MASTER

The bicycle base
promoting cycling in Stockholm

Snoeijen, J.M.

Award date:
2015

Link to publication
The Bicycle Base
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MASTER THESIS ABP
J. M. SNOEIJEN, 0739214
EINDHOVEN UNIVERSITY OF TECHNOLOGY
AUGUST 24, 2015
The Bicycle Base
Promoting cycling in Stockholm

Janet Maria Snoeijen
0739214

Graduation Studio:
‘ID: On the representation in architecture’

Graduation Committee:
dr. ir. Gijs Wallis de Vries (chairman)
ir. Wouter Hilhorst
ir. Sjef van Hoof
ir. arch. Rob Willemse

Master Architecture, Building & Planning
Eindhoven University of Technology
Den Dolech 2
5612 AZ Eindhoven

Eindhoven, August 24, 2015
The Bicycle Base is the result of my graduation project for the Master of Architecture, Building and Planning at the TU/e. The project was executed in the graduation studio ‘ID: On the representation in architecture’ for the master of Architecture, Building and Planning.

The graduation project exists of a research and a design assignment, both are explained in this thesis.

I would like to thank my tutors Gijs, Wouter, Sjef and Rob, for their guidance during the research process and design process of my project. I would also like to thank Wim Fijten, for his additional guidance and the inspirational conversations we have had, and the owners of the Velorama Museum, for the information and stories they provided during my visit to their museum. Finally, I would like to thank my family and friends for their support.
The Bicycle Base is the result of the graduation project for the Master of Architecture, Building and Planning at the TU/e. The project exists of a research and design assignment, which were executed in the graduation studio ‘ID: On the representation in architecture’ for the master of Architecture, Building and Planning. Both the research and the design assignment were individually executed.

The first phase of the project considers a research on the way sustainability is currently assessed in the Netherlands and how the approach should change to create more sustainable buildings. The triple bottom line, as defined by John Elkington, provides the framework in which the problems of the current Dutch approach become visible. The Dutch sustainability approach is also evaluated in comparison to sustainability leader Sweden and to a few Dutch and foreign sustainable building case studies. From the research, it can be concluded that the Dutch approach shouldn’t prioritize the subset Planet, but equally focus on all three subsets People, Planet and Profit.

The outcome of the research inspired to create an assignment which would enable people to become interactively involved with the topic of sustainability. Considering the bicycle being a very sustainable transport manner, it quickly became the main topic of this graduation project. The building is designed for the sustainable capital Stockholm, combining revised Dutch sustainability aims [based on Swedish expertise on sustainable building] with Dutch knowledge about cycling.

A short research about bicycles and movement in relation to buildings was conducted in order to gain a better understanding of possible building typologies for the design of a building that promotes cycling. This knowledge, combined with the site analysis for the design, introduced a building concept which later resulted in a masterplan and design.

The Bicycle Base is a complex of 3 main buildings connected by a connection zone. The complex is located on the museum island of Djurgarden in Stockholm and aims to promote cycling to its inhabitants and visitors. The functions of the complex (a bicycle museum, bicycle repair station and bicycle innovation center) are connected in such way that cyclists can ride their bicycles inside the building and climb or descend through the main volumes. An underground parking garage replaces the former parking lot of the site and now assures that the focus will go out to the bicycle instead of the car in this area. The Bicycle Base performs as a knot for various traffic types, poses as an entrance to the island for visitors that travel by ferry and connects to a beautiful area and cycling route. The complex aims for sustainability for People, Planet and Profit.
INTRODUCTION

The Graduation Studio ‘ID: On the representation in architecture’ is supervised by Gijs Wallis de Vries (chairman), Wouter Hilhorst, Sjef van Hoof and Rob Willemse. The main topic of the ID studio is identity and its representation in architecture, as well as the question to what extent sustainability plays a part in defining and representing identity. Other subthemes of the studio (besides identity and sustainability) were ‘globalization’ and ‘cross-culture’.

The wide range of topics and themes within the design studio, combined with the request for designing ‘a public building of choice’, has resulted in many different approaches and final designs amongst the students of this project. Therefore it can be concluded that this studio enabled us, the students, to decide and design our own graduation assignment, which has been both interesting and challenging.

Within the topics and themes of the design studio, the topic of sustainability has been one of the main points of departure for the outcome of the Bicycle Base. Starting with a research about the interpretation and representation of sustainability within architecture, the design project gained its first guidelines; designing sustainable not merely for the planet, but for people and profit (or prosperity) as well.

The triple bottom line, as defined by John Elkington, provides the framework for the research (described in Chapter 1) and the design assignment. Based on the aim to design for all three subsets of sustainability, the assignment for a public building that promotes cycling in Stockholm was created.

This project aims to show how sustainability shouldn’t merely consider the building from an environmental perspective. Instead, this project aims for creating a building that combines its environmental features with sustainable features for its users and its society; sustainability as an integral part of the design rather than ‘added’ solutions.

The research and explanation of the design assignment are followed by the location analysis and building concept. The chapters of the masterplan and the design explanation are followed by the conclusion that revises the aims of the research and how they have been implemented within the design.

APPROACH

During the research and design process, multiple case studies were analyzed in order to gain more understanding in ‘sustainability’ and ‘movement’ within a building. By combining and developing important elements into one building concept, the masterplan and final design were created.
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REVISING THE DUTCH SUSTAINABILITY AIMS
1.0 ABSTRACT

REVISING THE DUTCH SUSTAINABILITY AIMS: FOCUS ON PEOPLE, PLANET AND PROFIT

KEYWORDS:
Sustainability, triple bottom line, representation, resilient design, Dutch & Swedish sustainability policies

This article focuses on the way sustainability is currently assessed in the Netherlands and how the approach should change to create more sustainable buildings. The Netherlands faces not only the environmental problems, but building vacancy as well. While the Netherlands seems to mainly focus on the environment, vacancy however is often caused by social or financial factors. Therefore it becomes questionable whether the Dutch sustainability approach should be revised, which leads to the research question: What are the Dutch aims for sustainability and how should the Dutch aims for sustainability be revised for their representation within a public building?

The current Dutch sustainability aims are explained using literature considering Dutch regulations and the Dutch sustainability assessment system. The triple bottom line, as defined by John Elkington, provides the framework in which the problems of the current Dutch approach become visible. The Dutch sustainability approach is also evaluated in comparison to sustainability leader Sweden and to a few Dutch and foreign sustainable building case studies.

Putting the Dutch approach and case studies into perspective, it can be concluded that the Dutch approach shouldn’t prioritize the subset Planet, but equally focus on all three subsets People, Planet and Profit. The representation of People, Planet and Profit is based on both user cognition and user experience.

The architect is responsible for an integral design that will combine the three subsets and thus increase the overall sustainability of a building.
1.1 INTRODUCTION

THE NECESSITY OF SUSTAINABILITY FOR THE DUTCH BUILDING INDUSTRY

The impact of the building industry on the environment is significant. In the Netherlands, it was concluded that the Dutch building industry (responsible for both building and demolishing) was responsible for approximately 5% of the total Dutch CO₂ emission in the year 2010.¹ The emission of CO₂ stimulates global warming and as a result a rising sea-level. The rising sea-level is especially threatening for a country such as the Netherlands; the country is densely populated on land of which about 26% is already located under the sea-level and another 29% is very flood sensitive while located above sea level.²

The impact of the Dutch building industry on the environment is mainly caused by the production and transport of materials and resources and the material or waste treatment. Recycling and reuse of materials can significantly reduce the effects on the environment and reduce the CO₂ pollution. Besides the impact of material use, it is also the shrinking availability of fossil fuels that forces the Netherlands to think about solutions towards a more sustainable building industry.

Bouwend Nederland, the organization of building companies and infrastructural companies, has created 6 guidelines towards a more sustainable Dutch building industry.³ These guidelines focus on energy reduction and saving, sustainable material purchase and use and insight in the sustainability of buildings and their impact on the environment. The criteria do provide influential and necessary aims towards sustainable building, but however all seem to forget to address clear advices concerning another urgent problem in the Dutch building industry; the enormous vacancy of office buildings.

In the book 'De flexibele stad' the issue concerning structural vacancy in the Netherlands is analyzed and strategies for a more flexible city are proposed. Approximately 16% of the offices and 8% of the shop-premises in the Netherlands are structurally vacant,⁴ creating an unsustainable situation for the social community, the financial management and eventually for the environment as well.

In conclusion, the Netherlands doesn’t only face the environmental problems that are occurring worldwide, like a growing population, growing emission of CO₂, running out of fossil resources, global warming and a rising sea-level; the Dutch building industry needs to facilitate answers to problems like structural vacancy as well. Sustainability is needed from an environmental perspective, but also from the social and financial point of view.

¹. CE Delft, 2014. (pp. 61).
⁴. Bergevoet & Tuijl, 2013. (pp. 19).
QUESTIONING THE DUTCH SUSTAINABILITY APPROACH

It is necessary to ask whether the Netherlands are taking on the right approach towards a more sustainable future, or whether the focus of current guidelines and plans should be shifted. Therefore the research question is:

What are the Dutch aims for sustainability and how should the Dutch aims for sustainability be revised for their representation within a public building?

Using existing literature and published documents, the current Dutch approach to sustainability will be compared to some original ideas and definitions of sustainability. Case studies will be evaluated from the perspective of sustainability approach, to gain understanding in the possibilities towards a more ideal sustainability approach and possible revisions for the Dutch approach.
1.2 DEFINING SUSTAINABILITY

BRUNDTLAND SUSTAINABILITY AND THE TRIPLE BOTTOM LINE

One of the most cited definitions of sustainability comes from the Brundtland Report, dating from 1987. This report was created by the Brundtland Commission, formally known as the World Commission on Environment and Development. According to the Brundtland Report, sustainable development means:

‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’.\(^5\)

The Brundtland Report also states that ‘sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life’.\(^6\)

Another well-known definition of sustainability comes from John Elkington. As the pioneer on the field sustainable business, he defines sustainability according to the so called ‘triple bottom line’ of ‘People, Profit and Planet’, in which these subsets of social, economic, and environmental measures together shape the meaning of sustainability.\(^7\) From this definition, it can be read that there is more to being sustainable than just the environmental aspects that are often directly linked or even used as substitutes for the term sustainability.

People, profit and planet all need to be represented within the building industry in order to create sustainable buildings.

The word ‘profit’ in the triple bottom line was changed into ‘prosperity’ during the United Nations World Conference on Sustainable Development in Johannesburg in 2002.\(^8\) The change of the word implies a focus on not merely the economic profit, but also the societal profit; nonprofit organizations (like Unicef or the Red Cross) for example don’t perceive economic profit as their goal, while they do contribute to societal profit that helps the community and society, and eventually help creating a sustainable economy.

The definitions for sustainability named above, together create a framework in which sustainable building can be placed; in order to build sustainable, buildings must meet present and future needs in the categories of: People (social, ethical, cultural, human capital in the form of public health, skills and education), Planet (environmental, natural capital in the form of critical and renewable capital) and Profit (economic capital in the form of financial, societal, physical and intellectual capital).\(^9\)

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1.3 DUTCH INTERPRETATION

THE CURRENT DUTCH AIMS FOR SUSTAINABILITY

Since 2009, the Dutch statistics institution CBS, the ‘Centraal Bureau voor Statistiek’, publishes the findings on the sustainability trends and position of the Netherlands in Europe since 2000. On November 25, 2014, the ‘Monitor Duurzaamheid Nederland’ was updated, but shows no real big fluctuations for its most concerning criteria for sustainability for the building industry.\(^\text{10}\) The visualisation of the statistics ‘Duurzame ontwikkeling’ points out the following main problem fields of the Dutch sustainable development: decrease of natural capital (nature qualities and biodiversity), decrease of human capital (mainly the level of education and amount of work hours) and increasing pressure on environment and resources (due to energy use, CO\(_2\) pollution and import of resources).\(^\text{11}\) The problematic sectors, as detected by the CBS, can be mainly addressed to the sustainability subset Planet, but also to People.

The Dutch government has tried to increase the sustainability in both the private and public building sector. To increase the sustainability of many Dutch houses, the Dutch government introduced the ‘Energiebespaarten’, a loan for people to invest in energy saving. This loan is a part of the ‘Nationale Energieakkoord’, which is a national agreement amongst Dutch organizations for sustainable growth, dating from September 2013.\(^\text{12}\)

The loan should activate the owners of houses to invest in solar panels, boilers with a higher output and better insulation. But what does adding solar panels to existing buildings address? That people want to save money on their energy bills? Or that the buildings that are created are unsustainable and need to be upgraded with ‘architectural bling’ in order to end up in the category of sustainable buildings?

Solar panels that are placed afterwards are often applied as extra measures, sometimes fitting unintegral in the architectural design of a building. The main focus of applying solar panels takes place within the subset Planet, whereas it may also work in the subset of Profit for the house owners. But by merely applying technical elements to save energy (and money), a building does not automatically become sustainable; it takes more than a label that says ‘environmentally friendly’.

\(^{10}\) Centraal Bureau voor de Statistiek, 2014.
\(^{11}\) Centraal Bureau voor de Statistiek, 2014.
\(^{12}\) Sociaal-Economische Raad, 2013.
The prioritisation of the subset Planet can as well be read from the Dutch sustainability assessment tool BREEAM-NL that is used by the Dutch Green Building Council (DGBC). BREEAM, an abbreviation for Building Research Establishment Environmental Assessment Method, is the world’s leading design and assessment method for sustainable buildings and originates from England. BREEAM-NL is used in the Netherlands to define, support and certificate the sustainability of both new and redeveloped buildings, as well as for buildings that are in-use. A building can earn credits for the focus fields of management, health, energy, transport, water, materials, waste, land use & ecology and pollution.

When comparing the aims from BREEAM-NL to the categories of the triple bottom line, it becomes clear that the categories of People and Profit have less weight in the approximation of the sustainability of a building; 73% of the assessment is defined by the categories other than management and health. This results in a measuring system for which more points can be scored for Planet than Profit and People and thus means that the category of Planet has gained priority. But it is questionable whether this is the right approach, since a building that isn’t sustainable within the subsets of People and Profit might become vacant, demolished and replaced, which will eventually conclude in a negative impact on the so prioritized category of Planet.

After comparing the framework of the triple bottom line to the current Dutch approach of sustainability, it can be concluded that the 3 subsets of sustainability, as defined by John Elkington, are not equally represented within the Dutch aims for sustainable building.
MISSING PRIORITIES FOR SUSTAINABLE BUILDING

The construction process of a building is in itself an unsustainable action in terms of environmental impact; the production of a building material, its transport and the assembling on the construction site, it will all have a negative impact on the environment considering for example the CO₂ pollution. During its exploitation, a building could contribute to a sustainable economy, a healthy and satisfying lifestyle and possibly to a more environmental friendly way of living creating, organizing and producing. And thus buildings, created for people and organizations, can eventually contribute to sustainability, also for the environment. Because of the big environmental impact of the building industry, sustainability has mainly become about choosing the most sustainable options; options that have the least negative impact on the environment. That’s why it makes sense that every step of the building process is monitored on its sustainability for the subset of Planet, to eventually have the smallest impact on the environment.

But this focus on Planet also happens to imply a certain danger; if the other subsets of People and Planet lose their priorities in the creation of the building design, a building might end up being environmentally sustainable but unsustainable for the other subsets. If the building can’t answer to the future demands of its owner and organization, the building’s use and life cycle could be threatened by vacancy and eventually either redevelopment or demolition are required. Both of the options imply some unsustainable actions for Planet, meaning that it’s definitely worth to also investigate and invest in the subsets of People and Planet.

Cobouw reporter Thomas van Belzen writes in his book ‘Duurzaamheidsoorlog’ that building materials still are not sustainable. As an example, he names building materials that use crude oil in the material’s production and/or transport. Due to their branding as ‘sustainable’, the word sustainability seems to lose its value.

Sustainable building however will always imply making compromises between environmental impact and building material production, transport and use. Take for example the Nordic Timber, a building material that is often used in Norway because of its structural and cultural durability, the short material transport and its natural and vernacular look. Harald N. Røstvik states in his article 'The vernacular, the Iconic and the Fake': ‘Today, timber construction is faked as something new: a new kind of sustainable architecture with renewed aesthetics.’ It seems and looks sustainable, but incorporates unsustainable characteristics as well; cutting down trees means a reduction of healthy trees that could clean the air, and thus the pollution of the air with CO$_2$ will increase.

Maybe sustainable building isn’t about the perfect sustainable solution, but about the most integral sustainable solution of all the possibilities. The Dutch aims and BREEAM-NL focus on environmental sustainability for the future, but designing resilient for the future isn’t one of the main aims. Though resilient building should be one of the main aims as well; it provides diversity, redundancy, flexibility, and an optimal network construction.

Resilient designing, answering to the current and future demands of People and Profit as well, will help sustaining Planet in the long run. Because resiliency stimulates the possibility of conservation, which will eventually lead to sustainability since the building can keep answering to the needs of People, Planet and Profit.

1.5 SWEDEN AS THE LEADING ROLE MODEL

A COMPARISON TO SUSTAINABLE SWEDEN

The Netherlands is striving to become a more sustainable country. The sustainability of a country isn’t just depending on the regulations for sustainability created by one’s government, but also depending on the life style and behaviour of its people, of the consumers, and the link with the management and organizational framework.

Sweden is most definitely a leader in sustainability. Sweden is especially well-known for its measures and achievements within the subset of Planet; the country gets first place in the European ranking of organic food consumption, is a global leader in the organic cotton use as well as in the recycling of drink packages and the country leads in the energy production with renewable sources. The official Swedish website states:

‘The core principle of sustainable development is that members of one generation should act to conserve resources for future generations. For most Swedes today, sustainability is a way of life.’

In Sweden, buildings are assessed with BREEAM as well, in this case BREEAM SE, operated by the Swedish Green Building Council.

If the Netherlands and Sweden use the same assessment tool for sustainable building, then where is the difference between the sustainability approaches of the two countries?

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EUROPEAN GREEN CAPITAL 2010
STOCKHOLM, SWEDEN
The capital of Sweden was the first city to receive the award for European Green Capital in 2010. Stockholm, known for its nature, adventure, innovation and culture, is built up out of 14 islands. Water and nature are harmoniously connected in the city, which has therefore gained a blue-green identity. The European Green Capital award, meant to activate other cities to create a more sustainable environment, was handed to Stockholm for the following reasons:\[24,\,25:\]

People:
- Integration of water and nature in urban living and experience, providing recreational areas close to home,
- Experience of Stockholm’s modern advances and rich history through the city’s diverse architecture and settings,
- Raising awareness amongst citizens to prevent and reduce waste, connecting citizens to the aims of its city,
- Investment in cycling paths and features to improve citizen health and exercise, combined with congestion charging, results in reduced car use in the city,
- Varying experiences on the various islands with their own identities and activities, attracting various types of people,
- City easily travelled and explored by foot, bike, car or boat.

Planet:
- Management of natural resources,
- Sustainable waste-water treatment and waste recycling,
- Conversion of waste into heating and electricity and using waste heat for district water heating,
- Clean vehicles and public transport with use of renewable energy sources concludes in a very low CO\(_2\) emission,
- Use of eco-electricity.

Profit:
- Investing in innovation and education, contributing to the knowledge and prosperity of Stockholm’s society,
- Stockholm as the cultural, economical and political hotspot in Sweden, in combination with its ‘green’ mind-set, offers the society high quality living, exploring and working,
- Efficient use of information technology, which results in energy savings and thus financial savings for the city and its organizations and citizens,
- Maintenance and advertising of architecture, water, parks and attractions for the citizens and tourists (that will increase the economical profit of the city in exchange).

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Sweden is a country that integrates its sustainable approach more into its people’s lifestyles and companies’ managements in comparison to the Netherlands. In Sweden, the relation and experience between People, Planet and Profit are directly linked with the decisions for the subset of environment. Sustainability becomes more than placing a few solar panels of a roof; it becomes a way of living and organizing. And therefore it is more likely to remain sustainable.

The sustainability approach of Sweden, especially in Stockholm, resulted in the effect of a general and significant change in the sustainability attitude of its inhabitants and visitors. According to ‘The Medium is the Message’, written by Marshall McLuhan, the mediums are the messages that will evoke an effect. What are the mediums for Sweden that are the addressing of the sustainability and what can a building achieve in this perspective?

The building poses as a complex system of mediums within the medium of the building that is an extension of ourselves. The content of a sustainable building could be its solar panels, its recycled materials and its grey water system. The message of the medium isn’t its annual energy and resource savings; it is the change in the public attitude towards sustainability. Sustainable building as the billboard for the very core of sustainability that the building represents.

If a medium contains multiple other mediums, and the medium is the message, this implies that one medium or one message with multiple ‘sub’ mediums contains multiple ‘sub’ messages. The building may address the quest for sustainability, whereas its reused construction may address the importance of material reuse to prevent material waste. This leads to the assumption that, in order to strengthen the overall message of the overall medium, the submessages of the submediums must cooperate and not contradict. The general aims of the building should be represented within the various ‘sub mediums’. If a building should represent sustainability as its general message, then so should all the various submessages (the categories of People, Planet and Profit) of sustainability be represented in the building.
The Stockholm Waterfront Congress Center is located between Stockholm Central Station and the City Hall and exists of three buildings; a congress building, an office building and a hotel with 400 rooms. The Congress Center has to deal with and respond to various amounts of people due to its congress function. This asks for a flexible and well accessible building. Therefore an integrated connection between the congress building and Stockholm’s Central Station is established in the design of the Waterfront Congress Center.

The positioning of the congress center is very strategic in terms of its function, its connection to other facilities and to the public transport, which is directly advertised as a smart and sustainable travelling choice for visitors. The sustainable architecture of White Arkitekter has translated in the Stockholm Waterfront building, claiming to be ‘greener than green’ and a new attractor for ‘global events and visitors in one combined facility right in the heart of the city’:

**People:**
- Indoor climate well regulated and adjusted to varying uses and varying numbers of people inside the building,
- Providing accessibility to the central station and a hotel,
- Open, modern spaces with cladding of various materials,
- Impressive views overlooking the Lake of Mälaren,
- Building already nicknamed "the Crown of Lake Mälaren" due to its ‘spectacular addition’ to Stockholm’s skyline,
- Transforming experience of interior spaces due to moving walls and seats.

**Planet:**
- Heat generation by the glass façades with solar thermal collectors,
- Cooling with water from the lake Klara Sjö,
- An underground ice storage is used to quickly reduce indoor temperatures and thus to cool the building during sudden high occupation degrees,
- An energy system that levels out heat differences and energy needs,
- Partly reuse of materials from site.

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29. World-Architects, date unknown.
30. Stockholm Waterfront Congress Center, date unknown.
Profit:
- The Congress Center enriches the society of Stockholm with an impressive venue with a high service level,
- Multifunctional building that stimulates and attracts visitors to make use of the various functions (since a congress visit can be combined with a hotel stay next door), so various functions help creating economical profit for each other,
- Extremely flexible in its use, increasing the hiring possibilities which is profitable for the congress organization.

The Stockholm Waterfront Congress Center addresses the importance of a resilient design and the importance of its indoor use. Even though the statement of being ‘greener than green’ would seem to address only an environmental sustainable future for the subset Planet, the building design is ‘greener’ for the subsets of People and Profit as well. It thus covers the entire spectrum of subsets of the triple bottom line as ‘green’.

Particularly Swedish about this project in terms of sustainability is the ice cooling storage and the use of cold water from the lake. Given the more extreme temperatures and climate in comparison in the Netherlands, this is one of the features that is dependent on its location for its functioning.

The Congress Center will have to prove its sustainability in the future, but considering its flexibility and user experience, that varies along the changes made inside the building, it definitely has a shot at becoming very sustainable in the long run for People, Planet and Profit.
The WWF Head Office is located in a redeveloped agricultural laboratory. The design for the redevelopment was created by architecture firm RAU. Thomas Rau is a Dutch architect that focuses on sustainability and especially the reuse of material to create a circular economy. In 2013 he was listed as the number 4 of the Duurzame 100 (the ‘Sustainable 100’) of the Netherlands in the Dutch newspaper ‘Trouw’.

The WWF office was the first Dutch CO₂-neutral building and self-sufficient office. The existing rigid and geometrical building structure was mainly maintained during the redevelopment. However a big organic blob in the heart of the building now provides a new and more inviting entrance. The use of natural materials on the outside façades has increased the building’s relation with its natural surroundings. RAU states:

‘RAU’s intervention did not only give the building a new face, but fundamentally changed the user experience.’

Thomas Rau states that buildings must become a ‘grondstoffendepot’, a storage of resources. This way materials and their values won’t get lost once the building no longer answers to the future needs. The identity of the environmental organization WWF is in harmony with the sustainable design:

People:
- The user-experience was improved by an open atmosphere,
- Healthy indoor environment with natural ventilation,
- A blob in the center provides a more attractive entrance,
- Harmonious dialogue between building and surroundings, since the bare concrete is replaced by natural materials on the outside and natural materials are used on the inside,
- A water pond around the entrance creates varying light reflections inside the building with direct sunlight.
Planet:
- A very good energy performance; the building was the first CO$_2$ neutral and self-sufficient office in the Netherlands
- Environmentally-friendly materials, like mud plastering
- Recycled materials and use of existing laboratory structure,
- Direct surroundings changed into a biotope,
- Water and heat reuse,
- Graduate heat exchange for warming and cooling.

Profit:
- Partially flexible layout, space could be used by other parties, increasing the potential usage for its organization,
- Representation of the building to the society fits the identity of the nonprofit organization WWF and further strengthens the connection of the organization with nature,
- Redevelopment of an existing structure to prevent building waste and to function as an example for the society,
- No air-conditioning or radiators, a maximized use of space which is economically attractive for the WWF organization.

Not only the environment, but also the users and management have gained priority in this Dutch building design. Combined with some resilient design features, this building answers to the meaning of sustainability as defined by John Elkington. The WWF Head Office proves that sustainability isn’t merely achieved with new buildings but also with redevelopment of existing building structures. Since the redeveloped structure is still relatively new, the building’s sustainability in the long run still has to be proven in the future.

Besides of the water reuse, the project also incorporates street tiles that allow rainwater to penetrate into the ground. In the Netherlands the rainwater run-off is important to prevent flooding, considering its dense population and fully paved areas.
The Van Gogh Museum exists of two buildings nowadays; the museum building (1973), originally designed by Rietveld, and the new museum wing (1999), designed by Kurowaka. The main building was opened in 1973 and was afterwards renovated multiple times by various designers. The geometry and the open and light atmosphere were however maintained from the start. In contradiction to the cubistic design by Rietveld, the new museum wing shows elliptical shapes. The museum still continues to change; a new entrance hall for the museum is planned to be finished in the summer of 2015.

On June 30, the Van Gogh Museum was the first Dutch building and the first museum in the world to receive a 3 stars (= Very Good) certification for all three assessment categories (Building, Management and Use) for the BREEAM-NL In-Use score. This evaluation is based on the following characteristics:

**People:**
- Clear communication to users and stimulating the use of sustainable manners of transport like the public transport,
- Open structure of museum that creates a light and open atmosphere with longer sightlines,
- ‘Clean’ atmosphere due to white walls and ceilings, creating full focus for the displayed art,
- Experiencing the growth of the artist simultaneously with the travel through the museum; Vincent’s course of life as the visitor’s course through the building,
- Sustainable purchasing.

**Planet:**
- Connection of the installations to the museum’s thermal energy storage, resulting in energy and CO$_2$ reduction,
- A policy for reducing the environmental footprint, water and energy use, and waste sorting.

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36. Van Gogh Museum Amsterdam, date unknown.
37. Van Gogh Museum Amsterdam, date unknown.
Profit:
- Renovation without building new developments or demolition, saving money for the museum’s organization and posing as an example for the society to use existing structures for upgrading instead of unnecessary demolition,
- Re-evaluation of required spaces and volumes, contributing to both financially attractive use of spaces for the museum and for the appropriate display of Van Gogh’s art to the society,
- Renovation financed by existing budgets and money savings from energy savings that were accomplished without extra investments.

The renovated Van Gogh Museum has been evaluated on all three triple bottom line subsets separately and has scored ‘Very Good’ on all three subsets. This way of certifying excludes the prioritization of the subset Planet as an almost generalized substitute for sustainability.

Since the building has only recently received the ‘very good’ certification, it still has to prove its sustainability in the future. The fact that a building from 1973 can achieve this level of sustainability however already points out that the existing building structure has provided enough possibilities to adapt to future needs. The future will point out if the ‘very good’ sustainability can be maintained with or without multiple new renovations.

The building vacancy problem is a ‘hot topic’ in the Netherlands at the moment. Renovation or redevelopment, as shown in this case, can significantly increase the sustainability of existing building structures. Even though the Van Gogh Museum doesn’t fit in the category of vacancy, it could however pose as an inspiration for the treatment of vacant buildings.
FEDERAL ENVIRONMENT AGENCY
DESSAU, GERMANY, 2005
DESIGNED BY SAUERBRUCH HUTTON

The Federal Environment Agency was originally located in Berlin, but chose the former industrial city Dessau as its new base. The new headquarters needed to provide spaces for 800 employees and it would have to become an architectural project with a focus on energy. But another purpose for the building was added; a learning center with a public library, an auditorium, exhibition space and an information center, all focusing on energy-conscious practices. Old buildings that were located on the building site were used, like a former factory building that was recycled and a former station building that was redeveloped to create the library in connection to the new Federal Environment Agency complex. The relation to the industrial past remains due to the use of the existing industrial buildings, whereas the building complex also connects with its architecture to the relatively new apartments and commercial buildings in its direct surroundings.

Ursula Seibold-Bultmann investigated whether something like the ‘image of sustainability’ actually exists, or what could come close to this image.

In one of her articles, she named the Federal Environment Agency in Dessau, designed by Sauerbruch Hutton, as the image of sustainability. The building consists of the following characteristics:

People:
- Very good accessibility for disabled people,
- The building’s façade shows a gradual change in colors,
- Composition of glass, wood and steel that connects to the former industrial atmosphere and its surroundings,
- Varying light patterns inside the atrium during the day and seasons,
- The atrium provides space for a public ‘park’ for Dessau citizens, the canteen is freely accessible for the public,
- Hygienic air quality and daylight optimization,
- Triggering the senses (due to colors, light and air quality).

Fig 1.16: A design that works with colors and daylight (picture by Europe in 90)
Fig 1.17: The atrium in the building as a public park (picture by Europe in 90)

43. Sauerbruch Hutton, 2005.
Planet:
- Treatment of contaminated site,
- Use of renewable energy sources (using solar panels) in combination with active and passive strategies for a reduction of both energy use and CO$_2$ pollution,
- Geothermal heat exchanger, atrium as a buffer,
- Solar cooling,
- Lighting system that provides light only when necessary,
- Use of existing building instead of demolition.

Profit:
- The building’s concept is flexible, which increases the user possibilities and values for the organization, and the building was composed with standard building sizes, which enables the use of cost reducing standard sized materials,
- Integral planning, use of existing building instead of demolition and thus preservation of the former station building with historical value for the society of Dessau,
- Creating office space that is only for the organization, but simultaneously maintaining space for the society of Dessau within the building (the park and canteen),
- Investment in a building that will be more than compensated during the building’s lifespan due to reduced maintenance costs and energy costs.

The building combines a modest ‘eye-catching’ architecture that fits within its context with a design strategy that is focused on all 3 subsets of the triple bottom line. This results in a design that could indeed be considered as an image of sustainability and thus the building should have a fair chance to stand the test of time for the categories of People, Planet and Profit.
GUGGENHEIM MUSEUM
BILBAO, SPAIN, 1997
DESIGN BY FRANK GEHRY

The Solomon R. Guggenheim Foundation agreed on the proposal of the Basque government of 1991 to construct a Guggenheim Museum in the industrial port area of Bilbao. This museum for modern and contemporary art gained much attention from visitors and architecture critics right from the start, due to its iconic structure that introduces complexity and a form that provides new visitor experiences from different angles and spaces. The Guggenheim Museum Bilbao is located in an industrial urban context, which is reflected in the museum’s material use of titanium, stone and glass.

According to the World Architecture Survey by Vanity Fair in 2010, the most important work of contemporary architecture since 1980 is this Guggenheim Museum Bilbao by Frank Gehry. The building, chosen by more than half of the 52 surveyed experts, could therefore be described as ‘image of architecture’. In response to this outcome, Lance Hosey, an architect and writer promoting sustainable design, states that ‘sustainability, it seems, is not much on the minds of the architectural elite’. The museum in Bilbao however does display various sustainable features:

People:
- The interior spaces of the museum continue to surprise the visitors during their visit with varying shapes and daylight entering from different angles and heights,
- Walking around the iconic building gives new experiences from different angles and positions, the titanium cladding increases the iconic effect of the museum,
- Impressive non geometrical shapes; the building both as exhibition space and exhibition in dialogue with its art,
- Raising environmental awareness amongst staff,
- Guggenheim Museum Bilbao was the first museum in the world with a certification for its global accessibility management system (based on experience and accessibility for every visitor).

44. Pagnotta, 2013.
45. Hosey, 2012. (pp. 3).
46. Hosey, 2012. (pp. 3).
47. Guggenheim Bilbao Corporativo, 2013.
Planet:
• Efficient energy use and CO₂ pollution prevention system,
• Monitoring of museum impact with an environmental management system and waste recycling.

Profit:
• Investing in innovation and research in presenting art to stay attractive for a diverse audience, thus contributing to displaying art for the society,
• Use of EFQM (European Foundation for Quality Management) for a continuing process of improvement that enables the museum to keep up to date and thus to keep attracting visitors and to stay economically healthy,
• The Bilbao Effect; the entire city of Bilbao was improved and modernized thanks to the museum, creating both economic profit and profit in terms of life conditions for its society and tourism attraction.

Undoubtedly, the metal cladding of the Bilbao Guggenheim Museum isn’t the most sustainable solution within the field of sustainable material use. But sustainable building is and will stay a compromise; a different type of cladding could have lead to the building being less of an icon or statement and thus possibly less beloved.

The building might not seem to fit the category of sustainability at first sight. But taking the systems and focuses mentioned above into account, it becomes highly doubtful whether this building isn’t one of the examples for sustainability; it is loved by architects, by visitors, by people. And like Lance Hosey himself quotes a phrase by Baba Dioum in his book ‘The Shape of Green’:

“In the end, we conserve only what we love.” 48

REPRESENTING SUSTAINABILITY

The Guggenheim Museum Bilbao has proven to be very sustainable; not only for the building, its user and its management, but also for the city of Bilbao. The so called ‘Bilbao Effect’ refers to the building that gave the city of Bilbao an economic boost and concluded in the transformation and modernization of the city.\textsuperscript{49} Therefore the building’s sustainability is mainly attributed to its social and economical impact.

As an icon for contemporary architecture since 1980 and a continuing love from the public, translated in approximately one million annual visitors\textsuperscript{50}, the Guggenheim Museum Bilbao is most likely to be maintained for a very long time. Combined with its focuses for sustainability in the category of Planet, this museum might prove not only to be an icon for contemporary architecture, but an icon for sustainable architecture as well.

The representation of People, Planet and Profit varies in its approach; from the case studies it can be read that for People the representation of sustainability mainly takes place in user experience and usage, and thus requires experience to understand the sustainability.

Sustainability for Planet can sometimes be experienced by the building users, like its materialization, but sometimes knowledge is required about the hidden building systems. And thus the representation of sustainability for Planet asks for a cognitive approach as well.

For Profit both cognition and experience are required; change and flexibility of the building can be experienced, whereas pure economical or societal sustainability sometimes isn’t experienced by the building user without knowledge of the existence of these sustainable aspects.

In order to represent sustainability within a building, the architect must be aware of how a building’s visitor or user will interpret sustainability from experiences or how a user becomes aware of the more ‘hidden’ sustainability features.

\textsuperscript{49} Pagnotta, 2013.
\textsuperscript{50} Hahn, 2013.
REVISED SUSTAINABILITY APPROACH FOR THE DUTCH BUILDING INDUSTRY

The Netherlands shouldn’t prioritize the subset Planet of the triple bottom line, but equally focus on all three subsets of People, Planet and Profit; a sustainable design asks for a building that works for People, Planet and Profit. The design with the focus on the three subsets of triple bottom line should be integral, but their evaluation should be separate in order to measure not merely the sustainability for the Planet, but for People and Profit as well.

Depending on the choices of the architect, the various aims for People, Planet and Profit could be used as integral parts of the building’s design, instead of using additive solutions to sustainability problems that weren’t solved by the design of the building itself. The building can function as a billboard to inspire other architects and designers for their new buildings or products. Sustainability can both be achieved by buildings that derive their design strategy from their context or autonomous buildings that prove to be sustainable independent of their context. The revised sustainability aims must be represented in ways that are based on user cognition or user experience, or even both. This depends on what will be represented as sustainable and how the building user will be able to understand this representation.

The architect is responsible for an integral design that will combine the three subsets and thus increase the overall sustainability of a building.

Since this article shows how the Dutch aims for sustainability should be revised, the research could be continued and expanded with the following research or design question:

How can the revised Dutch aims for sustainability be represented within a public building devoted to the promotion of the sustainable transport manner of cycling?
2. Assignment

A PUBLIC BUILDING PROMOTING CYCLING
2.1 GENERAL AIMS

The research ‘Revising the Dutch sustainability aims’ has provided a framework for a design assignment that strives for the representation of sustainability. The assignment focuses on the promotion of the sustainable transport manner of cycling within a public building. Both cycling and the building must show sustainability features that take place within the fields of People, Profit and Planet in order to fit within the topic of revising the Dutch sustainability aims. Since the experience of cycling is changing throughout the year, due to the change of the seasons, one of the aims for the design assignment is to let the seasonal change be experienced by the visitors in the building. The promotion of cycling becomes more interesting once the bike gains a prominent role within the building itself. Therefore the building must become a building to cycle in or through.

DESIGN ASSIGNMENT AIMS:

- Design a public building devoted to the promotion of cycling
- Design for all 3 sustainability subsets (People, Planet, Profit)
- Design a building that stimulates movement and interaction instead of a static experience
- Design a building in which the seasonal changes can be experienced and used
- Design a building that provides flexibility for future usage and other functions

The building will be designed for the sustainable capital Stockholm, combining revised Dutch sustainability aims (based on Swedish expertise on sustainable building) with Dutch knowledge about cycling. Therefore the design question is transformed into:

How can the revised Dutch aims for sustainability be represented within a public building, devoted to the promotion of the sustainable transport manner of cycling, in the sustainable capital Stockholm?

In order to design a building for the promotion of cycling, it is important to understand the history and developments of the bicycle, and how movement for the bicycle can be enabled or stimulated within architecture.

Fig 2.1: Sketch of a bicycle and its components
2.2 VISIT TO VELORAMA MUSEUM

VELORAMA MUSEUM
NIJMEGEN, THE NETHERLANDS, 1981
DIRECTOR G.J. MOED

The Velorama Museum is the only bicycle museum of the Netherlands and is located in Nijmegen. The largest bicycle collection of Europe is displayed in a monumental building of over 200 years old. Hotel Courage is located next to the museum and provides a place to sleep for visitors of the Velorama Museum that wish to explore more of Nijmegen. Royal Gazelle, a market leading bicycle factory of the Netherlands, was the former sponsor of the museum.

IMPRESSIONS OF THE VELORAMA MUSEUM
The Velorama Museum has an incredible amount of bicycles stored on 3 levels of the building. The building is relatively small for the museum’s collection; too many bicycles are placed on too few square meters resulting in the visitor possibly missing some very special objects or details. If the collection would have been displayed in a bigger space, some important or special objects could have been highlighted better.

The route through the museum leads the visitor with some curves through the space on each level. The visit is relatively static; only the walking visitor is moving through the museum, there are no other forms of movement and there is no other type of interaction with the collection than looking at it. The museum is not accessible for people in wheelchairs, since the very small staircase is the only way to climb or descend the building.

The oldest bicycles are displayed in a very picturesque or romantic setting, especially on ground floor. The wooden building structure of columns and the relatively dark spaces, together with the decorations on the walls, create a rather historical atmosphere. Once the visitor moves up to higher levels in the building, the spaces become more lighted and have a more modern character. The spaces seem to change in time simultaneously with the change of the bicycles. The collection starts with the oldest types of bicycles and the walkways lead the visitor chronologically through the collection. Even though there are no examples of very recent types of bicycles, such as the electric bicycle, the collection of the Velorama Museum gives a rather complete impression of how the bicycle has developed throughout the years.
To increase the speed of pedestrians, the so-called ‘draisine’, a walking bicycle also referred to as ‘Velocipide’, was invented in 1817 by the German Baron Karl von Drais.\(^1\) This two-wheeled manomotive draisine was the forerunner of the bicycle as we know it and required the user to push-off on the ground to make the bicycle run. The first pedal driven bicycle was invented by the Scottish blacksmith Mac Millan in 1839.\(^2\) His later version of the bicycle also had a steerable front wheel, enabling cyclists to maintain speed in curves. Beside of the two-wheeled version of the pedomotive bicycle, people started experimenting with three- and four-wheeled cycles as well. The ‘Michaux’, which was later nicknamed ‘Boneshaker’, was a bicycle with pedals mounted on the front wheel’s axle. This bicycle, invented by the Frenchman Michaux around 1860, already had a braking-system.\(^3\) The nickname boneshaker resulted from the fact that the wooden or metal bikes would heavily shake (and thus make the user’s bones shake) when riding very uneven and bumpy roads (which were very common road conditions at the time).

Around the 1870’s, the size of the wheels changed; with larger wheels, people could travel further with just one turn of the pedals on the front wheel. And with increasing speeds, cycling started becoming popular also as a racing sport. The travel distance of one pedal turn increased even further in the design of the High Bicycle.\(^4\) The front wheel was enormous in comparison to the small rear wheel. Since the user of the High Bicycle was located relatively high on the bicycle, it was not without risk to drive the High Bicycle. In order to design a safer High Bicycle, a few things had to change according to bicycle manufacturers; they changed the center of gravity more backwards, the front wheel became smaller or the back wheel became larger and the pedal mechanism was applied with chains. The High Wheel Safety was very heavy in its use, resulting in the bicycle never becoming really popular.\(^5\)

The first chain-driven Safety with more equally sized wheels were designed by the Englishmen Lawson-Rudge and Humber.\(^6\) Their first versions date from 1879. The pedal system was no longer attached to the front wheel, but instead a chain system between the wheels would transfer the pedal power towards the back wheel. The English John Kemp Starley introduced his ‘Rover bicycle’ and this model shows many similarities to the bike of nowadays, except for the non-pneumatic tires.\(^7\) In combination with the pneumatic tyre, re-invented by the Irish John Boyd Dunlop in 1889, the bicycle of ‘modern times’ was born at the end of the 19th century.\(^8\) The bicycle became enormously popular and the ‘Bicycle-Boom’ was a fact; the bike was used by men and women for travelling or racing, and was also thoroughly used during World War II.

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1. Nationaal Fietsmuseum Velorama, 2011. (pp. 5).
2. Nationaal Fietsmuseum Velorama, 2011. (pp. 5).
Fig 2.3: The Draisine or Velocipide, a manomotive cycle

Fig 2.4: A three-wheeled pedomotive cycle

Fig 2.5: Boneshakers with pedals on the front wheel

Fig 2.6: The High Bicycle

Fig 2.7: The bicycle of modern times (end 19th century), based on the Safety concept

Fig 2.8: The racing bicycle of Dutchman Wim van Est, he fell into a ravine during the Tour de France of 1951
The bicycle became very popular around the end of the 19th century and has stayed popular ever since. Nowadays, the bicycle has also become a symbol of modernity, of culture, of freedom and independence. For children, the bicycle is most likely one of the first types of vehicles that they will learn to ride themselves (possibly after the children’s version of the walking bike or the tricycle).

The production of bicycles has changed in comparison to the historical approach; the assembly of the bike has changed from being produced entirely by one producer to becoming an assembly of multiple prefabricated parts from multiple producers. For designing a building that promotes cycling, this poses as one of the guidelines to how the building could possibly be constructed; using multiple prefabricated types of elements that can be assembled at the design location. The entire assembly should enable the user to understand its functioning, just like a person can ‘read’ the functioning of the bicycle from its entire assembly.

Steven Fleming is an architectural historian and an urban planning philosopher. He has written the book called ‘Cycle Space’, describing how the city is perceived from the perspective of the cyclists and how their view relates to other perceptions. Even though the car is a very dominant vehicle worldwide, the voice of the cyclist should be heard as well to improve the contemporary city. Combining his philosophical approach with his architectural approach, Fleming explores the relation between the bicycle and architecture. In an interview with Bike Portland, Fleming refers to the bicycle’s pure construction and functionally perfect design, resulting in the bicycle being “a really strong emblem for architects”. The aesthetical approach of architecture for the bicycle can be based on this emblematic bicycle principle. Architecture for the bicycle however, whether it focuses on parking or riding the bicycle, doesn’t need to be only functional to relate to the bicycle; there is much more that defines the experience of the bicycle than only its functional design.

Multiple events, for example the Bicycle Film Festival, use the bicycle as the emblem for a cultural event or festivity. In 2013 the Bicycle Film Festival was hosted in Stockholm, which was also its first time in Sweden. The festival was celebrated simultaneously with the Stockholm Bicycle Fest. These types of events could be used to promote cycling as a sustainable transport manner as well. Therefore the public building also needs a connection with its surroundings and needs to have open terrains to host special events on.

2.5 SUSTAINABLE TRANSPORTATION

The bicycle as we know it has already been around for quite some time. Relatively recent inventions, like the electric bicycle, ease the use of the bicycle for the elderly, increasing the various groups of people that can cycle. New improvements, not just for the bicycle but also for the bicycle conditions in the urban fabric, can keep increasing the attractiveness of riding the bike instead of the car.

As the theme of sustainability keeps gaining importance all over the world, riding the bike is one of the themes that can still be improved and promoted. Throughout history, cycling has proven to be a very sustainable way of transport, covering the categories of People, Planet and Profit;

People
- Exercising and healthy movement
- Relaxation and recreation
- Distances between places seem to become smaller due to increased travelling speed compared to walking
- Driving a vehicle that can be easily customized and chosen by design, reflecting one’s personality

Planet
- Relatively little material; an optimal construction
- Bicycles contain materials that can be reused
- No CO₂ exhaust by the bicycle
- No fuel use (other than the human power provided by the cyclist or electricity in case of electric bikes), very energy efficient

Profit
- In comparison to the car, very little investment costs and maintenance costs
- High flexibility; bicycle can be taken to many places, easily parked, easily travelled
- Shorter transport time in comparison to pedestrians and possibly to cars (no traffic jams for cyclists)
- No fuel costs

Steven Fleming states about bicycles¹¹:
‘They’re the sorts of things architects want to achieve with their buildings; frugality, perfection, elegance, personality, aspiration, fun.’

Fig 2.9: Interpretation of the cycling city by Cycle-Space (image by Cycle-Space)

¹¹ Bike Portland, 2011.
COUNTRIES KNOWN FOR CYCLING

Many people are familiar with ‘Nine Million Bicycles’ by Katie Melua. It is a song dating from 2005, naming the fact that (at that point in time) there were already nine million bicycles in China’s capital Beijing. That was indeed an impressive fact that we couldn’t deny. But even though the Chinese total amount of bicycles easily surpasses the amount of bicycles in the Netherlands, it is especially the Dutch who are known for riding the bike.

According to a ranking of Listverse, China takes 10th place in the ranking of ‘Top 10 Countries with highest Bicycles per Capita’. China’s total number of bikes is likely to exceed over half a billion, but it is approximated that less than 40% of its population owns a bicycle.

Sweden is number 4 on the list and has around 6 million bicycles, owned by approximately 60% of the Swedish population. The absolute leader is the Netherlands, a country with most likely more bicycles than inhabitants. Over 90% of the Dutch population owns one or more bicycles, so it is no wonder that the Netherlands is known as a country for cyclists.

A well-known Dutch bicycle organization is the ‘Fietsersbond’, which is fully dedicated to increase the cycling conditions in the Netherlands. Closely related to the Fietsersbond is the ‘Dutch Cycling Embassy’, an organization that strives to share the Dutch cycling knowledge about urban planning, road design, bike parking, traffic policy or (e)bikes with other countries. Members of the Fietsersbond and the Dutch Cycling Embassy could be housed in the building that is to be designed for Stockholm. This way the Dutch knowledge and expertise on cycling could be shared and implemented within the Swedish capital.

16. Fietsersbond, date unknown.
17. Dutch Cycling Embassy, date unknown.
IMPROVING CYCLING CONDITIONS IN STOCKHOLM

The design assignment is to create a public building devoted to the promotion of the sustainable transport manner of cycling. Since the building will be designed for the sustainable capital Stockholm, Dutch knowledge about cycling and Swedish knowledge about sustainability can be combined within the building. The fields of knowledge should strengthen each other in both the experience of the building and their functioning for cycling in Stockholm.

Stockholm has experienced some difficulties with cycling in the city. Back in 2009, three main cycling feature problems could be named, according to the report ‘Intermodal connections between cycling and public transport - A Stockholm case study’:

1. Problems with bicycle parking facilities
2. Problems taking bicycles into public traffic
3. Problems renting bicycles

Trafikkontoret is Stockholm’s traffic planning department, which is also responsible for the planning of cycling and the cycling conditions in Stockholm. Birkholz states in his report:

‘One very important aspect is that there is no superior authority that actively initiates or supports developments that aim for better cycling conditions

– in contrast to countries like the Netherlands or Germany where the federal governments are putting a lot of efforts and investments in improving the conditions for cycling. The collaboration between Trafikkontoret and the superior authority Vägverket is very unsatisfactory and the political leadership of the city has decreased the cycling budget and supports an increase of car parking space.’

With the help and knowledge of organizations such as the Fietsersbond and the Dutch Cycling Embassy, the cycling conditions in Stockholm could be improved. Simultaneously, cycling can be promoted to the inhabitants and visitors of Stockholm by the public building that is to be designed.

The cyclist will be the main focus of the building that is to be designed. In order to really stimulate the cyclist to explore the building, and to give the cyclist the main role, the building must enable the cyclist to ride in or through it.

BUILDING FOR THE BICYCLE
Cyclists will have a different experience of the building in comparison to pedestrians; they will have a higher speed, must maintain their balance, can't make very sharp turns, or drive up very steep slopes. Therefore the building must provide a cycle route that enables the cyclist to enjoy the ride through the building, ensuring a safe and enjoyable route for both cyclists and pedestrians within the building.

The individual differences between people (age, condition, weight, etc.) will also define the capability of a person to cycle through a building. Since the public building in Stockholm is supposed to activate people to cycle, its cycling features should be accessible and enjoyable to the various types of cyclists.
Fig 2.10: A happy cyclist (picture by Jeff Debooy)
3. Location

A CONCEALED PARKING LOT IN STOCKHOLM
The Swedish capital Stockholm is the center of sustainability, whereas the Netherlands has a wide knowledge and experience within the field of cycling and how to implement the cycling structure within the urban fabric. Therefore these two aspects will be combined; using the best of both worlds, the public building devoted to the promotion of cycling will combine Dutch cycling knowledge with Swedish sustainability knowledge.

The location for the building is closely connected to the topic of sustainability:

- Sweden as sustainability leading role model
- Stockholm as an inspiration; first city to receive the title of Green City, 2010
- Extreme climate (cold climate), all four seasons can be experienced (to which a building must respond)
- Modern atmosphere, city with a blue-green identity, but also 14 islands with 14 identities
- Location to test the revised Dutch sustainability aims and showcase these to an international public

During the 13th century, Stockholm was already a fortified market town, existing within the boundaries of the area now known as Gamla Stan.¹ Farmers lived in the surrounding area. The Swedish capital, existing of 14 islands, has one island known for its nature and attractions; Djurgarden.

This island is often referred to as Stockholm’s museum island. Djurgarden, named Valdemarsön during the Middle Ages, was used to defend the city of Stockholm and the agriculture for the castle’s supplies. In the 1400’s it became a national urban park.² Nowadays, Djurgarden is a part of the Royal National City Park, which contains a beautiful cycling route. The public building can be connected to this route.

The exact location on Djurgarden was determined by the following guidelines:

- Location within nature to see the building change along its natural environment
- Travel from urban environment to natural environment to show the various sides of Stockholm
- Use of both the green and blue identity of Stockholm, relating to nature and water
- Connecting the building to other museums and the existing cycling route on the island
- Upgrade of the location for Djurgarden, no degrading of the existing locations on the island

Beside of these guidelines, a study of Djurgarden’s history and a closer location analysis have helped determining what exact location would match with the task to design a public building that promotes cycling.

¹ National Stadspark, date unknown.
² National Stadspark, date unknown.
Fig 3.1: The bicycle route (black) through the Royal National City Park in Stockholm (red left mark: central station, right red mark: chosen location on Djurgarden)
Djurgarden is closely connected to Stockholm’s city center and the central station. From the station people can easily travel to Djurgarden, crossing its bridge Djurgardsbron. The route can be travelled using public traffic, a car or bike or by going on foot.

The Royal National City Park is protected according to the Environmental Code (chap. 4:7). The area Ulriksdal–Haga–Brunsviken–Djurgården is a national urban park. New development, new buildings and other measures shall only be permissible in national urban parks if they can be undertaken without encroaching on park landscapes or the natural environment and without detriment to any other natural and cultural assets of the historical landscape.  

Fig 3.2: Djurgarden at the connection of the urban fabric and park landscape

3. National Stadspark, date unknown.
Fig 3.3: The bridge Djurgardsbron connects the Djurgarden park with the urban environment.
3.2 HISTORY OF DJURGARDEN

Until the mid-1700’s the Djurgården park was used for hunting. King Adolf Frederick decided to transform the hunting area into an area for excursions and amusement. The fence was demolished in the late 1820’s and the deer were moved to the Deer Park. The park became open to the public for walks and thus became an asset for Stockholm’s residents and visitors. With the transformation of the hunting park to a public park, the amount of private residences on Djurgarden started growing. Wealthy citizens started to take over several plots on Djurgarden around the 1800’s. In 1792 a commission was formed to protect the Djurgarden land to prevent it from being taken over by individuals and becoming too privatized.

Djurgardsslätten, located on South Djurgården, became the amusement and entertainment area. There were inns, cafes, shows, music and dance studios. The first amusement park opened in 1850. Gröna Lund, the theme park opened in 1883, and the Circus, opened in 1891, were part of this amusement park. Visitors could take the ferry from Fjäderholmslinjen on Gamla Stan to Almänna Gränd, General Alley, on Djurgarden. Halfway the 19th century, the entire Royal National City Park had transformed for agricultural district to a park with representative landscapes. The royal palaces Ulriksdal, Haga and Rosendal show the royal influence in its landscape and buildings.

South Djurgarden, in the area of Lejonslätten, was used as the location for the General Art and Industrial Exposition of Stockholm in 1897, to depict Sweden as a modern industrial state. Another big exhibition was the Stockholm Exhibition in 1930, which was a manifestation of the Swedish dominant architectural style of functionalism. The buildings for the exhibition were temporary and the main architects for the fair were Gunnar Asplund and Sigurd Lewerentz.

Djurgarden is known for its military and maritime past as well. From Djurgarden the Baltic Sea could be travelled and defended. Skeppsholmen, Kastellholmen, Galärvarvet and Beckholmen still show signs of their military and maritime history. This area is also referred to as ‘Sjögården’ and is characterized by its maritime tradition, including the Vasa Museum and the shipyard operations on Beckholmen.

After the first half of the 19th century, many museums and institutions started arising in the Royal National City Park. Therefore Djurgarden became not only recreational but educational and research oriented as well, translated in the high museum density on the island.
Fig 3.4: The hunting park around 1700.
GALÄRVARVET – GALLEY SHIYARD/WHARF

The name Galärvarvet dates from the 1720’s and refers to an area on the museum island Djurgarden in Stockholm. This Galärvarvet area was used from the 1720’s as a site for the archipelago fleet galleys until 1969 as a part of Stockholm’s naval shipyards. Nowadays the area is used as a park, including various buildings, and is called the Galärparken.

Gustav Vasa, King of Sweden from 1523 to 1560, brought the war fleet to Stockholm. The Royal crown granted a piece of South Djurgarden for the fleet in 1722. The archipelago fleet galleys were stored on land in sheds. After moving the galleys temporarily to a galley port between Skeppsholmen and Kastellholmen, the galleys were moved back to Djurgarden in 1752. The galley area expended further eastward on the South Djurgarden island in order to accommodate 30 galärskjulen, galley sheds, on the Northern and Southern Arsenal along the shoreline. The northern Arsenal expanded even more during the late 1700’s.

A cemetery (initially) for naval personnel, Galärvarvskyrkogården, was created next to the shipyard in 1742. The naval dockyard grew during the 19th century with new workshops for the fleet’s ships. The Galärvarvet was being renovated from 1872 to meet the new needs and standards of steamships. A large dry dock was established as well.

Today only two of these galley sheds remain, in which the Spirit museum is housed. The other galley sheds were demolished or destroyed by a fire in 1921.

Over 1200 employees worked at the shipyard by the end of WWII. During the 1960’s, the maritime fleet started to gradually leave the Galärvarvet area in different phases. The entire maritime business moved to Muskö, an island just south of Stockholm with an underground naval facility. Most of the remaining industrial buildings were demolished and the dockside was changed as well; the former maritime Galärvarvet area was remodeled into a park.

The current area of Galärvervet exists of a park landscape with still some signs of its maritime past. The Galärparken and Vasa Museum are relatively new, while the cemetery Galärvarvskyrkogården and 2 of the original galley sheds and minesweepers hall have remained. The galley sheds now house the Spirit museum and the minesweepers hall (minsveparhallen) now houses the Junibacken museum.
The promotion of cycling is related to both the urban and nature side of Stockholm. Therefore the building will be placed somewhere at the start of the Djurgarden island, where park and city connect and where the bicycle route through the park starts. The connection with Stockholm’s blue-green identity is also of high importance, considering the recreational value of nature and water. At the beginning of the island, there are 2 open spots that could become the location for the public building.

These 2 open spots have a connection that goes back to the hunting park era of Djurgarden. The area in front of the Nordic Museum is called Lejonslätten and means Lion’s Plat. The name derives from the 18th century, when animal-baiting was a royal pleasure and fights between lions and bears were held at Lejonslätten. The lions were kept at Lejonkulan, located northwest of the Nordic Museum. Nowadays, an open parking lot is located on Lejonkulan.

Fig 3.7: Lejonkulan and Lejonslätten as possible locations

Fig 3.8: Lejonkulan nowadays (picture by Timo van Lieshout)

Fig 3.9: Lejonslätten nowadays
NOT BUILDING IN LEJONSLÄTTEN AREA
Both Lejonslätten and Lejonkulan have been investigated for their potential, qualities and problems. The clearing of Lejonslätten however proved to be inapplicable for a large public building; the beautiful park clearing surrounded by trees and a few buildings would disappear if a building was placed inside the clearing. Even placing a building on the edge of the clearing (in order for some of the spatial effect to remain) would still harm the peaceful area. This would contradict the aims of the design assignment and the environmental regulations for Djurgarden. The clearing doesn’t need a building; not building in the clearing is what gives that space its qualities.

Fig 3.10: The clearing of Lejonslätten across the water
3.11: The Nordic Museum functions as the background of the clearing

Fig 3.12: Traffic between the Nordic Museum and the clearing, the clearing has a direct connection with the water
BUILDING IN LEJONKULAN AREA
The other open area of Lejonkulan however does need an upgrade; a parking lot with over 100 cars right at the start of the Royal National Park doesn’t add to the value of the park (except that cars won’t have to drive further onto the island). The spatial quality and the connection to the surroundings of this open site can definitely use some improvement.

DISCONNECTION OF A BEAUTIFUL SPOT
The public building will be positioned on the area of Lejonkulan, where the space is currently occupied by an open parking lot. The parking lot, hidden between trees and somewhat lowered in the landscape, blocks a direct connection through a natural route; people will less likely continue their stroll through a parking lot if they could also continue their stroll in a park landscape.

Fig 3.13: Parking lot hidden between trees and disconnecting the area to the west from the rest of the park
THE AREA FARTHEST WEST
One beautiful spot, the area farthest west on the island, is currently cut off from the main routes on Djurgarden; only visitors of the Junibacken museum are highly likely confronted with the place that offers an amazing view of other of Stockholm’s islands. The image of parked cars should be replaced by something that fits the island, especially since the coastline on which the parking lot is located is also the ‘face’ of the island when approaching Djurgarden from the inner city.

Therefore this site is applicable for the function of a showcase of the bicycle and its use for recreation. The parking lot has plenty of green open space around its plot, which can be used during events for the promotion of cycling.

The protection of the Royal National City Park demands that the new development on the island should add to the value of culture, history and natural landscape. By using an existing parking lot, the existing environment receives an upgrade, and the location has an impressive former maritime identity to which can be connected.
Fig 3.23: The area farthest west of the Djurgarden island provides a beautiful view of some of Stockholm’s other islands across the water (picture by Timo van Lieshout)
Fig 3.24: Surrounding area south of Lejonkulan, with the Nordic museum (right) and Vasa Museum (left) (picture by Timo van Lieshout)

Fig 3.25: The parking lot of Lejonkulan is currently degrading the park landscape (picture by Timo van Lieshout)
Fig 3.26: A nice green park landscape on the area farthest west of Djurgarden (picture by Timo van Lieshout)

Fig 3.27: An panoramic view from the area farthest west of Djurgarden to other islands of Stockholm (picture by Timo van Lieshout)
3.5 SURROUNDINGS

The site of Lejonkulan provides a location for the public building that will receive direct sunlight (depending on the amount of trees that surround the building). The surrounding buildings are located far enough from the location to not block the direct light, even in winter when the angle of the sun is relatively low. The area of the parking lot is closely connected to the water and is surrounded by impressive building structures in a park landscape.

There are only 2 parking lots close to the entrance of Djurgarden. The area however does offer many eating facilities located in and near the many museums of the area.

The important buildings and areas that surround the parking lot (and the beautiful area west of it) are:
1. Nordic Museum
2. Vasa Museum
3. Ferry landing
4. Junibacken
5. Galarbryggen
6. Visit Djurgarden Visitor Center
7. Strandvagen

Fig 3.28: Functions and buildings surrounding the area of Lejonkulan

scale 1:5000
Arthur Hazelius wanted to save the old peasant culture and opened the Scandinavian-Etnographic Collection in 1873. The collection grew so quickly that the museum collection was moved to Djurgarden, to the Nordic Museum that was designed by Isak Gustaf Clason and opened in 1907. Hazelius also founded Skansen - the world’s oldest open-air museum - in 1891, showing Swedish housing and working culture throughout varying times.

The Nordic Museum is constructed of brick and granite and has concrete roof. Its construction is based on a very rigid grid, visible in both floorplans and façades. The building shows order and regularity according to the Renaissance style.
On the orders of King Gustavus Adolphus, the Swedish warship Vasa was built between 1626 and 1628. The ship sank during the maiden voyage before even reaching the Baltic Sea on 10 August 1628. Vasa was recovered in 1961 and temporarily housed in Wasavarvet, ‘The Vasa Shipyards’. The Vasa warship is now located in the Vasa Museum, opened in 1990.

Vasa is constructed with many different shapes, which work quite natural from the inside of the museum, but its façades from the outside are quite different to understand; the building must be seen as a whole to gain at least some understanding of its structure.
The company Waxholmsbolaget, founded in 1869, is responsible for the public boat traffic for visitors in Stockholm. The Djurgarden ferry, which follows the Djurgardfarjan route through inner Stockholm, travels from Slussen (near the old city center Gamla Stan) and it arrives at Djurgarden near the theme park Gröna Lund. The ferry continues to Skeppsholmen and can also lie at another landing on Djurgarden; near the Vasa Museum is another landing where visitors can decide to take the ferry and start exploring the island.

The ferry landing near Vasa provides a quick access to the museum, but the landing however doesn’t provide the feel of a ‘real entrance’ to the island and the Vasa Museum. Visitors are dropped at a rather unclear spot where there don’t get an overview of the island or the Vasa Museum. The museum’s structure is one with a very complex amount of shapes combined into one building and should also be captured by visitors in its entity. But visitors now enter so close to the museum, missing the spatial experience of the museum and instead directly running into its walls.
JUNIBACKEN MUSEUM
STOCKHOLM, SWEDEN, 1996
FOUNDED BY STAFFAN GÖTESTAM, FREDRIK URSTRÖM AND PEDER WALLENBERG

Junibacken is a museum for children in which they can walk through different worlds of Swedish literature such as the world of Pippi Longstocking by Astrid Lindgren. Beside of the displayed stories, the museum contains Sweden’s largest children’s bookstore, a theatre, a restaurant and temporary exhibition space. The museum is located in a former minesweeper hall that belonged to the maritime ensemble. The open green space north of the museum (the area most west of Djurgarden) is described in the following way for one of Junibacken’s events:

‘It is a lovely green spot in the heart of Stockholm, ideal for music performances, theatre plays, illustration workshops and much more.’

The boat trade Galarbryggan, located closely to the bridge Djurgardsbron, buys and sells boats. A pier is (depending on the season) filled with 60-80 boats waiting to be sold to their new owners. The pier with boats is partly blocking the view to the bridge from the island Skeppsholmen and the pier is located relatively far from the other boat piers on Djurgarden. Its location right across Strandvagen however, combined with the beautiful background of trees on Djurgarden, give the boat trade a very exclusive billboard position within the city.

A new visitor center for Djurgarden was realized in 2013. The center contains an information center, a cafeteria and kiosk, a boat and bicycle rental and public toilets. The building has a plinth with a relatively closed façade of slates, whereas the volume above the plinth has an inviting and open pavilion character with a glass façade. The visitor center connects to Djurgarden and the surrounding buildings with materials that are used in surrounding buildings as well and provides structures that will be overgrown by nature to blend into the park even more.
The boulevard across Djurgarden is called Strandvagen and is located on Östermalm. Constructed during the 1890’s, it was fully completed in time for the Stockholm World’s Fair of 1897. Walking or riding over the ‘beach road’ is very attractive, given the beautiful buildings, nature, water and boats. Strandvagen is facing south, thus being lit by direct sunlight during sunny days. The road is daily travelled by many people (by car, bike, public transport or on foot) making it a very popular and busy road.

The program for the public building to promote cycling exists of varying functions. Since various functions are combined in one complex and they all relate to the topic of bicycle, the public building will be referred to as ‘the Bicycle Base’.

**MAIN FUNCTIONS**

The Bicycle Base consists of 3 main volumes connected by a connection zone.

The 3 main functions are:
1. Bicycle museum (referring to the past)
2. Bicycle repair station (referring to the present)
3. Bicycle innovation center (referring to the future)

The main functions could be combined in one building volume, but in order to create movement between clearly distinguishable functions, the 3 main functions are split up. The zone between the main volumes, the connection zone, will function as a buffer space, providing a space for cycling inside the complex of the Bicycle Base. The main volumes can be read as separate volumes, whereas the volumes together with its connection zone can be read as one complex. The volumes could however be separately used and operated in the future, depending on the building’s new functioning.

Especially the routing through the building will be of major importance; since the cyclist will cycle through the building and needs to be confronted with the multiple main functions, the concept must enable a routing that functions for both cyclists and pedestrians. Movement must be introduced by the building itself.

Fig 4.1: Splitting the entire program into 3 main functions, connecting the separate functions with a connection zone
<table>
<thead>
<tr>
<th>Area</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Museum (relation to the past)</strong></td>
<td>4400</td>
</tr>
<tr>
<td>• Exhibition (historical and special objects)</td>
<td></td>
</tr>
<tr>
<td>• Expositions/flexible exhibitions</td>
<td></td>
</tr>
<tr>
<td>• Depot</td>
<td></td>
</tr>
<tr>
<td>• Back office and toilets</td>
<td></td>
</tr>
<tr>
<td>• Technical space</td>
<td></td>
</tr>
<tr>
<td><strong>Repair station (relation to present)</strong></td>
<td>2600</td>
</tr>
<tr>
<td>• Workplace and tool storage</td>
<td></td>
</tr>
<tr>
<td>• First aid room</td>
<td></td>
</tr>
<tr>
<td>• Element and bicycle storage</td>
<td></td>
</tr>
<tr>
<td>• Back office and toilets</td>
<td></td>
</tr>
<tr>
<td>• Recycle space/artistic space</td>
<td></td>
</tr>
<tr>
<td>• Restaurant, kitchen and storage</td>
<td></td>
</tr>
<tr>
<td>• Lounge area</td>
<td></td>
</tr>
<tr>
<td>• Technical space</td>
<td></td>
</tr>
<tr>
<td><strong>Innovation centre (relation to the future)</strong></td>
<td>3800</td>
</tr>
<tr>
<td>• Presentation room/flexible use</td>
<td></td>
</tr>
<tr>
<td>• Test space and visitor meeting room</td>
<td></td>
</tr>
<tr>
<td>• Office spaces</td>
<td></td>
</tr>
<tr>
<td>• Workshop</td>
<td></td>
</tr>
<tr>
<td>• Back office and toilets</td>
<td></td>
</tr>
<tr>
<td>• Technical space</td>
<td></td>
</tr>
<tr>
<td><strong>Connection zone</strong></td>
<td>8000</td>
</tr>
<tr>
<td>• Entrance area and outdoor space</td>
<td></td>
</tr>
<tr>
<td>• Technical space</td>
<td></td>
</tr>
<tr>
<td>• Elevators and staircase shafts</td>
<td></td>
</tr>
<tr>
<td>• Bicycle parking zones</td>
<td></td>
</tr>
<tr>
<td>• Load+unload space</td>
<td></td>
</tr>
<tr>
<td><strong>Parking</strong></td>
<td>6200</td>
</tr>
<tr>
<td>• Car parking employees and visitors</td>
<td></td>
</tr>
<tr>
<td>• Bicycle parking employees and visitors</td>
<td></td>
</tr>
<tr>
<td>• Parking guard pavilion</td>
<td></td>
</tr>
</tbody>
</table>
The Mercedes-Benz Museum is known for its fluent routing, using a double helix structure. The visitor of the car museum is first transported to the top of the building with an elevator and descends the building along one of the 2 routes; one route that displays the collection in a chronological order and the other route is based on themes and functions. The characters of the different routes also differ; one route is relatively dark and connected to the atrium, the other one is lighted by the glass façades.

The façades of the building show the two routes that lead through the building. Both routes end in the setting of ‘Races and Records’, along the way visitors can decide to switch to the other route to descend the building.
The Guggenheim Museum in New York is characterized by the spiral structure of its exhibition hall. The museum for modern art shows its routing principle in its façade. The exhibition hall is closed from the outside and lighted by the large atrium. Just like the Mercedes-Benz Museum, the Guggenheim Museum enables its visitors to travel to the top of the exhibition hall with an elevator and to descend the building in a circular way.
EXPO 2010 DANISH PAVILION
SHANGHAI, CHINA, 2009
DESIGNED BY BIG

The Danish Pavilion, designed by the Danish BIG, was used at the Shanghai EXPO of 2010 to display Danish virtues and some of Copenhagen’s best attractions (such as the bicycle and the harbor bath). The bicycle is a central element in the pavilion; together with the building’s structure and the use of the bike in the pavilion, the bicycle is promoted as a modern and sustainable transport manner, both applicable to Denmark and China. The building also uses a continuous double loop to achieve a routing for both cyclists and pedestrians, enabling both groups of visitors to experience the pavilion with different speeds.

Fig 4.10: Cycling path and pedestrian area harmoneously coexisting in the building (picture by Iwan Baan)
Fig 4.11: Spiraling cycling zone (picture by Iwan Baan)
Fig 4.12: Schematic routings (image by BIG)

3. BIG, date unknown.
The Chongming Bicycle Park is a concept for a complex with functions that focus on the bicycle. One of the complex’s buildings is a bicycle museum, the other functions are a visitor center and a multi-purpose hall. The museum has a spiral structure with a double helix, creating a route for both the cyclist and the pedestrians. The cyclists can climb the continuous slope of the museum collection on the inside and can descend riding the cycle path on the outside of the building.
The Bicycle Base is not only meant to stimulate movement (either by cycling or walking), the building will also consider other aspects within the various categories of sustainability:

Main aims for the category People:
- Routings and experiences based on cycling or not cycling
- Interaction for different types of visitors (cyclists/pedestrians, young/old)
- Interaction with museum collection, repair station and innovation centre
- Changing experiences throughout seasons
- Connection to blue-green identity of Stockholm (nature and water)
- Atrium as part of the public Lejonslätten park
- Healthy indoor environment with natural ventilation
- Varying daylight experiences

Main aims for the category Planet:
- Environmental-friendly materials, reused and recycled materials
- Water and heat reuse
- Systems working along seasons
- Use of buffer space (like an atrium)
- Lighting system that provides light only when necessary
- Producing energy using solar panels

Main aims for the category Profit:
- Flexibility, providing spaces for varying uses during seasons
- Spaces available for hiring
- Making profit from car parking and not necessarily from cyclists in order to stimulate people to come by bike instead of car
- Remaining of the ‘clearing’
- Investing in innovation and education about bikes and transport and recycling, contributing to the knowledge and prosperity of Stockholm’s society
- Multifunctional building that stimulates and attracts visitors to make use of the various functions
CHARACTER OF THE BUILDING

The character of the complex as a whole and of its separate main functions can be related to the design and character of the bicycle. Some of the bicycle’s characteristics, that could be used for the design, are:

- Light, not massive
- Open
- Human scale, designed for human comfort
- Flexible, adjustable
- Functioning within various surroundings (urban, nature, etc.)

Using materials that refer to the bicycle could increase the connection of the building with the theme of the bicycle. By using metals such as steel or aluminum, or with the use of wood, there is a direct relation between the materialization of the bicycle and of the Bicycle Base. The bicycle path can be made from colored asphalt, to clearly display what zone is meant for the cyclist and to prevent slippery bicycle path conditions.
Organizing the symposium ‘Buildings with Badges’ was part of the graduation studio ‘ID: on the representation in architecture’. The main topics of the graduation studio are identity and its representation in architecture, as well as the question to what extent sustainability plays a part in defining and representing identity. During the symposium, the following speakers discussed these themes from different perspectives, related to their background in architectural practice, education, and theory;

**HANS VAN DIJK**
Renowned Dutch architecture critic & former professor architectural history at the TU Delft, with a focus on identity in architecture within a theoretical and practical perspective.

**DO JANNE VERMEULEN**
Director and architect from Team V Architectuur & involved in the TU/e Main Building Renovation, with a focus on the relation between identity and sustainability in architecture;

‘Integrated sustainable design is (almost) invisible.’

**JOS VAN ELDONK**
Director and architect from Soeters Van Eldonk architecten & involved in Energy Flower Wuhan, with a focus on the representation of identity in architecture;

‘Identity is not a matter of rational thinking. In his irrational, sensitive moments an architect creates beauty and identity…..’

**NOUD PAES**
Architect of the architectural firm Paul de Ruiter & involved in TNT Centre Hoofddorp, with a focus on the representation of sustainability in architecture;

‘The architect as a chameleon: not an aesthetical advisor, but an integrator of ambitions and knowledge.’

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LESSONS FROM SYMPOSIUM

Especially the presentation and statement by Do Janne Vermeulen were very interesting in relation to the topic of representing sustainability within a public building. Because when integrated sustainable design is (almost) invisible, how is it possible to inspire others to become more sustainable if they cannot see the sustainability?

Do Janne Vermeulen explained her statement:

‘Integrated sustainable design is (almost) invisible, because sustainability is so much part of a building that it becomes its nature, it becomes natural. (...) Sustainability to a certain level has become the norm. It can be ALMOST invisible; sometimes it is also good to make it visible, it helps to make it more part of the building climate. Sustainability aspects like human comfort, use of daylight, a healthy building climate, high-tech materials, or the latest innovations might not be that visible, but they are integrated in the design. (...) If a building must either be ‘good’ or high BREEAM-rated and these can’t be balanced, then creating a ‘good’ building is more important.’

Another interesting remark was made by Do Janne Vermeulen when she was asked about building for future functions. Should buildings that need to be flexible have to be as neutral as possible and thus have a very neutral identity or no identity at all?

‘There is a big danger in creating a building without an identity, a former identity doesn’t prohibit a new identity in the future.’

According to Do Janne Vermeulen, an existing identity for a building might even strengthen its future functions and identities. For the design assignment of a public building that promotes cycling, this means that its current function can create an identity from which future functions for the building should be able to benefit; either by using the original identity or applying changes to a well-defined former identity of the building.

4.5 THE BUILDING CONCEPT

A CONNECTION ZONE: MOVEMENT & BUFFER
Just like a river with stones, the connection zone will function like a stream that will lead the visitor with different speeds and directions through the space and along the main volumes. To increase the working of the stream, the ground floor level of the connection zone will be entirely open.

The higher levels are ‘covered’ with glass façades and a roof, creating a buffer for the cycling paths which are located on first floor or higher. The buffer zone will protect the cyclists and pedestrians from extreme weather conditions in terms of rain and snow, wind and at some places from direct sunlight. The temperature conditions in the buffer zone will also differ from the outside conditions, which is preferable during extremely cold periods.

The main volumes have different functions, which is translated in varying shapes of the main volumes and differences in openness or closedness of the volumes. Every function will have its own character of space, thus increasing the variety of experiences for the visitor travelling through the building. The connection zone will sometimes lead past the main volumes, on other heights it will lead through the main volumes.

The connection zone has voids at various places, in order to use more natural daylight in the connection zone and possibly in the main volumes. This will increase the spatiality and allows varying light conditions during the day to change the visitor’s experience.

The cycle paths in the connection zone are continuous and lead through the main volumes. Between the paths the space is open, to remain the spatiality of the connection zone, to enable orientation and to increase the amount of natural light that can enter the zone.

The cycling path isn’t merely about the experience of the connection zone and main volumes. Along the cycling route various objects related to the bicycle are displayed; a collection that can only be experienced from up close when travelling the cycle route. To travel the route, cyclists have to climb gentle slopes and will be rewarded when they descend the building; driving down gentle slopes eases the ride and creates a variety of speeds through the building. For those who don’t wish to climb too many slopes, there are also elevators in which both pedestrians and cyclists with their bicycles can be transported to higher levels within the building.
Fig 4.20: Sketches of the original concept; round main volumes, connected by a relatively strict connection zone.
FROM ORIGINAL CONCEPT TO NEW CONCEPT

In the original concept, the main volumes were round shapes, all connected with a relatively strict connection zone. The new concept however shows more rectangular main volumes with the connection zone as a box in which the routing will be the more fluent and less strict element. The main volumes will have a more industrial look and character, in relation to the bicycle industry, and will be placed on the construction grid of an underground parking garage. The rectangular floorplans will provide flexibility for future usage, using a metal column construction inside the volumes.

The rectangular shapes are also a reference to the rectangular storage buildings that once stood on the location of Lejonkulan. Given the industrial assembly of the bicycle and its industrial character, the building will incorporate the same type of formlanguage and arrangement; the main volumes of the Bicycle Base are placed on a strict grid that refers to the maritime period of Djurgarden.

The connection zone however will imply and stimulate movement through the zone and to the main volumes. Therefore the connection zone will use the grid based construction but will be less strict in its construction. This will increase the variation of experiences between the main volumes and the connection zone in between.

Fig 4.21: Comparison between the maritime situation with 3 storehouses (top) and the current situation (bottom) with the parking lot of Lejonkulan

Fig 4.22: Variations for the main volumes and connection zone
Fig 4.23: Sketches of the new concept; more rectangular shape for the main volumes
**SCHEMATIC COMPOSITION**

The main volumes are arranged according to a grid of 8 by 4.5 meters, which continues in the underground parking garage. Between the building volumes there is an open space for pedestrians. In order to create movement between the different buildings, the corners of the main volumes could be rounded.

The connection zone physically connects the main volumes with each other. The ground level underneath the connection zone is open and thus still very accessible.

The buffer space created by the façades and roof of the connection zone enables pedestrians and cyclists inside the building complex to continue their ride or stroll during varying weather conditions. The buffer zone receives fresh air from the open ground level and this air is naturally heated within the buffer zone. With openings on the roof level of the building, the heated air can be automatically transported to the outside during summer to naturally cool the connection zone. During extreme cold days in winter, the openings can be closed to prevent the buffer from unnecessarily losing its heat. The main volumes can use the preheated air from the buffer for their ventilation during extreme cold weather conditions.
ROUTE THROUGH THE BUILDING COMPLEX

Each main volume is closely connected to a vertical shaft with an elevator. The elevator in the middle is the main shaft for vertical transport and also contains the main staircase.

The bicycle route through the building enters the connection zone at level 1 and leads its visitors between the main volumes. To create a clear language of the various shapes (and to clearly distinguish the connection zone from the main volumes) it becomes necessary to decide what elements are rounded and what elements are rectangular. Given the reference to the maritime past for the main volumes, and the request for the connection zone to be a fluent zone, it has been decided that the main volumes remain entirely rectangular and that the connection zone with its cycling paths will introduce curved shapes.

Cyclists can climb the building by climbing a slope between the main volume in the middle (the repair station) and either the museum or the innovation center. The level of the repair shop differs 1.5 meters from the other 2 main volumes, so cyclists will not have to climb very steep slopes to reach the next level of a main volume; from the museum or the innovation center to the repair shop only a half building level needs to be climbed to reach the next floor.
5. Masterplan

TRANSFER POINT FOR THE (NON-)BIKER
5.1 RECONNECTING THE AREA

Fig 5.1: The Bicycle Base in its direct surroundings
**CONNECTING TO THE CYCLE ROUTE**

The island of Djurgarden is known for its beautiful nature and various attractions for citizens and tourists. The island can easily be traveled by bike. The Bicycle Base is connected to the existing bicycle route through the Royal National Park and is designed as an addition of the cycling experience along the route.

The Bicycle Base is positioned on the area of Lejonkulan and its parking lot. The image of parked cars is replaced by a building which focuses on the cyclist. The coastline on which the parking lot is located is also the face of the entrance towards the island. Therefore the Bicycle Base also functions as a showcase of the bicycle and its use for recreation.

**CONNECTING THE BEAUTIFUL SPOT**

By placing the parking garage underground and using the area above ground to create areas for pedestrians and cyclists, the movement through the location becomes interesting and thus more attractive to travel further west. At the cross of the urban tissue and the park landscape, where the cycling route can be started from the inner city, the Bicycle Base shapes a linear and inviting connection between the cycling route and the beautiful spot farthest west.

**REALLOCATING BOAT TRADE AND FERRY**

The boat trade located north of the location has no direct connection to the concept of the Bicycle Base. Therefore a new location should be introduced for the boat trade that has the same type of qualities as its current location. The current location of the company is characterized by its billboard location; on the opposite site you have the busy boulevard Strandvägen with many people passing by each day. The green background of trees for the boat trade increases the attractiveness of the location. The new location for the boat trade should be visible from busy areas of Stockholm in order to maintain its billboard functioning.

The existing construction of the pier (located north of location) will be reused as a landing for the ferry boat that travels from the traffic knot Slussen (near Gamla Stan) towards Djurgarden. The boat trade is reallocated to the existing ferry landing near the Vasa Museum. A new pier will be constructed for the boat trade, that fits within the existing pier structure near Vasa. This location offers a billboard function as well; the ferry will pass the new boat trade location, it is closely connected to all the other ships in the area (so interested buyers will all search within that location) and it is closely connected to the famous Vasa Museum. The new boat trade location is also visible from other islands, like Skeppsholmen and the inner city.
5.2 ARRANGEMENT OF MAIN VOLUMES

Fig 5.2: Ground floor of the Bicycle Base in its direct surroundings
CONNECTING TRAFFIC STREAMS
The Bicycle Base is a transfer point where car drivers, ferry users and pedestrians can switch to the bike or vice versa. Bicycles can be hired inside the buildings connection zone. This way visitors can decide to start the cycle route from the Bicycle Base.

A NEW ENTRANCE TO THE AREA BY BOAT
The ferry stops north of the location for the Bicycle Base. Visitors can enter the Djurgarden island with a new entrance and can pass through the building to make a stop at the Bicycle Base or continue their route towards the other museums. From the Bicycle Base, visitors will have a nice overview of the surrounding area and will experience the entire ensemble of the Vasa museum in its surroundings. By connecting the ferry closely to the Bicycle Base, the building gains an increased connection with the water, which fits Stockholm’s blue-green identity; the building combines the water experience (north of location) with the park experience (south of location).

RELATIONSHIP TO SURROUNDINGS
The Bicycle Base relates to its surroundings with its arrangement of building volumes, its material use and the overall working of its structure. The grid structure of the Nordic Museum and its central volume as a pivot can be found back in the grid of the Bicycle Base that now fits between Junibacken and the visitor center. The main volume of the repair station functions as the pivot of the complex. The grid structure of Djurgarden’s maritime era is reintroduced by the Bicycle Base.

The Bicycle Base contains the three main functions or volumes of bicycle museum, bicycle repair station and bicycle innovation center. The three volumes are arranged in a way that is compatible to the maritime grid structure or arrangement of the 3 storage houses on Lejonkulan, but the Bicycles Base’s main volumes have been shifted respectively north and south. This increases the spatial effect between the volumes in comparison to the arrangement of the storage buildings from the past.

Instead of storage units for the maritime area, the main volumes now function as storages of experience and knowledge about the bicycle for the past, present and future. The main volumes could be used in the future as separate volumes for separate organizations.

The use of metal in the building’s structure and façade relates to the Vasa Museum and the minesweeper hall of Junibacken and connects once again to the maritime background of the area of Lejonkulan. Simultaneously it relates to the industrial character of the bicycle.
6. Design

THE BICYCLE BASE
The bicycle museum grants access for pedestrians, cyclists and car drivers. The car drivers can park their cars in the underground parking garage and continue their experience of the building as cyclists or as pedestrians. The connection zone will lead the visitors through the 3 main functions in the 3 main volumes of the Bicycle Base.

**MUSEUM: A RIDE THROUGH THE PAST**

Pedestrians can access the museum at ground level and decide to buy a ticket. If cyclists wish to depart from their bicycle during their ride through the complex and visit the museum as a pedestrian, they can stall their bicycle on one of the platforms in the connection zone. Stalling the bicycle equals access to the bicycle museum, thus stimulating people to come to the museum island on their bicycle. The same goes for renting a bicycle. The access tickets will grant access to the museum on higher levels and this way the route through the entire complex can be travelled. Visitors of the museum can choose to access the building on each floor by use of stairs, bicycle or elevator.

The museum collection is displayed in such way that visitors will make an entire ‘round’ on each floor, resulting in the idea of travelling a long distance and experiencing the varying light conditions. Visitors always return in the staircase zone after a lap through the collection at a certain level. The continuing row of staircases in the middle of the museum with rooftlights ensures a different experience on each level; the higher a visitor will climb the building, the lighter the rooms will become. This also relates to the order of the museum’s collection; starting on floor 0 with a temporary exhibition, floor 1 starts with the oldest bicycles and each floor higher will display newer models.
REPAIRING THE BICYCLE AND ITS OWNER
The repair station exists of multiple levels with each a different function; on the bottom of the building is the bicycle shop and the repair station located in the same space. Up higher the ‘repairing’ becomes more about the cyclist (or pedestrians). On level 1A [1500 mm above level 1 of the museum and the innovation center] the zone is only accessible to cyclists and displays both bicycles that were lifted and stored from the repair station below as temporary exhibition objects by artists. Level 2A and 3A are part of the eating and lounging area of the bicycle complex. At level 2A people can visit a small cinema to watch documentaries or interesting clips, see strange creations of recycled elements of bicycles and stall their bicycle to sit down and relax after the climb through the building. At level 3A, which can be accessed from level 2A by either the staircase or the elevator in the connection zone, a restaurant with a small bar is located and provides a view over the area towards the Vasa Museum and Nordic Museum.

COMMUNICATION AND EXPERIENCE
The innovation center could house members of for the Fietsersbond and the Dutch Cycling Embassy and members of the Trafikkontoret, Stockholm’s traffic planning department. Together with innovators that focus on new technologies with bicycles, the innovation center becomes a facility that could provide new outcomes and stimulations considering not merely the bicycle itself but also its implementation within the city of Stockholm.

The ground level of the innovation center provides a large room for flexible use; presentations, festivities, meetings or other ways of bringing people together with the bicycle as the main theme. Floor 1 displays a small lounge and cafeteria, which can be used by workers of the museum, repair station and innovation center. The higher levels can be crossed by bike and entered as pedestrians by members with special access passes. Some levels however might be open to public (more than just to ride through), for example to inform about the public opinion and to communicate and check new plans for the city of Stockholm with some of its visitors or inhabitants.

Beside of offices and a few laboratory spaces, the innovation center has a few meeting places which can be rented or booked by organizations or small visitor groups.
6.2 CONSTRUCTION AND TRANSITION

THE CONSTRUCTION
The construction of the parking garage is the basis for the construction above ground. The construction of the main volumes follows the strict grid structure of the parking garage with steel columns and beams, the connection zone however has a placement of columns following the cycle paths, these columns are reinforced mushroom columns cast in situ. The fluent construction of the connection zone is in contrast with the very solid, rectangular and industrial construction of the main volumes.

THE FLOORS
The pipes and ducts that are connected to the ceiling will stay in sight; the construction will remain open and pure, just like the bicycle, reducing the required amount of finishing material within the building. It adds to the industrial look of the main volumes. Just like the mechanism of the bicycle can directly be read and understood from its construction and assembly, the functioning of the building can be read by keeping functional elements in sight. The floors inside the main volumes are made of prefabricated hollowcore slabs, whereas the floors in the connection zone are made from concrete that is cast in situ and colored asphalt for the cycle path.

TRANSITION BUFFER ZONE TO MAIN VOLUMES
The cyclists travel from the connection zone through the main volumes. Since there will be a temperature difference between the buffer zone and the main volumes, it would be problematic to create an open connection between a conditioned and unconditioned zone without any additions to prevent thermal bridges. Some parts of the main volumes, where the cycle paths continue, are unconditioned as well, but at the transition of unconditioned to conditioned zones, air curtains will prevent the main volumes from getting an unpleasant inner climate. The heated air that is used to prevent a large thermal bridge can be reused to heat the buffer space during cold seasons.

At the transition from unconditioned to conditioned zones, the façade will also be insulated to prevent thermal bridges. The main volume of the museum will for example be conditioned, but less than regular; cyclists will also enter the building as pedestrians and are wearing clothes according to the weather conditions outside. Therefore the museum becomes a museum in which visitors continue in the outfits that they arrived in; if it is winter, visitors can explore the museum in their warm jackets. This will save energy since the space needs to be less conditioned. The climate conditions of the interior spaces are adjusted to the dressed and active cyclist and is meant to create a gradual transition of the buffer climate of the connection zone and the climate of the interior conditioned spaces.
Fig 6.4: Schematic section of the transition of main volume to connection zone
6.3 PARKING GARAGE

UNDERGROUND PARKING GARAGE

The Bicycle Base is constructed on the site of the former open parking lot. Since there are relatively few parking spaces compared to the annual amount of visitors of the Djurgarden island, it would be problematic to offer no new opportunities to park in the area of the Bicycle Base. The Bicycle Base is therefore equipped with an underground parking garage of 2 levels. Offering over 200 parking spaces, the parking garage increases the parking possibilities compared to the 133 parking spots of the original open parking lot. The parking garage is however not enlarged with more parking levels, since the bridge to Djurgarden, the Djurgardsbron is not opened for car traffic during the weekend. The Bicycle Base however would be a possible extension of the car permit during weekends; if the cars can only go up to the parking garage of the Bicycle Base, the cars still wouldn’t be able to drive through the rest of Djurgarden.

The parking garage is partially sloped to connect to the lower level of the garage without losing parking spots. This increases the social control and spatial working of the parking garage. The parking garage is located underground, since the main task of the Bicycle Base is to promote cycling. The car needs to make way for the bicycle. The garage defines the building grid that forms the base for the building construction above ground.

Fig 6.5: Floor -1 (P-3000), on the right the underground entrance to the parking garage is visible
Between the parking zones, in the middle of the garage, is a zone in which people can safely walk up or down the parking garage to the other level and can easily take their bicycle along. The regular parking spaces are all 2.5 meters wide, with extra space where the columns are located. At certain spaces, broader parking spaces are created. Behind the parking spaces there is a pavement to safely walk through the garage and to safely load or unload bicycles from behind the car if necessary.

The entrance and mechanical space on the right side of the building is where fresh air from outside enters the garage. On the left side, the mechanical rooms will transport the ventilation air back to the outside again.

The location of the elevators is also where some daylight will enter the garage. Since people will walk towards daylit or lights spaces, the main elevator is located in the middle of the parking garage.
6.4 SITE PLAN

GROUND FLOOR
The pedestrians enter the building at the ground floor level. Since the connection zone is open, there is an easy access to the inside of the building from various sides. The main pedestrian entrances to the main volumes are located on the inside of the connection zone.

SQUARES ON GROUND FLOOR
Due to the arrangement of the main volumes, the connection zone exists of three squares. The main volume on the left is the museum, the one on the right is the innovation center. Located in the middle is the repair station, which functions as a pivot between the other two main volumes if one wishes to climb up to higher levels while riding their bicycle. This is in correlation with what the buildings represent; the repair station (which refers to the present) functions as a pivot between the past (museum) and the future (innovation center).

ELEVATORS
The elevator shafts for the vertical transportation are located in the connection zone. The main elevator is connected in between the three main volumes and also contains the main staircase starting in the parking garage. This elevator continues to the bottom of the parking garage and enables natural light to enter the parking garage. The other two elevator shafts start at ground level (with an escape staircase from the parking garage) and continue to the roof. All elevator shafts can transport people, bicycles and objects that need to be transported to and from the main volumes.

Each elevator shaft can be lighted in a specific color using LED-lights. This way the elevator shafts function as beacons within the connection zone and from the main volumes; the elevator shafts enable visitors to easily tell where they are located within the entire complex. The elevator shafts extend above the roof of the connection zone to also function as a recognizable beacons from outside the building volume. The elevators have glass walls, so the vertical movement can both be experienced by the users of the elevators and visitors watching the elevators. The main elevator in the center of the building stops at every level +1500, this way objects can easily be transported from the main elevator to the main volume of the repair station. The other two elevators stop at the level height of the other two main volumes.
Fig 6.7: Floor 0 (P=0) of the bicycle base; the public pedestrian squares between the volumes are connected to the rest of the park

scale 1:500
ENCOURAGING TO CYCLE

The slopes for of the cyclists are relatively gentle. Most slopes, which are around 4 degrees, should enable different types of cyclists (different ages and conditions) to complete the cycle route through the building and to reach the higher levels. In order for the slopes to be gentle and to enter higher levels, the main volume in the middle (the repair station) has a level difference of +1500mm in comparison to the two outer main volumes. This way the middle volume can function as a transition zone between 2 levels of the two outer volumes and thus becomes a pivot in the building. Just like the present is the pivot between the past and the future, it is the repair station that enables a continuous route with the museum and innovation center.

The safety for the various types of building users is of course of high importance. Cyclist shouldn’t gain too much speed, since the track through the building is about experiencing what’s along the route instead of racing through the building as fast as possible. Especially the museum function asks for a more gentle pace. Therefore the cyclist will never enter the museum riding downhill, but only after riding up a slope or after a flat path. At some points on the cycle route, pedestrians will have to cross the cycle path. At these points it is of high importance that the cyclists and pedestrians have a good enough overview of who is planning to cross to prevent accidents from happening. The width of the cycling paths is approximately 3 meters and only allow cyclists to ride in one direction, increasing the safety of the cycling paths for both cyclists and pedestrians.

The cyclist can travel through the connection zone and can decide along the way to either drive through the main volumes or to make use of the functions in the main volumes. Along the route the cyclists can stall their bikes in the areas for bicycle parking (located on big concrete floor slabs within the connection zone) and continue their experience of the building on foot. This way the experience of the visitor can continuously be changed from pedestrian to cyclist and vice versa. People that don’t arrive at the Bicycle Base by bike can rent a bicycle that can be used for both the Bicycle Base and to start the cycling route through the Royal National City Park.
Fig 6.8: Floor 1 (P+4000), cyclists can enter from the left or right of the complex and decide to continue their route or to ride through the rest of the complex.
Fig 6.9: Floor 2 (P+7000) and 1A (P+5500)
Fig 6.10: Floor 3 (P+10.000) and 2A (P+8500), the floorplan shows a shortcut for cyclists that can be used when the upper level isn’t opened due to extreme weather conditions.
The roofs of the connection zone are accessible for visitors. A cycle path on the roof will be accessible for the cyclist, depending on the weather conditions (if it is very cold or very wet, the cyclists will have to use a shortcut one level lower to continue their route). The rest of the roof is accessible for pedestrians.

**THE ROOFS**

The roofs of the connection zone are green roofs. They provide a large surface that can capture and slow down the rainwater run-off and will insulate the connection zone, lowering the temperature in the connection zone during summer. The cyclist can drive on a cycling path that leads through the green on the roof.

Some skylights are placed between the roof elements, to let natural daylight enter the connection zone from above, as well through the elevator shafts with glass façades. The roof between the museum and innovation center is lowered towards the water, creating a nice overview to the water and to the boulevard and buildings across the water.
The roofs of the main volumes combine solar panels with roof lights, which has translated in sawtooth roofs. This way the building can collect solar energy and make more use of natural daylight in the main volumes. The roofs of the museum and the repair station are located at level 5, whereas the volume of the innovation center extends 3 meters above the other volumes (P+19.000).
THE FAÇADES

The façade of the connection zone is very transparent and open. Since the connection zone works as a buffer and is open on ground level, the façade doesn’t need to be insulated but should provide shelter against the weather elements such as wind and rain. Therefore the connection zone is clad with ETFE foil, which has a very high light transmission and is very light in comparison to glass. The foil prevents the need for an enormous glass façade which would be rather expensive and uneasy to install between the curved floors of the connection zone. The foil can be printed, and combined with the horizontal lines in the façade (of the floors and the railings) the connection zone gains a different atmosphere than the more static façades of the main volumes.

The façades of the main volumes are partly closed, partly open, depending on their function. The façades exist of glass and sandwich panels clad with aluminum panels are placed in front of the column constructions of the main volumes. Some panels in the façade are translucent. The façade is, just like the façade of the connection zone, not load bearing. The façades differ depending on the main volume, but clearly form a unity together, a complex. The design for the façades is based on its current functions, but is also for unknown future functions.
Fig 6.15: South façade (the repair station in the middle is best visible from this side) scale 1:500

Fig 6.16: North façade (the innovation center on the left and museum on the right together shape the image of carrying the connection zone in between) scale 1:500
6.8 THE BICYCLE BASE COMPLEX

APPROACH
The Bicycle Base can be approached from different sides. Each approach gives another experience of the building. Approaching from north or south gives a very raw, structural image. A static build-up, an industrial look. It shows a solid and calm build-up. Entering or approaching from west or east, the building shows more dynamics, movement.

Fig 6.17: View of the Bicycle Base from north; a static view, main volumes carrying the connection zone
Fig 6.18: View of the Bicycle Base from east; a dynamic view, cyclists entering the building at level 1
7. Conclusion

SUSTAINING THE CONNECTION
The Bicycle Base was not meant only to promote the sustainable transport matter of cycling, but also meant to promote the revised Dutch aims for sustainability. The promotion of cycling however can’t be seen separately from the success factor for the sustainability aims; the aim to promote cycling is something that is integrated within the building and that will help sustaining the buildings functioning in the long run.

7.1 PROMOTING CYCLING
How can the revised Dutch aims for sustainability be represented within a public building, devoted to the promotion of the sustainable transport manner of cycling, in the sustainable capital Stockholm?

The revised aims can be represented by being fully integrated, a building that functions from the perspective of the cyclist, but from other perspectives as well. Since cycling ticks all the boxes for the sustainability subsets of People, Planet and Profit, the building can do the same by learning from the bicycle.

The bicycle as its base to sustainability.
BIBLIOGRAPHY


Veen, E. van der (September 2014). Van Gogh Museum


**IMAGES**

**COVER: OWN IMAGE**

**CHAPTER 1**


Fig 1.5: Own image.

Fig 1.6: Own image.

Fig 1.7: Own image.


Fig 1.10: Own image.

Fig 1.11: Own image.


Fig 1.18: Own image.

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CHAPTER 2

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Fig 2.4: Own image.
Fig 2.5: Own image.
Fig 2.6: Own image.
Fig 2.7: Own image.
Fig 2.8: Own image.
Fig 2.9: Cycle-Space (date unknown). Welcome. Retrieved February 24, 2015, from http://cycle-space.com/


CHAPTER 3

Fig 3.1: Own image.
Fig 3.2: Own image.
Fig 3.3: Own image.
Fig 3.4: Own image.
Fig 3.5: Own image.
Fig 3.6: Own image.
Fig 3.7: Own image.
Fig 3.8: Timo Van Lieshout [August 2015].

Fig 3.9: Own image.
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Fig 3.11: Own image.
Fig 3.12: Own image.
Fig 3.13: Own image.

Fig 3.14: Timo van Lieshout [August 2015].
Fig 3.15: Timo van Lieshout [August 2015].
Fig 3.16: Timo van Lieshout [August 2015].
Fig 3.17: Timo van Lieshout [August 2015].
Fig 3.18: Timo van Lieshout [August 2015].
Fig 3.19: Timo van Lieshout [August 2015].

Fig 3.20: Own image.

Fig 3.21: Timo van Lieshout [August 2015].
Fig 3.22: Timo van Lieshout [August 2015].
Fig 3.23: Timo van Lieshout [August 2015].
Fig 3.24: Timo van Lieshout [August 2015].
Fig 3.25: Timo van Lieshout [August 2015].
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Fig 3.31: Timo van Lieshout [August 2015].


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Fig 3.34: Timo van Lieshout [August 2015].

Fig 3.35: Own image


Fig 3.37: Timo van Lieshout [August 2015].


Fig 3.40: Timo van Lieshout [August 2015].

Fig 3.41: Google Maps [2015].


Fig 3.43: Timo van Lieshout [August 2015].

Fig 3.44: Timo van Lieshout [August 2015].


Fig 3.46: Timo van Lieshout [August 2015].


Fig 3.48: Own image.

CHAPTER 4


Fig 4.1: Own image.


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Fig 4.4: Own image.

Fig 4.5: Own image.


Fig 4.7: Own image.

Fig 4.8: Own image.

Fig 4.9: Own image.


Fig 4.11: BIG [date unknown]. XPO. Retrieved February 19, 2015, from http://www.big.dk/#projects-xpo

Fig 4.12: BIG [date unknown]. XPO. Retrieved February 19, 2015, from http://www.big.dk/#projects-xpo


Fig 4.15: JDS [date unknown]. Bike / Bike City. Retrieved February 19, 2015, from http://jdsa.eu/bike/


Fig 4.17: Own Image.
CHAPTER 5

Fig 5.1: Own image.
Fig 5.2: Own image.

CHAPTER 6

Fig 6.1: Own image.