office	200 m²
	Maintenance facilities	50 m²
	Waiting space	70 m²
	Ticketvending	6 m²
Station hall 18% 7.000 m²	Entrances	120 m²
	Information booth	60 m²
	Ticketvending	10 m²
	Waiting space	40 m²
	Station café	100 m²
	Retail	780 m²
Services 4% 1.700 m²	Public facilities	160 m²
	Luggage storage	50 m²
	Travel information	100 m²

Station program
16.400 m²

ACCESSIBILITY PROGRAM

Parking
20%
8.000 m²

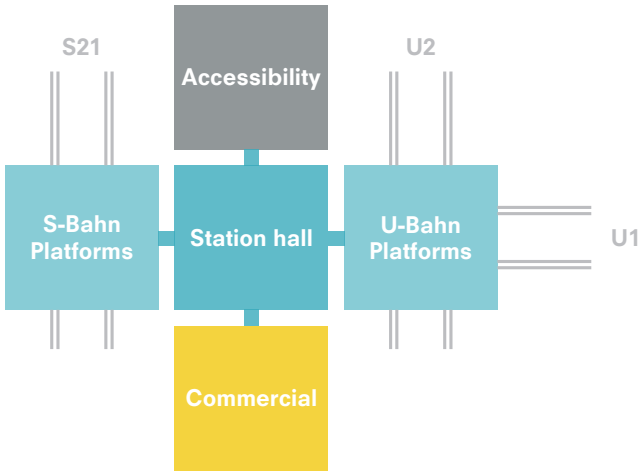
Bike parking	4000 m²
Car parking	3000 m²
Personel car parking	300 m²
Shared mobility	400 m²
Bike mechanic	300 m²
Bike renting	300 m²
Bike parking office	50 m²

Other
2%
800 m²

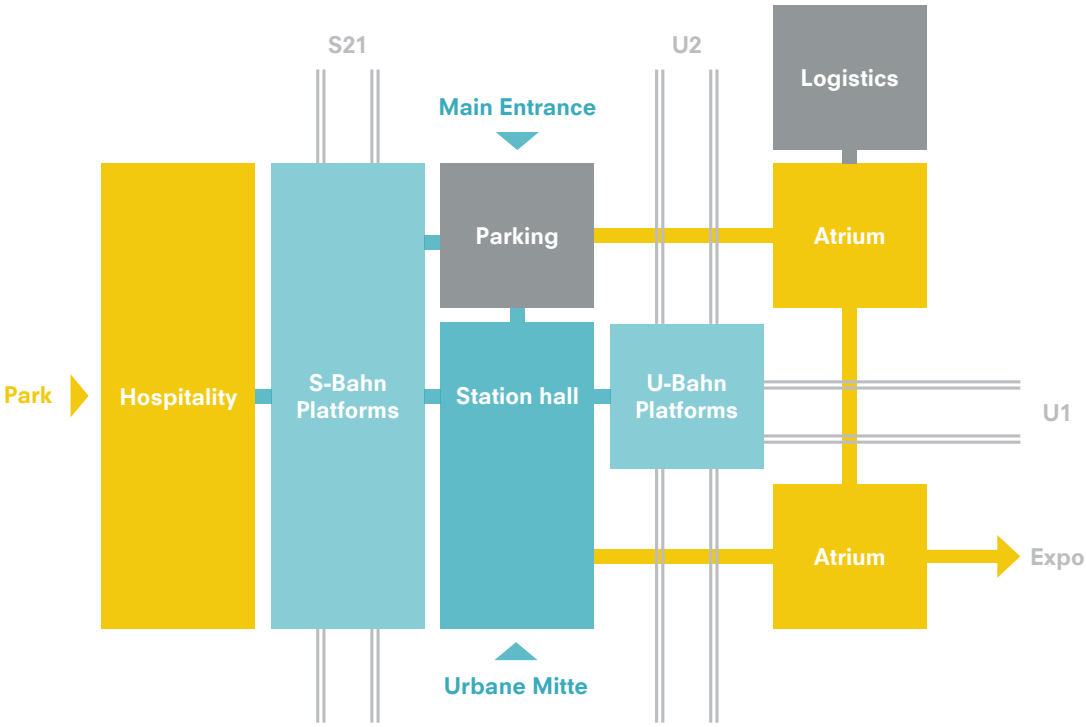
Logistics	400 m²
Storage	200 m²
Personel facilities	100 m²

Accessibility program
8.800 m²

PROGRAM ORGANISATION

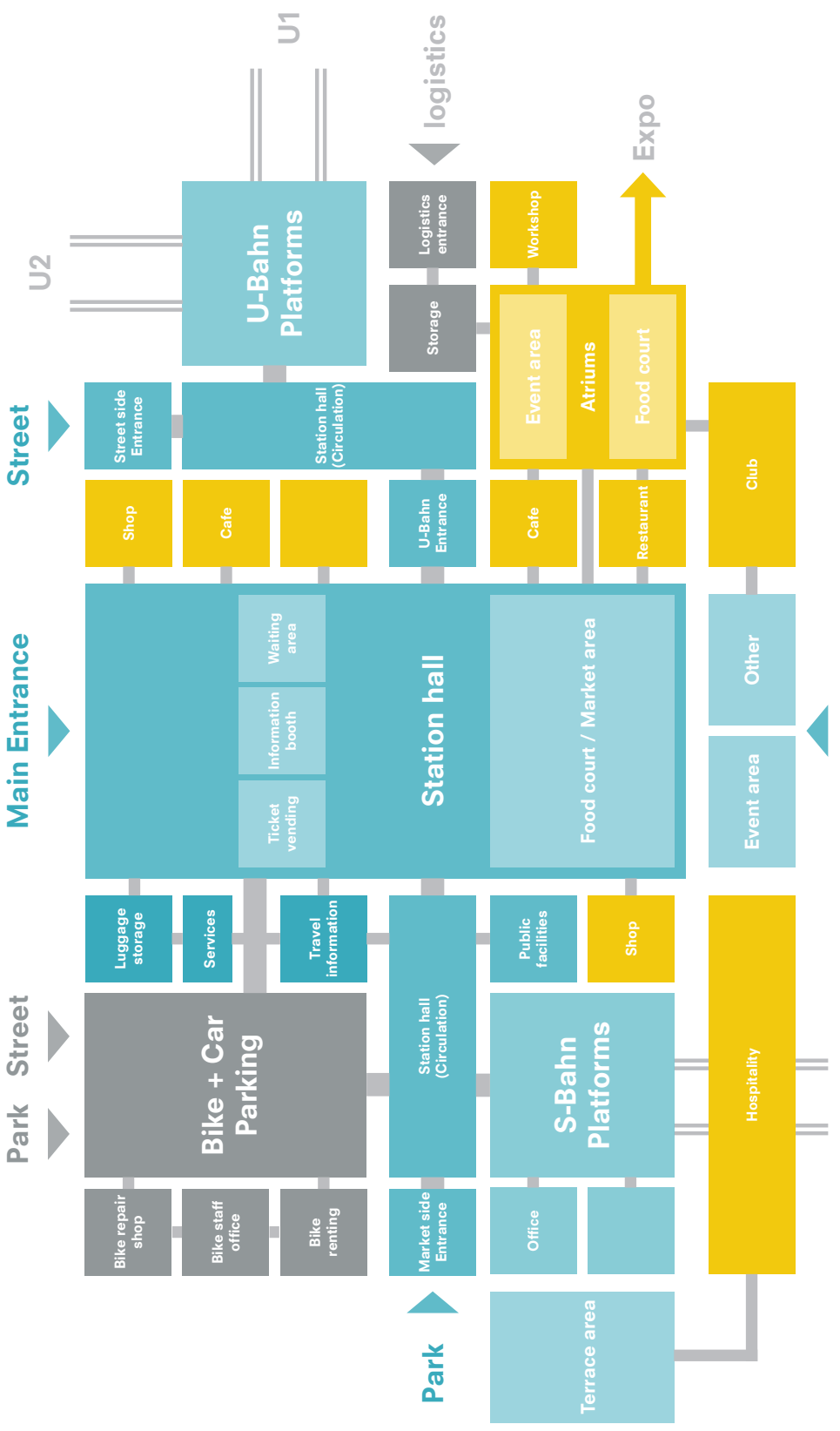


Station hall as main connecting element



Connecting station with context and creating atriums

4.1 Program



Specifying function relations

MAIN INITIATORS

Bundesministerium für Verkehr, Bau und Stadtentwicklung

German federal government

BERLIN

Berlin municipality

Funding transport and infrastructure

RAILWAY CLIENTS

DB

Deutsche Bahn

BVG

Berliner Verkehrsbetriebe

Owner and manager of railway infrastructure

STAKEHOLDERS

URBANE MITTE
AM GLEISDREIECK
Development Network

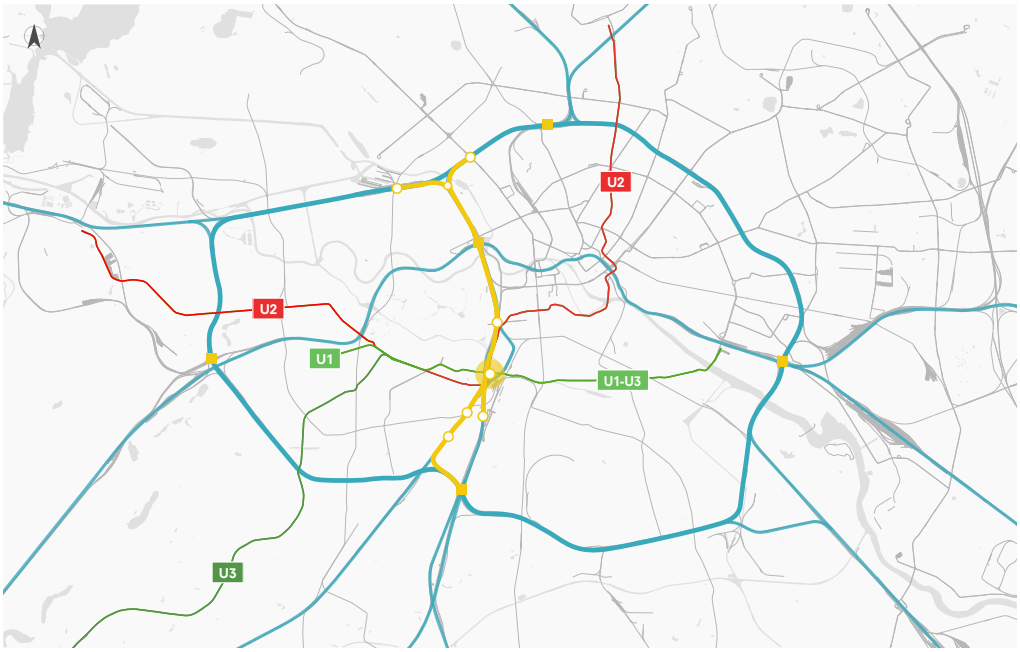
Urbane Mitte Development Network

STATION BERLIN

STATION Berlin Expo

Connecting businesses and activities

CONNECTION FOCUS

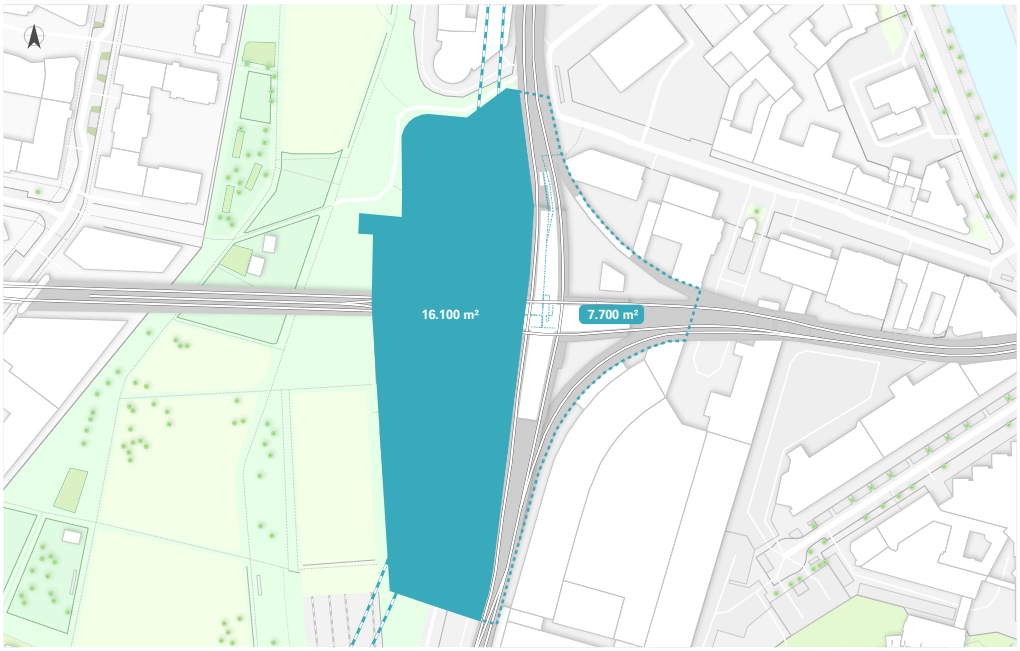


L I Future north-south connection

FUTURE S21 LINE

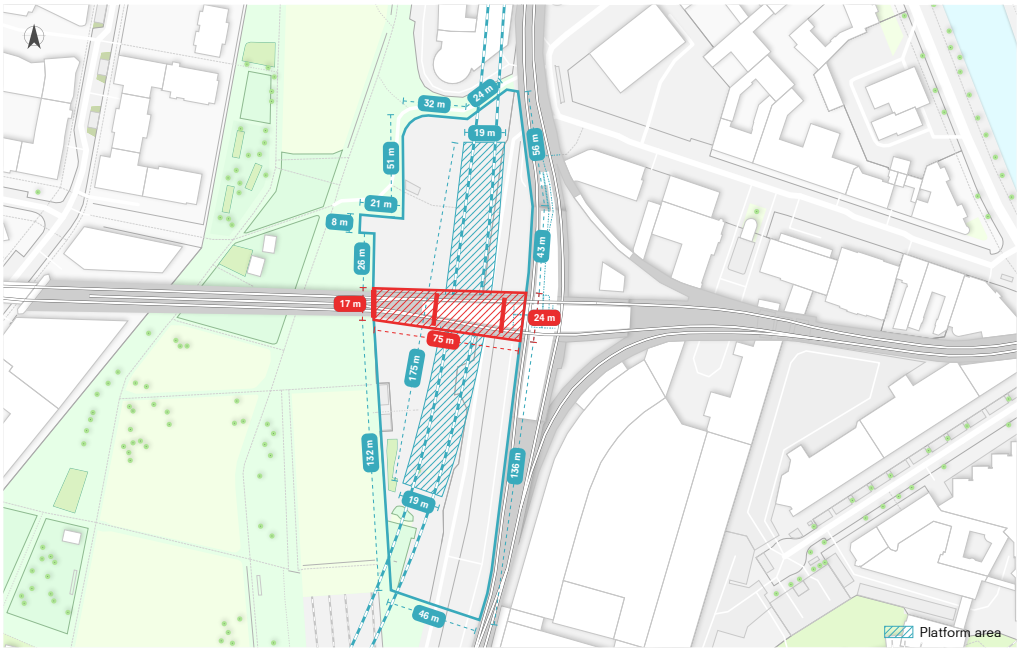
M I Site situation

AREA OF FOCUS



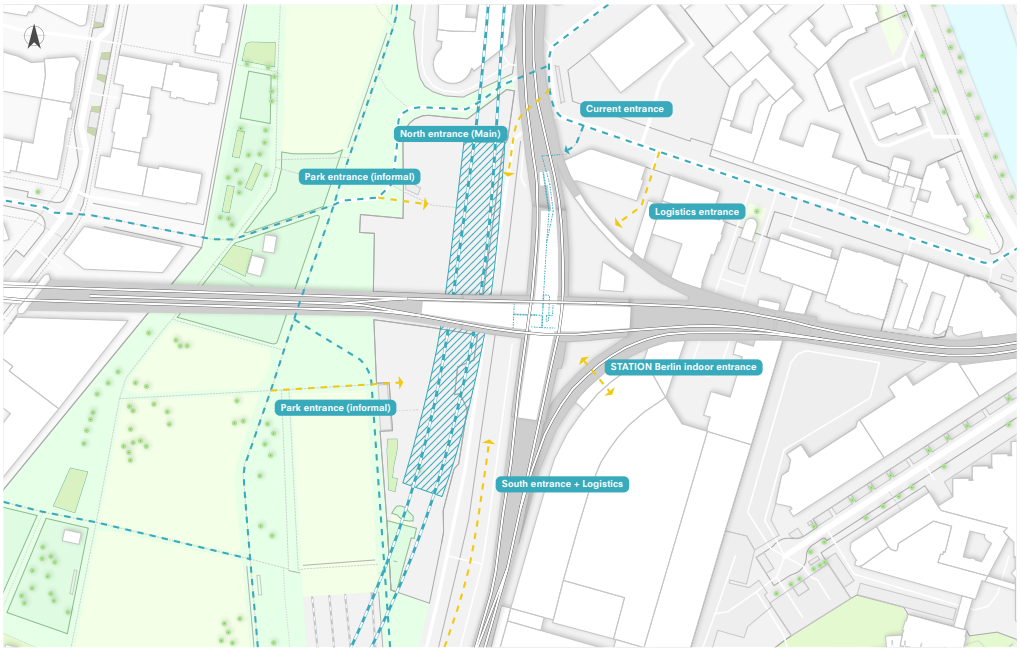
S I Plot **PLOT I** 24.400 m²

PLOT CONSTRAINS

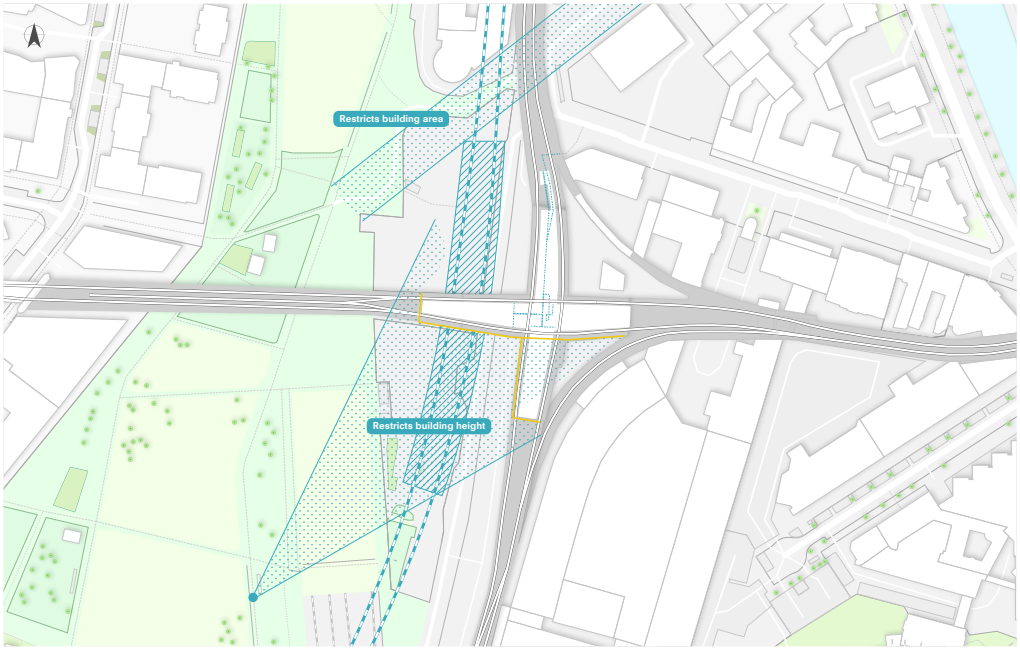


S I Plot constrains **GFA I** 40.000 m² **PLOT I** 24.400 m² **FSI I** 1.64

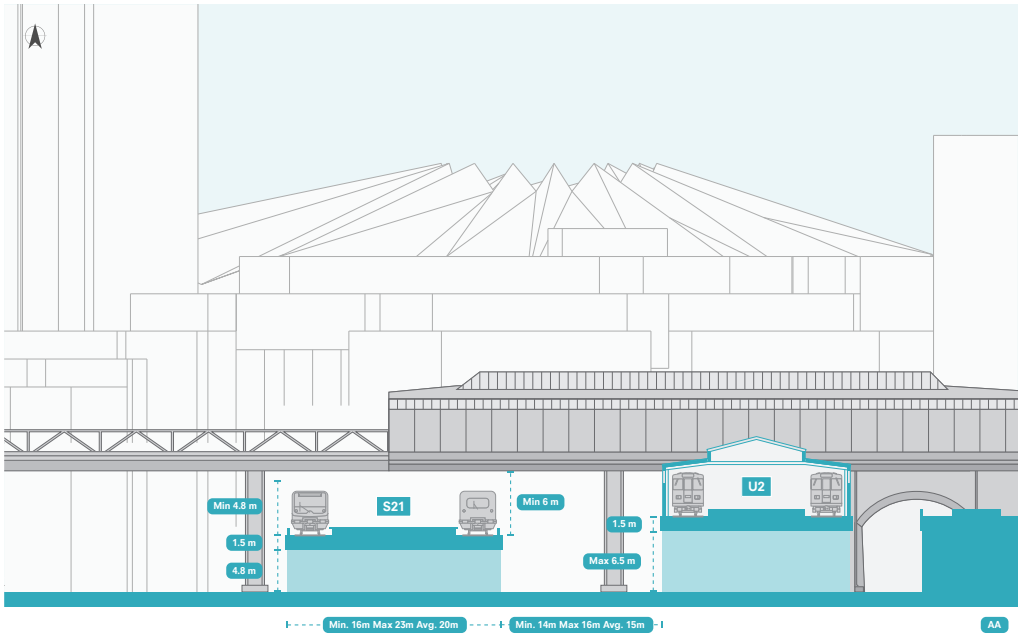
ROUTING OPTIONS



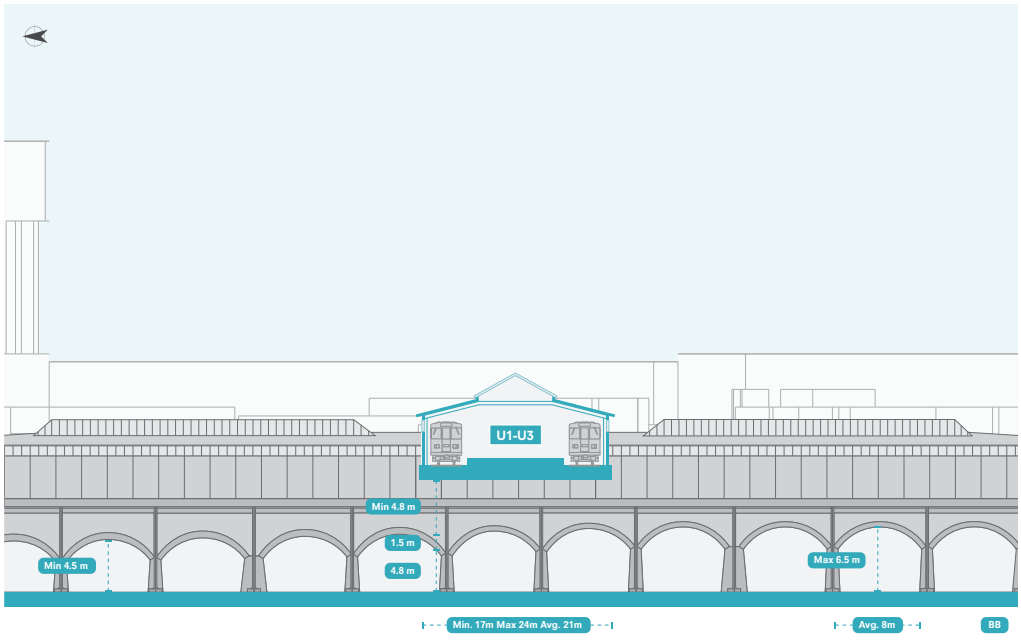
SIGHTLINES OF IMPORTANCE



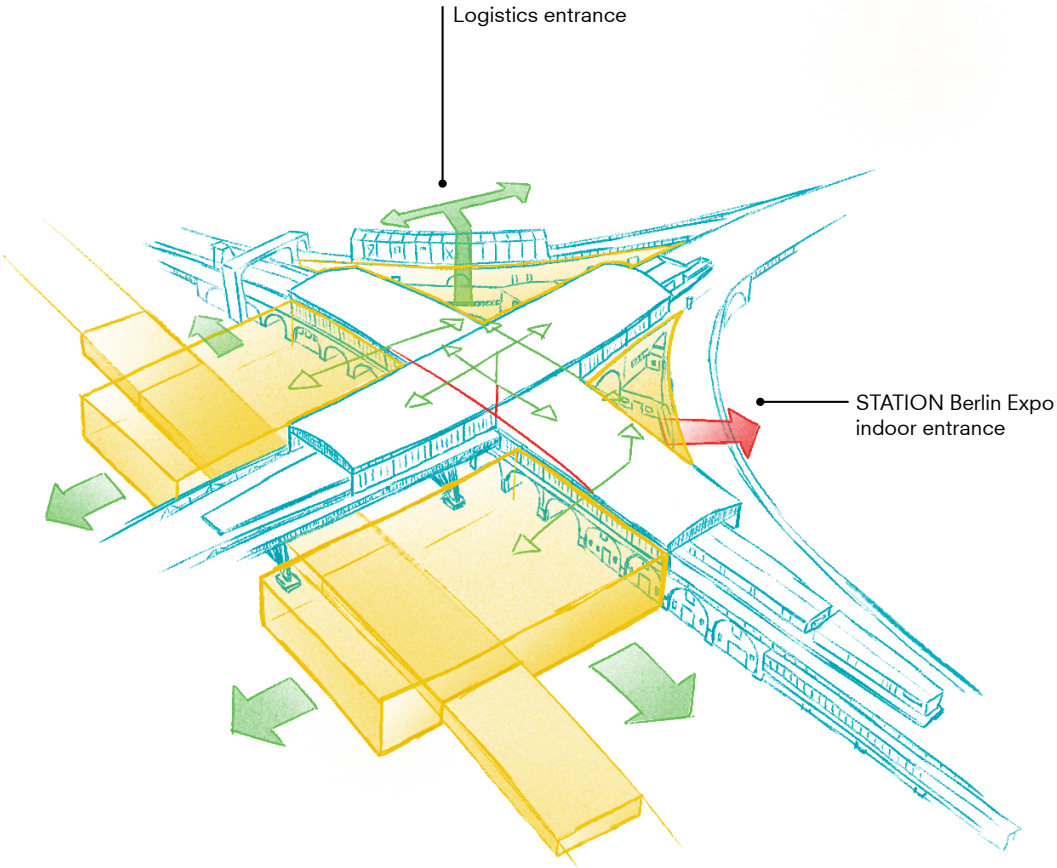
SECTION AA | RESTRICTIONS



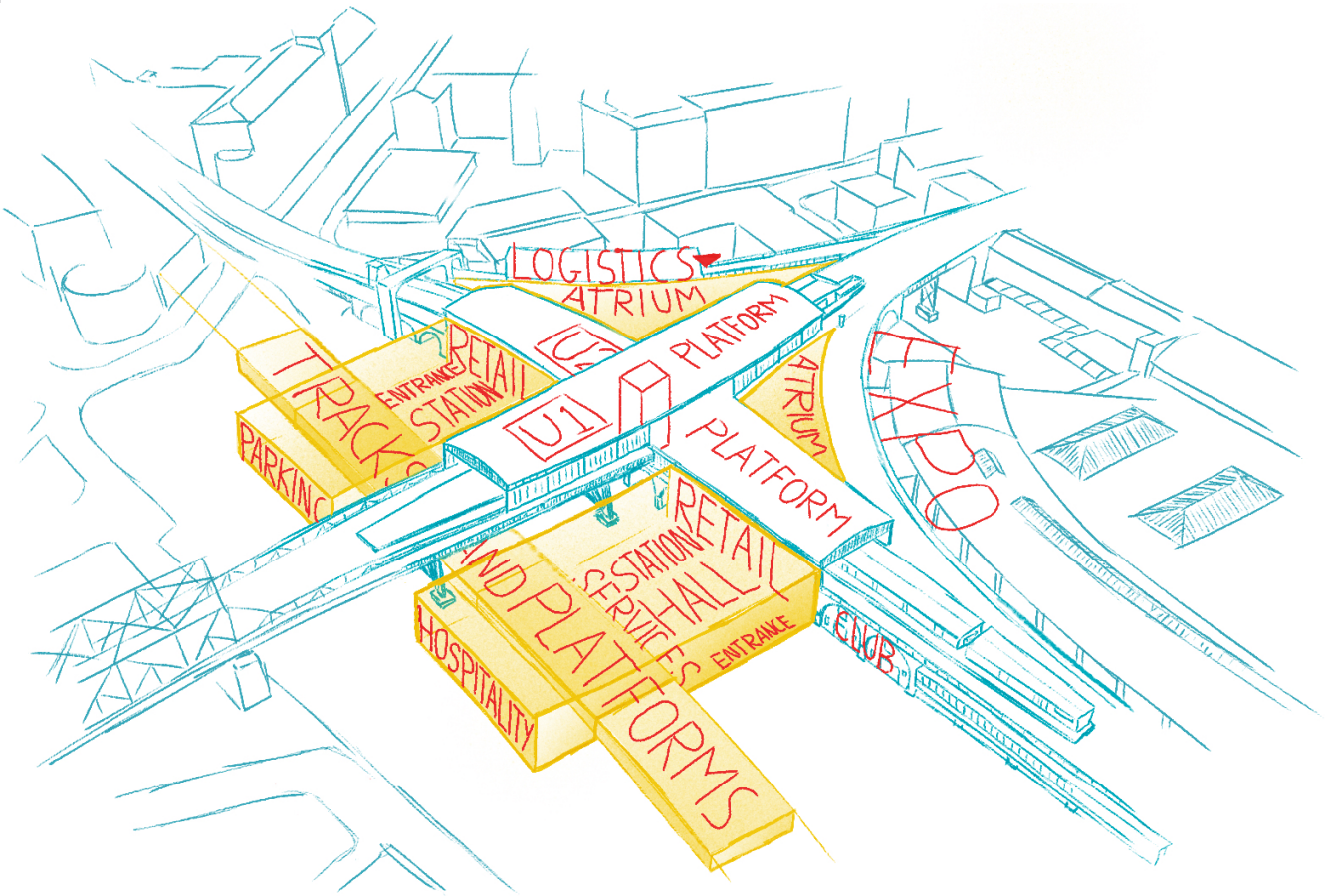
SECTION BB | RESTRICTIONS



MASSING | ACCESSIBILITY



MASSING | PROGRAM ON SITE



APPENDIX

05

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