TEAM KEYLINE, CU BOULDER MENV 2024

Vasbyhave, Copenhagen



C40 CITIES Students Reinventing Cities

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Introduction

In the heart of Copenhagen, a city renowned for its commitment to sustainability and livability, lies a unique opportunity to redefine urban space—a chance to transform an **industrial site** into a **vibrant green space** that enriches the lives of residents and visitors alike. In Copenhagen, a former rail yard area is being transformed into a green and thriving neighborhood with 9,000 residents and 4,000 jobs over the next 15 years.

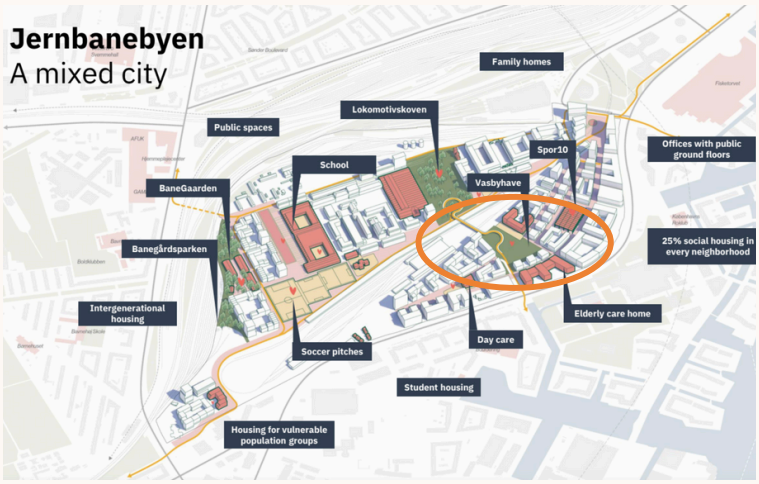
The area, **Jernbanebyen**, is a world-leading example of how to promote health for people & the planet through urban planning and design. The project takes an evidence-based approach to healthy neighborhood development, focusing on urban interventions for diverse ages, incomes, and backgrounds. The interventions focus on facilitating easy access to healthy and affordable food options as well as providing accessible opportunities for physical activity. Furthermore, the project emphasizes the creation of social infrastructure to foster deeper social connections and support overall mental health.



Jernbanebyen aerial image.

Vasbyhave, a one-hectare park, is part of the 9-hectare first phase of development and represents an incredible opportunity to test health interventions at the neighborhood scale with a special focus on **intergenerational uses**. As one of the few remaining undeveloped areas in the city, its preservation as a green, public space is not merely a luxury but a necessity—an essential component in maintaining the city's livability and comfort amidst rapid urbanization.

In a city where space is at a premium, the need to balance the demand for housing and infrastructure with the preservation of green areas is paramount. Yet, it is precisely within these challenges that the true potential of Vasbyhave emerges—an opportunity to create a park that not only promotes **physical activity** but also cultivates moments of **calm and tranquility** amidst the hustle and bustle of urban life.



Jernbanebyen site plan.



Moreover, the park links the neighborhood to the harborfront in Sydhavn and establishes a connection between the east and west in the southern part of Jernbanebyen. As Vasbyhave connects to existing green corridors and parks (Lokotivmotivskoven), it creates pathways for **exploration** and **connection**, inviting residents of all ages and backgrounds to engage with their surroundings in meaningful ways.



Image of green coherence.

Also central to the creation of Vasbyhave is the promotion of **planetary health.** Through climate adaptation measures, such as stormwater management, the site can mitigate the impacts of climate change while simultaneously enhancing the biodiversity, ecosystem services, and resilience of the community.

In alignment with Vasbyhave's identity and intention, our vision statement, along with the C40 and ARUP design principles, guided the decisions and actions for our **stacked functions** addressing the site priorities for Jernbanebyen.

Vision:

Our **vision** is for Vasbyhave to be a place of health, vitality, and connection for intergenerational uses that boosts climate **resilience** and **biodiversity** through nature based adaptation measures

Vasbyhave Site Priorities:

1. Promote health of people & planet

2. Focus on the diverse user groups, creating intergenerational meeting points and enhancing inclusivity

3. Boost climate resilience & biodiversity



A rendering of the park's ariel view

Design Principles

In order to address the main objectives of this green space in Vasbyhave, it was critical to follow the **10 C40 Cities** and ARUP principles for Green and Thriving Neighborhoods (Chartier, Hélène, et al. 7). The two main pillars of this site design are net zero emissions and thriving, resilient, and people-centered places. This site design primarily follows the second pillar, though the nature-based solutions proposed in this design do effectively sequester carbon. Three of the main design principles that guided the designs for this site are **connected places, place for everyone, and climate resilience**.



A rendering of the park's connected spaces.

The strategies and design solutions for Jernbanebyen followed in accordance with the 15-minute city urban model. Many priorities were considered for this site, but the primary focus is on ensuring equal access to high-quality green spaces through promoting **health** for people and the planet, focusing on **diverse and intergenerational** user groups, and boosting **climate resilience and biodiversity**. Furthermore, promoting **inclusivity** was at the forefront of decisions so that all residents and visitors of this site could access the services and spaces needed, which in return fosters connectedness and activates community engagement. Given the location of the park within Vasbyhave, it connects people to the rest of the neighborhood and Copenhagen beyond. There are many bike and walking paths, roads, and access to public transit available throughout Jernbanebyen and across Copenhagen to keep people **physically and digitally connected.**



(ReNew Orleans, 2023)



Action Plan

Stacked Functions

Our proposed systems serve multiple functions that align with the principles of connected places, a place for everyone, and climate resilience. **Sound barriers, windbreaks, and stormwater management** mitigate noise pollution, enhance comfort, and promote sustainable water practices. A **green amphitheater and events programming** provide spaces for community gatherings and diverse activities, fostering social connections and engagement. **Nature parks and biodiversity** conservation offer recreational areas that support ecosystem health and resilience. Meanwhile, a **green corridor** connects urban areas, promotes mobility, and mitigates urban heat island effects. Each system embodies stacked functions, addressing multiple design principles simultaneously to create vibrant, inclusive, and sustainable environments.

	**Sound Barriers, Windbreaks, and Stormwater Management**
	**Green Ampitheater and Event Programing**
	**Nature Park & Biodiversity**
	**Green Corridors and Urban Heat Island Management**

Sound Barriers, Windbreaks, and Stormwater Management

Vasbyhave Park is designed to withstand Copenhagen's various climate challenges, including **heavy rain, snowstorms, strong northwesterly winds, and noise** from surrounding roads. Keyline Design provides a framework for **effective and resilient water management** at the core of the park **to build resilience to these issues simultaneous..**

Keyline Design is a design framework that enhances ecosystem services to build resilience to climate hazards and noise pollution. Bioswales, berms, retention basins are strategically placed to channel, store, and infiltrate stormwater, **reducing erosion, flooding, and reliance on expensive gray infrastructure.**

Leverage existing infrastructure features like paths and roads as water management earthworks, using them to channel water slowly (at a 1% slope) from dry portions or the site to wetter areas, or to channel water overflowing from street side retention basins toward the central amphitheater. **Locate retention basins and bioswales on either side of paths**, then densely plant locally relevant trees such as linden, hawthorn, maple and oaks along the sides to create "avenue plantings." These plantings provide cooler temperatures, increased biodiversity, and wind and sound protection.

We recommend excavating soils along the sides of the paths and in open sections of the site **to create more water catchment area, and for the construction of the bridge**. Plant trees in and around the basins to passively harvest abundant stormwater from cloudbursts and provide ecosystem services, and on contour along the side of the bridge.

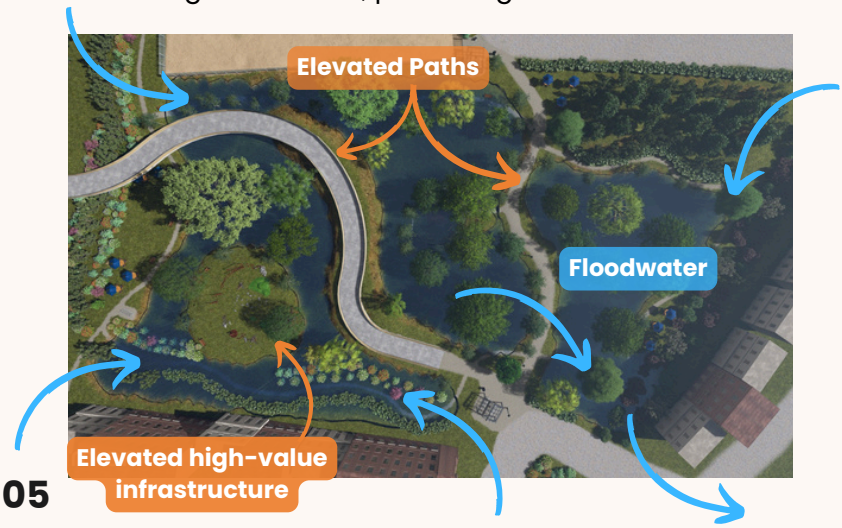
Plant trees with short shrubs on the windward side of tall trees to create "ramps" that deflect wind over the park. **These dense plantings reduce wind speed and dampen sound simultaneously.**



Short shrubs windward of tall trees create wind ramps

We recommend using the Miyawaki method, inspired by natural ecosystems to establish **fast-growing urban green spaces.** This approach densely plants native saplings just 2-3 feet apart to create windbreaks and sound barriers. These forests mature 10x faster, are 30x denser, and boast 100x more biodiversity than traditionally planted forests. Requiring minimal maintenance after establishment, Miyawaki forests offer a **fast and effective solution for stacking functions to build urban climate resilience.**

Basins designed to flood, protecting elevated infrastructure



Sound Barriers, Windbreaks, and Stormwater Management

Case Study

Keyline Design in Action: Ridedale Permaculture Farm in Sweden (59° North) exemplifies Keyline Design's success. By **adapting the method to local conditions,** they reduced wind and snow, created site and sound barriers, and boosted biodiversity, water quality, and carbon capture.



Keyline at Ridgedale Permaculture Farm in Åsen, Sweden

Low-Maintenance Design and Adaptive Management: The park is designed for **efficient maintenance.** Parallel tree lines spaced according to the width of mowing equipment minimizes oddly shaped, hard-to-manage grass areas. Weeding around young trees (years 1-3) can be integrated into community programs. Heavy mulch further reduces weeding needs. After establishment, maintenance focuses on thinning and the occasional removal of dead trees for optimal windbreak and sound barrier function.

Natural Filtration and Flood Control: Planted swales and basins capture runoff from roads, roofs, and pavement, preventing erosion and eliminating the need for expensive flood control infrastructure. The plants' roots absorb the water, **reducing flood risk and enhancing ecosystem services**. However, prior to infiltration, **the site must be tested** for railroad contamination and potential saltwater intrusion from standing water. If contamination is found, trees should be planted on berms instead of in basins.



A Holistic Approach for Vasbyhave: The Vasbyhave design offers a comprehensive solution that addresses multiple challenges simultaneously while providing a range of benefits to the Jernbanebyen neighborhood and Copenhagen as a whole.



A rendering of a Miyawaki forest planting in Vasbyhave



Green Amphitheater

To provide a multifunctional event space for the community and a piece of green infrastructure to enhance flood resilience, we propose developing a recessed green amphitheater in the center of Vasbyhave. This small amphitheater at the center of the park provides an easily accessible venue for public events and **small local performances** that may be otherwise too small to host at other outdoor venues in the city. Bellahøj Outdoor Stage is a nearby example of a much larger outdoor music venue; the Vasbyhave amphitheater would work to complement existing venue assets like this at a much smaller scale.

This recessed amphitheater serves as a detention basin that can **withstand periodic flooding**, and works as part of a keyline design system across the park which we will expand later in our action plan. Recessed construction also creates a more intimate sense of place for this theater, allowing visitors momentarily to escape the urban skyline.

This amphitheater is also intended to be used as a regular gathering place for the nearby **daycare and elderly care home**, providing a venue for **outdoor lessons** and other activities.



Example photo of a similar green amphitheater



Rendering of the ampitheater during normal use



Rendering of the amphitheater during a flood event





Event Programming

A robust programming directive should be implemented to achieve the most benefit from this relatively small park site. This programming could be managed by a local community organization, the long-term operations team for Jernbanebyen, or another authority with a vested interest in the success of the neighborhood. Programming priorities for Vasbyhave would focus on **mental health activities** such as yoga, group exercise, or tai chi. This programming should be freely open to the public, or available at a small fee with options to waive fees for low-income participants.



Event programming could take place in the green amphitheater or elsewhere in the park as appropriate, and all events should focus on increasing **intergenerational participation and diversity**.

Outdoor workshops for continuing education and nature-based education should be included in this programming, to build on the natural education work done by the City of Copenhagen. Outdoor event programming provides an opportunity for education and mental health activity for all ages.



Example of mental health acitivity



A rendering of bike parking and seating areas.

Nature Park & Biodivserity

In our endeavor to integrate themes of increasing biodiversity and fostering **intergenerational connections** within the park, we're committed to a multifaceted approach that merges ecological stewardship with recreational and educational opportunities.

Biodiversity Support

One of our prominent priorities lies in nurturing habitats conducive to sustaining diverse wildlife species native to the region. By providing essential resources such as food and nesting sites, we aim to increase ecological value and promote **thriving ecosystems**. By embracing native plants, we will enhance the park's resilience to the impacts of climate change, fortifying green spaces against environmental adversities.

Furthermore, our focus on pollinator support through strategically cultivating plants that attract **pollinators** not only enhances plant biodiversity but also ensures food security, vital for the ecosystem's equilibrium. These initiatives are seamlessly integrated throughout the park, with special emphasis within the designated nature park.

Nature Park

At the heart of our design is a commitment to fostering play, exploration, and intergenerational connections; **ten percent** of children in Denmark go to forest school, which is increasing in Nordic countries. The inclusive learning garden design ensures that visitors of all ages can engage with the natural world and learn about various topics such as native plants, animals, the history of the Vasbyhave site, etc.



Example of inclusive learning garden design.

This plan provides adequate seating through permanent picnic tables and chess tables with chairs and benches. Moveable tables will be added to foster educational and creative workshops within the nature park.



Example of kids nature park.



Example of pollinator plants.

Nature Park & Biodivserity

Tangible gardens and accessible play areas with various plants, rocks, and trees provide **sensory-rich** experiences, fostering a deep connection with nature. We aim to incorporate numerous **educational opportunities** for all ages, with informative signs, interactive exhibits, and programming offering insights into plants, ecosystems, and the park's rich ecological heritage.

Additionally, we aim to incorporate local and **cultural art**. There is an opportunity for a partnership with local artists to help design the space, including installing sculptures or other Norwegian woodworking displays. Another idea is to partner with local schools and senior facilities to implement community art. This area will additionally be conducive to all types of recreational activities such as picnics, birdwatching, and nature walks, further enriching the visitor experience and encouraging **exploration** and appreciation of the park's natural wonders.



Example of interactive exhibits.



In summary, our vision for the park seamlessly weaves together biodiversity support, intergenerational connection, and green, **nature-based solutions**. By prioritizing habitat restoration, pollinator support, and climate resilience alongside play, exploration, and education, we aim to create a vibrant, inclusive space that enriches lives, nurtures ecosystems, and inspires a deeper appreciation for the natural world.

In our endeavor to integrate themes of increasing biodiversity and fostering intergenerational connections within the park, we're committed to a multifaceted approach that merges **ecological stewardship** with recreational and educational opportunities.



Example of wooden troll and local art.



Green Corridors and Urban Heat Island Management

The approach to Vasbyhave as a **green corridor** embraces a multifaceted strategy aimed at enhancing both environmental **resilience** and **community well-being**. Recognizing the pivotal role that vegetation plays in mitigating urban challenges such as air pollution and extreme heat, by strategically integrating vegetation into the corridor, Vasbyhave can become a natural air filter, purifying the surrounding atmosphere by removing pollutants and particulate matter. This not only enhances **air quality** but also reduces respiratory health risks, ensuring a healthier environment for all who traverse its paths. Furthermore, the presence of greenery within Vasbyhave contributes to **temperature regulation**, offering shade and cooling effects that combat the urban heat island effect.



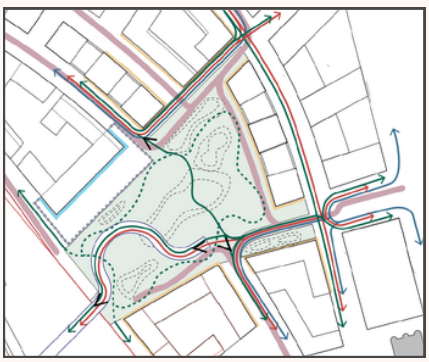
Example of green corridor pathway.





A rendering of the bridge looking into Vasbyhave

In addition to their environmental benefits, these green corridors serve as safe and inviting routes for walking, cycling, and other forms of **active transportation,** thereby promoting **physical activity** and reducing reliance on cars. Bike parking is strategically located in small groups at access points and on the park's periphery, supporting a people-centered approach to urban planning. By providing pleasant non-motorized travel options, the corridors encourage physical activity while decreasing car dependency, thus improving **public health** and contributing to sustainability goals by reducing greenhouse gas emissions and congestion.



Taking inspiration from the railroad heritage of Jerbanebyen the park trails can be designed to look like railyard tracks



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