MASTER

Re-use of the former NBDS railway cycling as a strategic & spatial design in the medium size region of Brabant

Houben, M.H.P.

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Link to publication
Re-use of the former NBDS railway
Cycling | as a strategic & spatial design in the medium size region of Brabant |
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Cycling | as a strategic & spatial design in the medium size region of Brabant |
This document is intended as a written and illustrative product of the graduation project.

The graduation project itself is an individual perpetuation on the graduation studio Midsize Brabant 2015/2016 at the University of Technology in Eindhoven.

The graduation project is based on previous analytic outcomes from the graduation study together with new in-depth analysis of future development in parallel of the integral approach of the ABP master’s versatility.

The project concerns multiple contemporary issues the region of East-Brabant faces, which the medium size terminology already gave attention as an overall theme.

This project report gives both content to analytic and practical opportunities in the region of East-Brabant. Solutive structured analyses on the medium size region with focus on the re-use of heritage from the NBDS in the region as a bicycle highway.
Preface

The houses, neighbourhoods and landscapes mankind has built over the years. The changes in society. The decay of these same things we have built over time. A complex constellation as future fundament.

As society develops and grows, new things are build. The prognosis is that by 2050 70% of our world population will live in cities. Simultaneously, tangible historical resemblance of developments from certain periods decay. These remainings are naturally re-used or demolished over time. As society increasingly change and develop I notice a current day difficulty in the maintenance and appreciation of heritage in regions and places that once had a great function, meaning and identity in our daily life and surrounding.

Places and fragments lose their original functions, where the question could be asked if these hold opportunities or foundation for current and new developments. The link to our past, the collective value and part of the current spatial resemblance of the urban and rural landscape. Could they fulfill a certain re-use and placemaking for their surroundings? Is there a need to search for more innovative economic models in the execution of spatial development project? The reconsideration of one and each other’s role in the current society. More slow value creation for more long term results? The weight on several systems in society that don’t innovate fast enough. The pressure on the network that is increasing, the necessity of other more durable ways with a more suitable method and approach in the spatial development of sustainable regions of tomorrow.

I see these continuous transformations in our build environment and society as a personal challenge.

My interest and drive to do the things I do. This graduation project as a step and preoccupation in the discipline of urban design and planning. Within this context secondly important as a citizen facing this challenge to try to improve and engage its surroundings to the regions we live in for the coming future.

During the writing of this thesis, a lot of people have helped me. I would like to thank my supervisors, Professor Pieter van Wesemael, Ad de Bont and Sukanya Krishnamurthy. They offered good support, motivation and shared knowledge and gave feedback when needed.

Special thanks to my family and closest, who supported me during this busy time.

Finally, I would like to thank all the other people who I spoke with, who motivated and inspired me during my graduation project.

For now, I hope you will enjoy the read.

Maastricht
December 2015

Marc Houben
This graduation project researches the re-use of the former NBDS railway which runs through East part of Brabant in the Netherlands. In parallel, the medium-size city terminology is considered as an approach for future improvement of the region. Since the NBDS line has lost its original function over time, but still present and visible in the urban and rural landscape makes it an interesting object. Secondly, actors and residents underpin the importance of the former line as a historical collective value. Both the situation of this heritage and mobility questions make the consideration of re-use a multi-disciplinary research. Using explorative scenarios results for the re-use as a bicycle highway as a new suitable and sustainable successor to the former railway.

The distance between places on the former line, together with the network of the medium size city fit the potential cycling distance improvement. The original connection between the places due to the former NBDS line as a backbone for the medium size city of Veghel, Uden, Bovetel, Schijndel, Gennep could be restored. The heritage and the experience of the variety and diversity within the surrounding landscape are bearers of the experience of this route.

The new typology of ‘high speed cycling’ gives people the opportunity to travel fast, flexible and individually between places. However with the existing cycling routes, this new typology demands a safer and straighter route. The combination of these variables makes the concept self-evident as it logically fits each other.

Secondly, the scale and distance of the network in the medium size city structure suits the average distance that could be practicable increased with high speed cycling.

The parallel growth in sales of e-bikes makes for another argument to construct an infrastructural network that answers society’s demands.

Analyses of the historical remainings and different landscape represent the variety of the cycling route. As a backbone, the user can easily travel in two speed differentiated lanes towards other connections in the cycling network of the region. The former railway is already positioned with a minimum of interruptions which makes the execution of the cycling lane much more feasible. Other locations with a comparable straight cycling lane face generally considerably more obstacles and barriers.

Its easy to reuse this already linear element in the landscape in a function that demands the same linearity.

In addition to traveltime and distance improvement secondary benefits and opportunities arise with the come of a high-end cycling connection between the medium size cities.

Improvement of the local economy, recreation as well as the possible catalytic effect on the un-used spaces that are near the rail track which could develop over time with it.

Spatial developments on several locations on the line are inseparable, connected with the project and potential of it. To receive a good image of this development a categorization is made. The categorization is based on typologies that represent the former railway in pieces. Secondly, speed difference and landscape types are incorporated. All these preconditions formulate 6 different representative locations. These 6 locations have been worked out to give a clear impression on the potential of the former railway as a cycling route.
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Regional strategy

Developing high-speed cycling route

Local resemblance & intervention

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Multiple drawings
Noord-Brabantsch-Duitsche Spoorweg-Maatschappij.

AANDEEL AAN TOONBER
gegoed
TWEE HONDERD Vijftig Gulden.
De Directeur:

[Signature]

[Location]

Gennep
Introduction

Previous Groupwork

The initial project definition started with a collective research on the mid-size terminology. The research-subjects were in the broad range of the urban design and planning discipline. Together with several other students, a research atlas was developed for the region of East-Brabant. In this region two places, Veghel and Best were selectively chosen to be examined on a more detailed scale. This led to an atlas as product of the first part of the studio.

The Atlas gave the base for the individual graduation phase. From the findings in the atlas and personal interest a location and research with a design and intervention was chosen.

Graduation project

The former Noord Brabants Duitse Spoorlijn (NBDS) runs through several medium size cities in the network of East-Brabant and lost its original function over time. Much of the rail-track is however still present. It was not allowed to do anything other with it than consider the re-use of it by trains for transport. After several debates between the provinces, municipality’s and train and transport associations, the re-use of it as a traditional train railway wasn’t approved. This gives as a spatial element regarding the medium size cities and future development of it, an opportunity to come up with other ways of strategic and spatial use of this former railway.

In the following document the analysis, together with the re-use of this railway, will give a comprehensive elaboration of the possibility of a cycling route as a backbone in the medium size network. It will conduct several current day and locally defined trends and developments in a project located in the urban and rural landscape of East-Brabant. The link between a practical project concept and design, together with this mid-size viewpoint, could be questioned in the current situation. Is there a fertile collaboration of actors from mid-size perspective? And how is this project able to link interventions and scale level for future improvement of the complete mid-size region in cohesion with the value of heritage and cycling? This also brings us to the main Problem Statement:
Problem Statement

How can the former NBDS railway both strategic and spatially form a new role in the medium size network of East-Brabant and local spatial development?

Parallel to the main Problem Statement and the answering of it; additional focal points on preservation of the heritage remaining’s of the railway and the bicycle as a bearer for the future as re-use of this regional backbone are important.

The Medium size region

Usage and opportunities from cultural and industrial heritage in urban planning in the network of medium-size Brabant.

The Former Railway

Re-use of the former NBDS line

Value as Heritage

Value for the medium size region

Image 4 | Picture of the Railway in current state, Veghel
Research Challenges

As this research demands many subjects the most important subject to conceive a good view on is the region medium size network in relation to the NBDS line.

The diversity of the urban-landscape and rural-landscape will be one of the guidelines since this is a large spatial element that runs across 50 kilometres through the region.

This brings us to the current opportunity of a possible new backbone in the network of the medium size cities in this region.

The First main challenge is the ambition to constitute a good match between the conclusions and data given from the general research into the regional strategic and design of the new use of the line.

A Second challenge is the inescapable fact of the possible wide involvement of subjects that both underpin the medium size cities demands, landscape, functions and local identity of the spatial element of the cycling highway in the region.

A more practical challenge is the motivation “where” and on “what grounds” several locations as a redesign can lead to a good understanding of the potential of the future design of the line. This is both for its general use and future catalytic attitude towards other spaces that are on or around the line.

The research on a strategy and design for this former railway line need to consist out of several aspects.

Formulating the right situation on the former objects that used to be part of the historic rail track and still exist today. Also events and stories that are important from historical perspective that once where identified with the line are vital to achieve a good base for the re-use of elements of the line as a legacy for the future.

The landscape analysis is a second important part. The multiplicity of types of landscape the line runs through gives a second narrative which the design and strategic re-use of it should be based on. The use of the landscape differences in the experience of the singular element where the line can tie the regional and local identity together.

Regional/ Mobility analysis give insight to the possible practical re-use. The Region which the former railway runs through is important to provide the right context for the use of the new line. Both the local and its position in the network of East-Brabant region constitute to a backbone for the medium size cities and villages that are situated on this line.
[map of East-Brabant, in purple the Dutch part of the NBDS railway.]
History of the NBDS Railway

Industry & The NBDS Railway

The NBDS line was opened in 1873.
The line runned through the villages Boxtel, Schijndel, Veghel, Uden, Mill, Haps, Oeffelt and Gennep. The industrial sector was one of its main users. For the NBDS railway a special train was build. The special locomotive was named ‘the Brabander’. It was common in this period to develop beside the railway track a special train simultaneously.
The areal picture shows the only deflection of the track of the former NBDS to the CHV NoordKade in Veghel. This part connected the industries as well as the canal with the NBDS line. Currently this industrial part is still important for Veghel. Not for traditional industrial use but for new creative industries. Recently a bar and theatre were built in the CHV factory.
The other picture is showing the transportation of pigs in Mill in 1900.

Image 5| locomotive NBDS, Image 6| pigs transportation on train, Image 7| areal Veghel Noordkade, Image 8| long distance train.
Traveling & The NBDS Railway

Still a lot of people travelled by train. In its prime time in 1914, 880,000 people made use of this line. Most of the passengers used it for long distance trips all the way from London to Berlin. Beside the international character of the line also local schools made use of it for school-trips as the pictures shows parents waiting for their children to return.

Image 9 | people in Uden waiting for the arrival of children from school vacation, Image 10 | daily time scheme of trains transportation
The network of daily mail train destinations. Without any transfers the trains reached this destination in one route which made this the fastest route in that time. Many highnesses and important people used this route. Visible is the route between Boxtel and Goch that was within the network the busiest part of the line. Not only people from England and Germany passed the route. A fair amount of passengers from Belgium also travelled through this fast connection towards Germany and the rest of Europe.
WO II & The NBDS Railway

From a historical perspective the railway has many stories that are important for its collective memory. Several places and objects therefore have a certain value and consist of pieces in the landscape that needs to be taken care of for preservation in the future.

In the Second World War the Germans secured the bridge over the Maas. All other bridges were destroyed by the Dutch defence. The Germans were able to travel with a Panzer train all the way to Mill. This was the first invasion of the Germans in the Netherlands in the Second World War (1940). Due to the asperge blokkage the train derailed and the battle of Mill was a fact.

Image 12| The Maasbridge 1940, Image 13 & 14| derailing of the German pantzer-train, Image 15| blokkage that is still present in current landscape
Buildings and Objects & The NBDS Railway

These days the surrounding of the railway still has many objects that do remember on the time when the train used to play an important role in the network of these medium size cities. More than fifty waiting posts where positioned along the railway together with station-buildings for each place it crossed. Also nine bridges were built over water. Several of these bridges are still present. The two biggest bridges over the canal and the Maas aren’t present anymore. The columns from the bridge over the Maas still exist and partly used for cars now. The bridge over the Zuid Willems Canal is now positioned in Veghel as a monument. Another longer bridge has been build there due to the widening of the Canal for larger ships. As this situation develops and there is certainly a local awareness on the heritage of this railway an overall view and approach isn’t visible.

This fragmentation and lack of recognition of the heritage on a larger scale can be referred to the work of Burman P, and Stratton. M, [1997], They stated that, “the railway heritage has been slow in coming, and that there have been few attempts to see and understand it and its problems in a holistic way. If asked to define the railway heritage, it ought to be possible to reply in the same terms it must surely embrace the rich treasuries of railways archives, buildings, such as stations, engine sheds, structures as signal boxes, technical equipment and major structures in the landscape such as bridges and viaducts.” P19
Decay & The NBDS Railway

Since the line mainly was focused on long trips into Europe and the come of more passenger plane flights and cars after the rebuild of Germany made the NBDS stop traveling most of the people trains in 1955. The NBDS itself was actually already in 1950 bankrupt. This meant only goods were transported by the NS and finally also goods were not vital enough to keep this line going. Around 1970 the decay started rapidly, and parts of the railway were demolished. Only the industrial parts in Schijndel, Veghel and Uden made use of it. The last train drove on the railway in 2005. Despite the value and recognition of the line from residents Pro-rail stopped maintaining the line.

Images show the last trips of the train in 2005 on the part between Boxtel and Veghel.

*Image 21, & 22, Both trains that are passing as a ceremonial ending of the use of the NBDS rail-way, 1990*
ANALYSING THE LINE

HISTORY & OBJECTS

PLACES AND VILLAGES

NATURE AREAS

ECOLOGICAL STRUCTURE

challenges of the landscape

HISTORY 1910

40 in total

8 in total

9 in total

LANDSCAPE

HISTORY 1910

40 in total

8 in total

9 in total

ANALYSING THE LINE

| LANDSCAPE |
| HISTORY & OBJECTS |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100

Boxtel | Schijndel | Veghel | Uden | Mill | Haps | Oeffelt | Gennep | Gothen | German Border

Green Surrounding 44%
Historical and Landscape Inventory Matrix

Historical Matrix

These days the surrounding of the railway still has many objects that do remember on the time when the train was in-use.
In the matrix on the left side the river crossings are visible. For the Dutch part 9 intersection with bridges were build. Next to the river-crossings also the position of station buildings and waiting-posts are visible. The matrix shows two parts. The upper part shows what once was there and the lower part showing what is currently left. This matrix gives a good overview of the potential heritage that could be involved in the re-use / design of this line. Due to the involvement of many historical sources this matrix was constructed.

Landscape Matrix

The great variation of the landscape along the line demands a similar analyses which adds the environmental context of the line. It gives insight in it potential, quality and differences.
The landscape could be divided into 5 main types. However these 5 types both rural and urban surrounding is present in each landscape.
The position of the line as an elevated strip in the landscape is interesting for the further re-use. Roughly we could say that the line going East rises in contrast to it surrounding. The main reason for this can be found in in the fact that the soil becomes more wet going East which needed to be solid and reasonable dry beneath the railway. Remarkable is the two Nature zones. Both of them are part of the Dutch EHS (ecological main structure) ‘Het Groene woud’ and ‘De Vilt’. The landscape varies from flat agricultural sand grounds towards more landscape with relief made by the river the Maas.
The difference in this landscape and cohesively it different qualities will give direction towards the re-use and experience of this rail way in the future.
Roughly every seven kilometres a new landscape arises. Halfway the line a geologic crack zone is positioned. The Peelrand crack creates an own landscape-type for the length of 8 kilometre’s and also called "The Peel".

Images 23 t/m 44 | Historical Matrix  Analysis, remainings that are still present, beeldbank bhic, brabantscentrum, stationsweb and own collection. Image
ANALYSING THE LINE

LANDSCAPE

ECOLOGICAL STRUCTURE

NRW National Ecological Head structure
NRW Provincial Ecological Head structure
Agriculture use of land
High intensity
Grassland, Nature
Low intensity use

NATURE AREAS

PLACES AND VILLAGES

HISTORY 1910

9 in total in Netherlands

MID BRABANT SAND GROUNDS

PEEL RAND BREUK

ECOLOGICAL STRUCTURE

NRW National Ecological Head structure
NRW Provincial Ecological Head structure
Agriculture use of land
High intensity
Grassland, Nature
Low intensity use

Image 45| image of track near Groene woud, own collection, Image 46| Nature area de Vilt, satellite image
Lots of the rail-track is still visible. For approximately 22 kilometres the track is visible with its original steel rails. This part is positioned between Boxtel and Veghel. Further on to the East only small pieces are remained. However throughout the line the resemblances in the surface and locations are still visible in the landscape.

The province of Brabant decided that the rail track will not be revitalised in the near future based on several discussions and a feasibility study. The study was executed on demand of the government by the province of Brabant, association MCA, Municipality of Veghel, Schijndel, Sint-Oedenrode, Boxtel and Intermodal in February 2015. Nevertheless the outcome of this study the value and interest in this historical railroad is still present.

The reason why traditional train traffic isn’t self-sustaining and found not beneficial enough in this location comes due to the fact good transportation from and to the industrial clusters attached to the line are not prepared to make use of it in the future. Currently the bigger industries in that surrounding mainly make use of shipping goods through the canal and by truck.

Most of them declared not to be able to guarantee in anyway the use of this rail track in the coming future for their business. [Report Feasibility Study Province Brabant, March 2015]

Unless the outcomes of the feasibility study the province of Northern Brabant asked the ministry to demand the re-introducing of the maintenance for the coming 20 years by current owner Pro-Rail. Preserving the track and make sure the worst overgrow will be pruned.

Concisely we could say there is now an ‘impasse’. The situation describes a value stated from several stakeholders. Both from a historical perspective and an important connective element in the region.

On the other hand the counterbalance of the strong analytic conclusion that says the re-use as a traditional rail-track wouldn’t be useful and feasible. [17-3- 2015 Province Brabant]

The only ongoing discussions is now between several actors on the preservation and possible maintenance to ensure the track could still be used when there would be enough demand for it. The current owner (Pro Rail) declared already in 2005 that they would want to stop the maintenance of 150,000 euro a year. The cost reduction saves money for other projects since the railroad isn’t used enough since 1998. Pro Rail did cut of the connection to Boxtel in 2005 and with that also very little attention to the maintenance of the remaining part. The main control and decisive actor to re-use of this space as a new function is the Ministry of Infrastructure and Environment. In the work of John Tillman [2002] the difficulty is described of the sustainability of the railway heritage. He states that one of the important influences is the private sector which could encourage the value of railway heritage:

‘The Government can either undertake the conservation itself or can encourage the private sector to do so by; information dissemination to create awareness and a consensus for preservation. The tools include: disclosure, publicity, identification and recognition in the collective memory’
| unused space |

Train network

Unless the decrease of the railway use, the research by CBS 2009 says that the Netherlands still have the busiest railway network of the European Union. For each kilometre of present tracks, 20,000 train kilometre’s are covered each year. This is almost twice as much as the average amount of other countries in the EU.

The analyses of the train network in the Netherlands have resulted in a single map overview. This map shows a combination of five different states of railway’s. The first differentiation is made by Dutch tracks, the border area of Belgium and Germany. Due to the international character of the former NBDS line this was important to add to gain a complete context.

The platform ‘Do-lightrail’ has focussed on several regions to find the potential of the lightrail in the Netherlands. According the analyses only the Randstad area in blue is suited for re-use of rail tracks as a lightrail network. This uses the same rail tracks as the traditional train does, but in practice more a hybrid between a metro and a traditional train. The lightrail can stop and accelerate much more efficient. The re-use for the NBDS does not match the conditions for a cost-effective light railway.

Due to the come of more flexible busses between medium size cities and the car, the train network decreases. Especially the connection towards other countries as an international network vanishes over time. In orange the unused and vanished routes are visible.

Both the vitality of transport of people and transport of goods by railway decreases in the Netherlands. The canal and trucks started to take over the transport by train. Currently the existing train-network uses only 18 percent for transport of goods. This resembles also the current situation for the NBDS line were the line for transportation of goods is not cost-effective.

Moreover, trains are mostly used for transporting goods on an international scale. The industries that are located along the line do have their transport destination and demands mostly on a national scale.

The green line shows the location of the NBDS train-line and in orange other parts of old train lines.

The unused train tracks are in clear presence. This gives us a second objective to accommodate, and possible represent a reiterative research since other locations deal or demand a similar situation as the former NBDS- line does.
**Legend:**

- NL: In-Use Railway network Netherlands
- BE: Unused/ demolished railtracks
- In-Use Railway network Belgium
- D: In-Use Railway network Germany
- Former NBDS - line

### 1953 Railway network length Netherlands in 1953
- 3251 Kilometers
- 6776 Million travellers Km
- 59% passengers
- 41% goods

### 2015 Railway network length Netherlands in 2015
- 3063 Kilometers
- 17100 Million travellers Km
- 92% passengers
- 8% goods

#### Effective LightRail Application zone

Aspects other than regular trains:
- Fast acceleration
- Runs on existing tracks
- Need for more stops
- Use due to densification of the area

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- **In-Use cycling highway**
- **Preparations for cycling highway**
- **Potential cycling highway**
- **Former NBDS - line**

**Legend:**

- A: Cycling Netherlands 2015
- U: Drukste fietsroutes van Nederland version 6 juli 2011
- R: Order
- H: CiTy
- T: Location
- dB: cyclists currently
- E: Location 2020

<table>
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<th>Expected Cyclists</th>
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<td>18.700</td>
<td>22.400</td>
</tr>
<tr>
<td>2</td>
<td>Almere</td>
<td>21.000</td>
<td>20.700</td>
</tr>
<tr>
<td>3</td>
<td>Rotterdam Coolsingel</td>
<td>18.000</td>
<td>19.300</td>
</tr>
<tr>
<td>4</td>
<td>Groningen Antonius Deusinglaan</td>
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</tr>
<tr>
<td>5</td>
<td>Den Bosch Stationstunnel</td>
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<td>18.600</td>
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<td>6</td>
<td>IJmuiden Lange Nieuwstraat</td>
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<tr>
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<td>Zwolle Van Karnebeektunnel</td>
<td>11.000</td>
<td>pm</td>
</tr>
<tr>
<td>10</td>
<td>Apeldoorn Fietstunnel station</td>
<td>10.700</td>
<td>pm</td>
</tr>
<tr>
<td>11</td>
<td>Amersfoort Meridiaantunnel</td>
<td>10.000</td>
<td>pm</td>
</tr>
<tr>
<td>12</td>
<td>Assen Nieuwehuizen</td>
<td>8.700</td>
<td>9.300</td>
</tr>
<tr>
<td>13</td>
<td>Zutphen Oude Ijsselbrug</td>
<td>6.100</td>
<td>8.800</td>
</tr>
<tr>
<td>14</td>
<td>Eindhoven Fellenoord</td>
<td>6.000</td>
<td>pm</td>
</tr>
<tr>
<td>15</td>
<td>Traject Boxtel-Uden</td>
<td>1.500</td>
<td>2000</td>
</tr>
</tbody>
</table>

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**Drukste fietsroutes van Nederland**

- The busiest bicycle routes in the Netherlands
- Data as of version 6 July 2011
- Percentages and distances
- Key cities and routes listed

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**Efficiency of LightRail Application zone**

- Fast acceleration
- Runs on existing tracks
- Need for more stops
- Use in dense areas
The Netherlands is known to have many bicycle users in comparison to other countries. In the Netherlands 13.5 million people have one or more bicycles (84% of the total population, CBS statline). In total this means that there are more bicycles than people in the Netherlands. This high amount of bike-use is declared due to the fact using it is a very flexible method of transportation in small street cities. Also the bike-use is partly from cultural origin. Both recreational use as functional mobility makes people to cycle in the Netherlands. The technology in cycling develops and currently new types of electric bicycles are increasingly sold. Currently there are 1.4 million of these e-bikes. The innovation of the electric bike makes the last models to have a larger range and higher top speed around the 45/50 kilometres per hour.

Because the Netherlands is a genuine cycling country, the demand and pressure increases on the current infrastructure due to these e-bikes. The e-bike makes the potential of a bicycle highway a reasonable consideration. A more straight and safe lane where the measurements and design fit both the e-bike and other cyclists.

If we would consider the linear upcoming bicycle highway we should actually refer to another infrastructural problem. Christian Moed [2012], describes in his research; “the recent origin of the bicycle highway in the Netherlands started with the problematic of car-traffic congestion.” Due to this cause several new projects in the Netherlands were suggested to decrease the amount of congestions. One of the projects was ‘Met de fiets minder files’, later this was called ‘Fiets Filevrij’ and original five locations in the Netherlands were chosen for first interventions and research [Rijkswaterstaat 2006].

As an effect of this anti-car congestion policy, in several locations in the Netherlands the bicycle highway was introduced as a new typology. Within this typology there is however still much difference in the appearance of this cycling path. Also there isn’t a clear definition of what this typology is and under which condition the term can be used.

Other than the main reason of car congestion in 2006, the innovation of the e-bike could give an extra push in the development of the bicycle highway.

As all roads and paths are part of the total infrastructural network, the overview in the Netherlands could give the potential of a single route in connection with another. In the map on the next page several cycle paths are pointed out that could be identified with this new high speed cycling typology. As already pointed out there is still a variation in this typology. This is translated in several colours that represent a certain stage and characteristic of the high speed cycling path.

The main division is based on existing routes, routes that are under construction and potential routes that are likely to come due to acknowledgment of interest by actors in that location. Clearly can be seen that there are two sorts of patterns of networks that currently represent this typology. The first pattern is that of an equal network between several locations. The polycentric city structure. (Randstad and d8, central Brabant). The second pattern is that of the bigger Dutch city that provides with high speed cycling routes the connection with its direct more suburban surrounding (G,Groningen).

Within cycling based on data from CBS we also can define in the use of this cycling routes a difference in age. The highest potential users are young people between 12-22 since most of them limited to use the bicycle and public transport. With the possibility to provide employees E-bikes and a cohesive strategic infrastructure network can increase also this age category (25-60). As a result it helps people to travel faster and more individualistic. Secondly it can exonerate the pressure on the current car-road network.

If we further would speculate of the amount of users of the bicycle highway it would come to an estimation 1500 people a day in the part of the former NBDS line. With the comparison of other similar locations in the Netherlands. The number of cyclists can be substituted for this location with the improvements as a bicycle highway. Together with the prognoses of a general growth in bike users in the Netherlands and as an alternative for car use shapes and validates the potential of cycling in the future.
Duraat fietsroutes van Nederland
versie 6 juli 2011

Order City Location cyclists
1 Utrecht Neude 18.700 22.400
2 Almere Sportbaanpad 21.000 20.700
3 Rotterdam Coolingerl 18.000 19.300
4 Groningen Antonius Deusinglaan 19.400 19.000
5 Den Boch Stationstunnel 14.000 18.400
6 Dieren Lange Nieuwstraat 16.700 16.900
7 Amsterdam Marsstraat 16.300
8 Maastricht Williambrug 12.600 14.700
9 Peize Van Karnebeektunnel 11.000
10 Apeldaarn Fietstunnel station 10.700
11 Amersfoort Merdriantunnel 10.000
12 Assen Nieuwkerken 8.700 9.300
13 Zutphen Oude IJsselbrug 6.100 8.800
14 Eindhoven Feinenoord 6.000

Traject Boxtel-Uden 1.500 2000

Legend:
- In-Use cycling highway
- Preparations for cycling highway
- Potential cycling highway
- Former NBDS - line

cycling Netherlands 2015
Biggest group AGE

12-22 45-60

Effecitve LightRail Application zone
Aspects other than regular trains:
- Fast acceleration
- Runs on existing tracks
- Need for more stops
- Use due to densification of the area
Images 64,65 | Railtrack near Groenewoud in the West part of the line.

Images 66,67 | Overgrown railtrack, Railway crossing with signs.
Observations

I went to the former NBDS line several times to make pictures and observe the location. With this field work a clearer view of the rail track and the remaining’s was conceived. Also the build of a cart that could glide with 8 wheels on the rail track made sure I got a constant same angel on the height of cyclists. During the shooting it was interesting to see how many people actual made use of this strip of land. I often spoke to them, both interested in each other what we were doing there. Unfortunately the extensive growth of bushes around the track almost made it impossible to capture long distances of railway.

Images 68, 69 | Remainings of the railtrack in Veghel, former station area.

Image 70 | Building the rail-cart on the site.
Sheep transportation over the former NBDS line near Boxtel
Image 72 | vegetable gardening near a abandoned railtrack in Stockholm
The Regional Strategic Opportunities

The network society grows and several physical networks (as the NBDS) change over time in use. The NBDS line provides several opportunities. According the work of Manual Castells [2011]; A base principle on development of it is important with most crucial forms of stratregional follow-up in the logic of network-making. He states that “In a world of networks, the ability to develop in a network is based on two basic mechanisms: (a) the ability to constitute network(s) and to reprogram the network(s) in terms of the goals assigned to the network; and (b) the ability to connect and ensure the cooperation of different networks by sharing common goals and combining resources while fending off competition from other networks by setting up strategic collaboration” [Castells, 2011].

The opportunity from the NBDS line lies in the position of the medium size city in the region along the line. The opportunity of this element is the historic connective character between towns and medium size cities in the region as a network. This former NBDS line could have a new function as a cycling route. Previously the line was a bearer of Transport for People and Goods. With the come of a bicycle highway and the addition of cycling on the local economy with regard towards it historic artefacts and local identity as a strategic collaboration in the region.

The region asks for both safer and better mobility, future use of this NBDS line and multiple qualitative functions that could develop with it. The line as a backbone could still be a bearer in the region as Castells describes. Therefor the use in the future makes the line from a more contemporary value than before.

This also translate into the higher feasibility of the project since the benefits are broader and from larger potential.

The Re-use of the former NBDS line in a bicycle highway as a ‘regional strategy’ also addresses the pioneering situation of the region as a future high-speed cycling network. In other nearby cities in the network, the build and need of this high speed infrastructure for the upcoming e-bike are considered. This project constitutes an answer for this as an addition to this network.

From the research on the medium size cities and their network, it becomes clear that these cities ask for a more suitable approach and intervention based on the size of the network and location they are positioned in. ESPON [2006] describes that both small and medium-sized cities are far more important to polycentric regions than previously assumed. Particularly in Western European countries, medium-sized cities are accounting for an increasing share of economic growth. Additionally, medium-sized cities contribute to the quality of life, both for city dwellers living close to rural areas and those rural residents within easy reach of services.

With the use of the line it becomes a new suitable connective element that strengthens the polycentric network of the medium size city in East Brabant based on the medium size terminology. Other important current day aspect that comes with this project is the catalytic effect the line can have on its surrounding. The Re-use of the element as an intervention also leaves room for individuals and municipalities to come-up with new activities and added value. The participation and role of others in the development of the line are both traditional and top-down but unseparated as a backbone giving opportunity to facilitate other local initiatives.

The need for the line to be re-designed also comes with its historical value. To make sure the collective memory, stories and value of remainings of this line don’t disappear, a qualitative embedding of it in new use is crucial.
The map on this page shows the opportunity specified as a collaboration of several municipalities, with the present high speed cycling routes and the development of a route and new use of the former NBDS line. Also the comparison in length of alternative existing cycling routes is visible both in location and length. The route of the former NBDS is much shorter but still runs through the same places as the yellow and orange route.
Introducing explorative scenarios gives an overview of the possibilities of the re-use of the line.

A combination of the conventional re-use of train or other rail related transportation and more spatial use for residents provide a wide range of different direction for re-use.

From the analysis seven scenarios arose. These could be divided into four categories since they were very similar in certain ways.

The four made categories are:

1. **Do nothing scenario**, where local municipalities can buy the plots separate and use the space in different ways for its local own initiative without a clear regional connective character

2. **Transport scenario** for new train, metro, light rail as main interest

3. **Cycling highway** for new mobility

4. **Local re-use** of area’s that are in-line with the local identity where food and heritage plays an important role for the re-use of this space.

The combination of both scenarios III and IV provide the content for the final strategic and design for the line.

Both scenarios III and IV based on the analyses have the highest potential regarding the medium size terminology. The benefits as far as they are possible to predict, are from more value for the region. Secondly the benefits are both local oriented on the heritage preservation together with the connection with the regional network of cycling. Currently trends in mobility show the necessity in cycling infrastructure and the unfeasible future of re-introducing a train for this line.
How to address the challenge in the proposal

The re-design of the former NBDS line with the application of the mid-size terminology, regional strategy, local design and current day challenges combine the variety of disciplines and competences that come with making an integral project design. In the content of the proposal, it means that both strategic and spatially based design will be made for the NBDS line that addresses both a large and local scale. The ability to come up with an integral project, the proposal touches a wide range of variables as guidelines. The guidelines conceive a contextual situation for the creation of a new use for the NBDS line. Also, the locations that are designed and examined more closely logically based on the conclusions and guidelines formulated from the previous more general analysis.

First, the project gives a regional view on the future structure of the cycling network with development of a high speed bicycle lane, secondly 6 sections on the line provide an overall diverse view of it future potential and in exclusivity place-making and experience in these 6 locations. This will give insight to the possibilities of re-use for this typical area of the line. This multiple scale proposal leaves on the one hand room for more and other interpretations, but one the other hand gives a realistic direction and strategy with a spatial translation how to do so.

The re-use of the NBDS line with cycling addresses the formulated challenges in this enumeration:

- Regional connective element as a backbone for the medium size city.
- Providing new infrastructural context for the up-coming e-Bike
- Preservation of Cultural Heritage from the artefacts of the former line for the future.
- Improvements on local economy and identity. Food can flourish again, and recreation and mobility find each other in a sustainable use of this abandoned space.
- Provide implications in the differences in landscape, speed and typologies that can be found on the line.
Cycling Factsheet

High Speed Cycling

The overview on this page is intended as a factsheet according to the prognoses on the improvement for cyclists as a route from Boxel to Gennep. Both the distance and time improvement is presented with the general speed difference between a regular cycling lane and the high speed lane. Also according the analyses from the fietsersbond, the distance range improves for users who would want to cycle with an e-bike and new designed high-speed cycling lane. As an overall conclusion the scheme shows that the bicycle highway as a typology for the e-bike is two times faster as regular cycling paths.

61% from the inhabitants of the Netherlands lives under 15 kilometers distance from their work

25% from all employees goes to work with the bicycle

Veghel = 47%
Uden = 53%
Boxtel = 33%

| Boxtel---- Schijndel----Veghel----Uden----Mill----Oeffelt----Haps----Gennep |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| current:        | future:         |
| 9,5km 36min     | 8km 17min       |
| 8,3km 32min     | 7,0km 13min     |
| 7,9km 29min     | 7,0km 13min     |
| 12,6km 51min    | 12 km 24min     |
| 6,5km 26min     | 5,4km 11min     |
| 5,6km 22min     | 5,0km 9min      |
| 3,2km 13min     | 3,1km 7min      |
| 70km 3h 23min   | 51km 1h 40min   |

Speed for different kind of bicycles:

<table>
<thead>
<tr>
<th>regular cycling lane</th>
<th>cycling highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>citybike</td>
<td>16,5 18,8 22,4 25,2 27,6</td>
</tr>
<tr>
<td>sporty bike</td>
<td>19,4 21,9 25,9 29,0 31,6</td>
</tr>
<tr>
<td>Race bike</td>
<td>21,8 24,8 29,4 33,1 36,2</td>
</tr>
<tr>
<td>Low lie bike</td>
<td>24,3 28,4 34,6 39,5 43,6</td>
</tr>
<tr>
<td>E-bike</td>
<td>24,9 30,3 38,9 45,5 51,2</td>
</tr>
</tbody>
</table>

Speed in km/h. Cyclist is 78kg, 188cm, temperature is 20 deg and no wind.

Source: Fietsersbond Nederland 2014

Cyclehighway is:

2 x faster for E-bikes
1,6 x faster for normal bikes
4 Elements of Cycling

On the figure on this page the overview of cycling as four dimensions is displayed. Visible is the multiplicity that cycling could consist of and contribute to.

First of all, cycling is a healthy method of transportation for people. However cycling is healthy for the human body, it is vital to ensure a safe surrounding to minimize the possibilities for accidents since cyclist are vulnerable in traffic.

Secondly, local economies sail better with cyclist than car users for example. This economic environment for cyclist is called ‘Bikenomics’ as Elly Blue describes in her book [2014]. Since cyclists use food as fuel and do stop more since they are slower and in need for rest or shelter which provides new local economic flows.

Both the mobility and social advantages of cycling are also incorporated as new technologies with apps and interactive techniques, which allows users to have features that makes cycling more fun and efficient.

'Bikenomics'. Good connection towards pedestrians and cyclist gains more profit than that of OV or Car

0,5 to 1 trillion euros due to congestion of traffic cycling highways can save 30 million euro

CONNECT TO LOCAL IDENTIY & ECONOMY
Strava Application

This application uses real time data collection of cyclists all over the world. The overview is based on the measurements of cyclists over the year 2014-2015. The colour lines resemble the used routes. The intensity of the colour on the location resembles the amount of use of the location in comparison to another. The images give a very representative view due to the smartphone and applications and millions of users. This makes it reliable data. The application makes a difference in running and cycling.

Incorporating the data from this region in addition of the research question on the re-use of the NBDS line can help the analyses. The existents of these devices give an easy and free access to a large amount of data with clear interactive translation into maps.
Strava Application

The information standard provided by the application can be used to regenerate a future situation for the region which the former NBDS line runs through. The data from the application gives other than the maps provided by the standard cycling associations not the cycling routes that are pre-designed. In contrast the data from the application provides the actual use of routes by cyclists. The downside of this application is the more recreative character of the type of cyclists that use the app. However this variable, the last two years e-bike users are picking up on the data base as a user of this app. A future application pure for a more specific target group would give even a more specific dataset.

The images from the application confirm the high amount of bicycle use in the Netherlands compared to other European countries.
**Strava Application**

The more detailed maps on this page represent the routes in the region. This gives us up-to-date insight in the cycling network. Due to the addition of the cycling highway a reinterpretation of the map could be made. On the right page the region shows the future situation. The presence of a high speed cycling route and the predicted intensity of use of cyclists. The map is constructed by extrapolation and estimation in comparison to the current use of cyclist in the region in the year 2013-2014 and 2014-2015.

Both images are rough and experimental to a certain extend. If compensated, it still gives explorative possibilities which the current day technology can add to the discipline of urban planning.
Image 85 | future situation with the come of the network of bicycle highways.
Cycling | Tempographical

Tempographical map that represent the distance which on a certain amount of time per bicycle could be covered of current situation with starting point centre of Veghel. Each cicular zone is based on 5 minutes cycle-time.
Cycling | Tempograhical

Tempograhical map of future situation with starting point centre of Veghel. In the direction of the NBDS line we see a strong improvement in the distance which could be covered in the same amount of time. Even Boxel and Mill could be reached under 35 minutes now.
Tempographical map that represent the distance which on a certain amount of time per bicycle could be covered of current situation with multiple starting points in this Region. Each circular zone is based on 5 minutes cycle-time.
Tempographical map of future situation with several starting points. In the direction of the high speed cycling lanes line we see a strong improvement in the distance which could be covered in the same amount of time. All of the bigger and medium size cities in the region easily could be reached under 25 minutes.
Regional Network & Comparison

The Future User

The new cycling route runs through several medium size cities and villages. As later in the report will be explained the line could be roughly divided in two areas. The more functional-mobility part (Boxtel, Schijndel, Veghel, Uden) and the recreational part. For the functional part the inhabitant number is from influence on the potential users. Secondly the distance between these cities and the combination of time for cyclist to travel with the new cycling route.

-Boxtel = 30.311
-Schijndel = 21.815
-Veghel = 37.723
-Uden = 41.145

total = 130.994 (CBS Statline/ inhabitants)

61% is likely to cycle with the main users from an age from 12 years t/m 70 years
Residents that potential have to use and experience advantages from this cycling highway is therefore not the total of 130.994 people but still a fair 79.906.

Comparison to the F35

Oss-s’Hertogenbosch

Comparison with the cycling route F59 between Oss and S’Hertogenbosch facilitates approximately 89.796 people from Oss and 140.786 inhabitants for S’Hertogenbosch.
However this large number the small villages’ in-between only count 9000 people. And therefore the potential of the line over the same distance is mostly from people that travel completely from S’Hertogenbosch to Oss. In the comparison to the first part of the NBDS line, the situation between Boxtel and Uden is much more evenly spread.

Veghel- Uden

The two biggest cities on the line are also an exception towards the possible use of cyclist in the future. The situation in Veghel and Uden is much different because of the fact that many amenities since the last 15 years started to merge in one of the two cities. This means that a lot of people that live in Veghel or Uden need to travel to each other for several amenities. In other cities on the line this didn’t happen as much as it did here.
Comparison

- **Inhabitants:** 200,000
- **Target group cycling:** 126,000
- **Inbetween area live:** 10,000 people
- **Distance:** 18 km

- **Inhabitants:** 131,000
- **Target group cycling:** 79,910
- **Inbetween area live:** 52,000 people
- **Distance:** 22 km

Average: 6.3 km normal bike
9.8 km e-bike
14.1 km highspeed infra
Image 85: tyre profile: city topography 2013  Bruno Ferrari & Rodrigo Paranhos
The Concept

The re-use of the former NBDS line consist of a combination of 3 main components that form the composition of the concept.

- Introduction of a safe and fast cycling route as a backbone for the Region of East-Brabant.
- Preservation on heritage of the NBDS railway
- Addition to the local identity and economy

The introduction of the cycling route as a backbone makes the actual programmatic connection between the other two components (preservation heritage and local identity/economy).

The combination of the 3 components establish a unique fundament for the re-design of the former rail way. Due to the combination of the different subjects, the project has a multilevel influence on both the line itself and its surrounding. The issues concerning the region from the medium size city standpoint are a collaborative situation on a big scale constitute both to the preservation of the heritage of the former NBDS railway next to improvements in the local identity and economy.

This approach provides a suitable range of possibilities over a length of 50 kilometers. There is a clear structure and basis what the project has to be. The design basis leaves enough room for other interventions along the line that contribute to the backbone as a functional bearer for the former NBDS.
The Network

Existing high-speed cycling
NBDS Line
Other potential connections
Phasing

The line could roughly be divided into two parts. The West-part as a mainly functional part due to a higher percentage of inhabitants. The East-part mainly for recreation and tourism. If analysed closer the difference in much more subtle since both parts consist of recreational and nature areas. However the use of the line the differences can still be based on two main parts since the West-side has 4 times as much inhabitants and potential users than the East part. In the development of the line both parts could if needed be separately developed in time. One of the main criteria is that the functional part has to be executed as one piece since the connection between the four cities establish the functional backbone.
Image 86: Citizens initiative collaboration for a petition, 2014 Chelsea’s Tammy Scott in Ottawa
Upcoming e-bike

CBS shows that the e-bike is an upcoming transport method in the Netherlands.

The e-bike could in characteristics of comfort and speed be compared with the moped. In the increasing sales numbers of the e-bike there is no visible compensation in the amount of people buying or driving a moped. Actual both devices are growing in sale numbers and a clear separation between both of them in terms of road use becomes more and more evident. The increase of sales in both of them are related to their alternative for public transport and car use. Short distances in especially urban areas could be easily covered with a flexible and cheap device.

Currently in the Netherlands we have ca. 13,5 million people who have one or more bicycles. From these 13,5 million users 1,5 million people in the Netherlands have an e-bike. This makes that 1 out of 9 cyclists rides an e-bike. This spectacular increase of this type of bicycle started to increase rapidly since 2010. Then only 89,000 e-bikes were sold and in 2014, 223,000 e-bikes were sold.

The difference in speed becomes also a larger problem, since 8 out of 9 cyclists still uses the traditional peddle bike. Beside the difference in speed due to the traditional bike and e-bike, also the difference increased due to the broad range of models of the bike or e-bike.

In the left scheme can be seen how the most common types of bicycles are transforming towards electric assistant in propelling the bike.

19 million usable bicycles
1,5 million usable e-bikes
Safety

Traffic safety and safety in the Dutch bicycle network is an important subject in the Dutch policy already. Considering the high amount of bicycles, the accident rate are relative low. According to Wegman et al (2012), safe conditions for cyclists in countries with higher levels of cycling may be one of the explanations for their lower death rates. So due to the high rate of cyclists it is very safe for them in general.

As a result we see that the number of traffic casualties decreases each year. However, while there is a decrease of causalities overall, we see a rise in percentage of fatal accidents in the Netherlands by cyclists [CBS 2015]. Currently of all traffic casualties, 32% is a cyclist. This number is 1% more than car drivers [CBS 2015].

Almost 40% of the cyclist accidents happen due to a collision with another faster transportation mean. [C.C. Schoon & A. Blokpoel , SWOV ,CROW 2006].

Traffic accidents need to be reduced and moreover, the increasing percentage of bicycle accidents.
“Today an average of 430 accidents happen each day with cyclists involved.”[CBS 2015, gezondheid en welzijn]

The introduction of safer bicycle paths are crucial in the future oppression of the accident rate in the Dutch cycling traffic.

Both the increase of cyclist and development of a bicycle highway can still ensure safety. As Dill and Carr [2013] describe “As the numbers of cyclists increase, politicians may be more likely to invest in the safety of bicycle facilities (e.g. adequate bicycle path and lane width, even road surfaces). Providing attractive bicycle lanes and paths may even encourage more people to commute by bicycle”.

The infrastructural context is from high influence on safety of cycling. The protective clothing and head protection are vital to introduce to the increasing and faster cycling. Both the separate cycling lane and protective gear can make it safer and should reduce the percentage of casualties in traffic [Schepers, 2013].
Different speeds & the cycle-path

Speed of cyclists:

- **highest speed**: Speed > 22,5 km/h
  - Highest speed of cyclist. Most functional purpose and key to the cycling highway. The infrastructure needs to allow cyclists to have as few stops as possible and a specific fast lane is in some occasions preferable. "E-bike"

- **medium**: 17 km/h < Speed > 22,5 km/h
  - Medium speed, normal work traffic or recreational speed for the normal modern bike.

- **slow speed**: Speed < 17 km/h
  - Normal cycling speed for citybikes. Less recreational experience live effort 100w, on crossings and busy places a more safe speed surrounding.

DIFFERENT SPEEDS COMBINED

- **3 speeds combined**
- **2 speeds combined**
- **only 1 speed**
In the circular scheme on the left page the possible involving actors are displayed. The most inward circles represent the bottom-up orientated actors and the outside circles represent the top-down oriented actors.

Due to the large amount of places this railway runs through, makes that on the authority and local authority level a lot of actors will be involved. Two provinces and 10 municipalities are involved despite the relatively small strip of re-use. The authorities are displayed in an own segment.

Other segments in the figure are symbolising the different categories which actors could be divided into. The 'funding' segment is intentionally a dotted line since also a fair amount of the authority segment should fund the bicycle highway. However this partition of the development budget two programs in the recent past have for a large amount contributed with similar development projects.

The Stimulation fund for cycling “Fiets filevrij” and the fund for “Beter Benutten” provided both a total of more than 50% of the cost of the execution of bicycle highways. The use of this fund is also in this context an important partner.

However this top-down economic base for the development of this line also the involvement of the local community could be considered. Another economic dimension could be fulfilled with a parallel adoption or crowdfunding project for the new cycling path. Secondly the involvement of citizens can give a positive contribution to the development and awareness of the potential of cycling this route. Citizens for example could get in return free use of repair or charging services along the route. Also the health care support could have a role in this project as an actor. Since cycling is a very healthy way of transportation, the cost reduction could be translated into advantages for people who make more use of the bike than drive their car to work. A reduction in their insurance premium for example, or a reduction in the purchase price of an E-bike. However the small contributions of this segment there is still the contribution in the awareness of the advantages of cycling regarding healthcare.

Also the nature related organisations are substantially represented in this project as potential partners. Since the concept of this cycling route together with the value of the landscape should be in balance with the ecologic and recreation sector regulations and conditions.

Both local actors and top down actors can help to constitute a win-win situation rather than an oppositional situation.

Other than the most infrastructural project the presence of cultural heritage and the involvement of more local interventions along the new cycling lane make the involvement of actors bigger. The benefit is also the broader improvement predicted due to this line in the region and local community. The other more disadvantage side of this is the complexity of the project which grows parallel with it.
The cost-benefit analysis

The bicycle highway is a relatively new typology in the cycling network of the Netherlands. One of the main questions beside the question “what is the practical improvement of it?” a more difficult question to answer: What is the economic profit on the long term? Where can the main cost-reductions be found? How effective is it?

To give a direction in answering these questions the reference of the recent publication in the Journal of Health and Transport of the VITO institute could help. Several Belgian scientists studied in a broad way the economic costs and prediction of the amount of economic recovering from the investment in high speed cycling lanes.

J. Buekers, E. Dons, et al 2015, compared two case studies on the bicycle highway in the region of Flanders. Due to the elementary research and the general attitude of the bicycle highway in general it is suited to translate in the context of the bicycle highway as the re-use of the former NBDS line.

The publication describes a cost prediction between the 300.000-800.000 euro per kilometre. The range of this number could be declared on the fact if there are many civil engineering obstructions to overcome. And the foundation of a flat supportive surface that is suited to be turned into a cycling lane. Users between the 600 and 4400 a day could be categorized as profitable numbers of users for this typology.

The amount of the recovering of the initial investment is highly related to the amount type of users. The main difference becomes clear in their research between the recreational and functional user of this bicycle highway.

The outcome of the research gives a highly promising economic benefit. If we would consider the less favourable scenario of only 600 users a day, it eventually will safe even double the costs on healthcare than the construction costs of the path itself over 20 years. If we consider a more positive and expected scenario of the range between 3000-4000 users a day would gain a cost safe of almost 10 times the construction cost.

Beside this approach in the research also the CO2 reduction and car users that would change to bike use are both points of economic efficiency that even separately considered give a positive recovery of the construction cost within 20 years.

Overall the publication shows promising positive economic advantages of the development of the bicycle highway.

A comparison between the variables used in their research in relation to the development friendly base of the NBDS line will give a reduction in the costs. Due to many infrastructural intersections and obstacles already tackled, it would be a relatively low cost bicycle highway to construct. The model as a prediction of the construction cost varies in the range of 300.000-400.000 euro per kilometre.
“Re-use of steel in the lights”

The unique profile of the rail could be positioned vertically in the ground to function as lighting poles.

“Dynamic lights”

Using sensors the lights and power could be limited to the part where the cyclist is positioned.

“Thuja occidentalis brabant” lifetree

600/800 years old, deep rooted, small conifer type, stays green during winter period, original species from Brabant.

“Rainwater drainage”

Wet cycling paths and especially bio-asphalt can be slippery if there is high amount of water on the lane.

“Bio-Asphalt”

No bitumen but Lignine, that comes as a binding additive in plants and trees.

Design of new cycling Lane

former railtrack

Heat storing in summer for snow free paths in winter

Rainwater drainage

Heat storing in summer for snow free paths in winter

Design
The double laned cycle-path

The former rail track is incorporated in the new design of the cycling path. First of all the rail track with its small stones work perfectly as a water drainage part and base for a hedge to grow as a barrier between the two directions. Second this green hedge gives a visual identity on this cycle route. The double lane is divided in a fast lane and slow lane, 5.4m in total. The fast lane has a green colour to indicate the difference. In several institutions new hardware technologies are developed to improve cycling lanes. These can be incorporated. Most of these innovations provide a safer and more sustainable cycling lane. First of all due to heat storage the lane can be kept ice in the winter. Second the regular asphalt can be replaced with bio-asphalt. Dynamic light system involving LED that will follow and guide the cyclist in the dark.

A green wave system also provides a more efficient flow of traffic at crossings. This is already known as a method in the current road network an easily can be adopted in the cycle lane system. Further important esthetical part is the recognition of the presence of the old rail track which reminds the users of its original use. The old remaining’s as booms and signs of the railway are important to preserve since these add to the experience.
Cyclingpath innovations to consider

Green Wave indication

Next to the traditional Green Wave method also other variations of it are developed. By giving the cyclist the notification of this method other than by standard signs, a led strip aside the path will give the cyclist the presence of the system. It will guide cyclist with the light moving aside the path and give an idea how the cyclist can reach the target to cross as he gets green light priority.

SolaRoad

This energy producing cycle path in Krommenie in the Netherlands is developed with TNO and Philips. 2.5m by 3.5 over a length of 100m it is currently tested. However the innovative and sustainable idea it is still not ready to apply on a large scale. The pictures shows that water and frost broke the topcoat of the panels.

Van Gogh-Roosegaarde Path

The cycle path is executed with stone flakes that glow in the dark. The stones charge during the day and can keep glowing all the night. The path is located near Neunen (Eindhoven) and over a length of 600 meters resemblance a safe but also esthetical art piece representation of the location which the famous painter van Gogh used to live.

The application of a more standard line indication could also be realised with this same material. As a light dynamic paint it could glow in the dark to show the cyclist the edges of the path better. Heijmans company has incorporated this in the Smart road concept they are developing for the future roads in the Netherlands.
Programming functions along the bicycle highway

Next to the hardware of the bicycle highway lane itself also functions along a bicycle highway are developed.

The possibility to park and charge the e-bike is important for the locations along the line were users stop.

The Dutch weather in combination with information screens can help the user in his journey.

Finally there are also for the e-bike itself innovations developed regarding the service and maintenance. The cyclist can repair and clean the bike along the route on his own.

Images innovations|several opportunities for the bicycle highway, from urbanvelo.org/archiexpo/
In choosing the most illustrative and strategic interventions for this project certain categorizations are made. Both the, repetitive typology on the line, as well as the zone and speed together with the type of landscape provide a matrix. From this matrix 6 locations have been chosen and represent in the elaboration of the design the most representative potential of the re-use of the former NBDS line.
<table>
<thead>
<tr>
<th>Mid Sand grounds</th>
<th>East Sand grounds</th>
<th>Peel grounds</th>
<th>Maas valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>Recreational</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nature & Cycling

Image 90 A | RGV, 5 meter statue of bicycle, Putten, 2002

Image 90 B | Cycling Recreation in Fall, source: Kruller.nl
With the come of the bicycle highway in this part of the NBDS railway the nature area of Groene Woud becomes more reachable. Also the old cafe that still exists and is along this railway can now function as a stop for cyclists. It is located on a section with a road in to the forrest. Further the cyclist is more likely to stop here. From Veghel and Boxtel you both reach under 15 minutes of cycling this nature area. An advantage is the line already is present into the Forrest-edge and there is no need to cut any trees or damage part of the nature area.

The fact that it runs on the edge of the forrest allows the cyclist to experience on one side the scenery of the forrest itself and on the other side the view over mostly small agrarian fields.

The location of the stop for cyclist is an important point along the line since this part is expected to be used intensely both by functional users who travel from and to work between Boxtel, Schijndel and Veghel and the recreational user which takes this route to enjoy the nature and Groene Woud. The intersection with the old café will provide the cyclist a possibility to park their bike, take shelter in suddenly bad weather and the opportunity to charge the E-bike. Take a rest and drink or eat are another important functional use in this location. In comparison with the car highways this could be seen as a ‘gas station’.

These locations are the important meeting points of the bicycle highway that facilitate the cyclists in their needs and give back a similar dynamic in the historic remainings it once had. These type of remainings along the line can be re-used inline with its own identity and re-programmed as facilitator for users of the bicycle highway.
The connecting element
The connecting element
The connecting element

The industrial zones of the medium size city along the NBDS line are separated from the residential areas in the cities. Remarkable is that the former NBDS line passes in each city both these zones and from a backbone perspective creates another opportunity. The example in Veghel is the most complex one but also the example with the most urging problem concerning this division between the residential and industrial zone. Since 6 years the Noordkade and CHV factory is re-programmed as the cultural centre and creative industry for the city. This is a very successful project with positive effect in the re-use of old industrial heritage. The down side is the growing tension between the historic centre of Veghel. More and more shops vanish and retail-buildings become vacant. For this issue the re-using the NBDS line (which had a side-way to the CHV haven) could help reconnecting these two concurring parts within the city of Veghel. The crossing over the canal still consists of the presence of a white waiting post. The waiting post is exactly positioned on the start of the bridge and the crossing with other directions of cycle paths towards Eindhoven and s’Hertogenbosch. Re-using this waiting post as a post for the bicycle highway which facilitates the user in charging, information, (etc.) relinks the remaining’s of the NBDS line with the new function of a bicycle highway.
Both the industrial and residential zones are crossed and the loading platforms along the canal and the CHV factory can be re-programmed for bicycles. Due to the widening of the Canal the original bridge of the NBDS couldn’t cover the distance anymore but has been relocated and replaced with a bridge for bicycles. The old bridge has been moved to the CHV factories Quay. Using it as remembrance of the NBDS line, it could be incorporated in the new cycling path (see visualisation). The execution of this part as a bypass is differently designed as the main line without a dividing hedge.
The Station Park

LEGEND

- Former NBDS Line
- Existing cycling route
- Water
- City Center
- Residential Area
- Work & Industry
- Nature
- Agriculture
- Objects NBDS
- Focal points along the route
- Locations of sections

The map illustrates the Station Park with various locations and features, including residential areas, work & industry zones, natural and agricultural areas, and focal points along the route.
## The Former Railway Station

**Landscape Speed Typologies**

<table>
<thead>
<tr>
<th>Section Location</th>
<th>Functional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time x Distance</td>
<td>Slow</td>
</tr>
</tbody>
</table>

**Former Trainstation Typology**

- East Brabant Sand Grounds

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66 meter total

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Image 91,92 | pictures of the railtrack of the NBDS in 2005

Image 93,94 | pictures of the railtrack of the NBDS in oct 2015
With the come of the bicycle highway in this part of the former NBDS line a reconsideration of the railway station as an typology could be re-incorporated as a spatial element in the city structure of Veghel. The railway station as a re-design location for the bicycle highway repeats itself several times since every place had its own station. Currently the city structure of Veghel holds several opportunities which could be solved in the re-use of this location. The analytic maps show two main structures that meet on the location of the former station. A green connection through the city and a functional connection towards the sports accommodations and high school from the residential area.
Images 95,96,97 | pictures of allotment yards near railtrack in the Netherlands

Image 98 A | corrot, union harvest 1915
The ground from and around the station and railtracks became covered with grass, bushes and trees. Very limited maintenance was done on greenery around the old tracks since 2005. The location is currently open for public and often people can be seen walking their dog. This unique oasis in the middle of the urbanised area of Veghel could be appreciated as an emerged quality. In the re-use of this location in relation to the bicycle highway a station park will be developed. This station park will be developed in respect of the remaining’s of linear geometry of the old tracks with re-use of the waiting-posts and station-building. A combination of food production as a derivative re-incorporation from allotment yards located in the buffer zone between rail tracks and the houses. This practice of local community gardening as a form of urban agriculture which the residents of Veghel can make use of. Food production fits the identity of Veghel since several major industries for food production are located and started there. The old tracks kept visible and the presence of a rusty locomotive reminds people of the original use. The park is partly designed and partly a recapturing by nature. Wild flowers and herb picking fit the natural appearance of the location.

The former buildings are both re-used as a bike re-pair shop and a cycling café with a food market. The local product can be tasted and purchased.

Image 98 B | Transportation of food with bicycle in Veghel 1932

<table>
<thead>
<tr>
<th>need of 9 x more calories with than car</th>
<th>= 90% local economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>city/ departure</td>
<td>€</td>
</tr>
<tr>
<td>smaller city</td>
<td>€</td>
</tr>
<tr>
<td>own</td>
<td>€</td>
</tr>
<tr>
<td>small city</td>
<td>€</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>= 20% local economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>car</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
The station Park
Re-use of the train station in Veghel.
Artefacts & cycling

LEGEND
- Former NBDS Line
- Existing cycling route
- Water
- City Center
- Residential Area
- Work & Industry
- Nature
- Agriculture
- Objects NBDS
- Focal points along the route
- Locations of sections
Bunker
Experience remainings in the landscape

W.O.II Blockage

monument / artifact
typology

part Recreational

Time x Distance Medium

Landscape

Experience remainings in the landscape

Bunker

The Peel
This crossing of the defence canal, also called the Peel canal with the former NBDS line gives an opportunity for cyclist to experience the remainings in the surrounding. These remainings vary from objects related to the old rail track and objects that relate to the Dutch Deference Structures.

Visible is the train line was built on a dike due to the wet environment. This elevated strip of land give advantages to the new cycling path with dry conditions. This elevation of the path in relation to the landscape provide a wider view for cyclists and for this recreational part of the route an extra quality.
Images 99 t/m 105 | pictures of remainings around the line, booms, military platform, bunker.
The former NBDS Railway was in intensive use for almost hundred years. Due to this period of almost a complete century resulted in a broad range of historic remaining we can still find along the line these days. The definition of these elements as artefacts are in this context intended as a derivative of the theory of Aldo Rossi in his book *l’architettura della città* [1982]. He describes the collective memory of a place in terms of artefacts and monuments and not the definition of artefacts exclusively resembling a ‘pre-historic’ remaining. The remaining’s of the past and the role of them in the presence of our environment is a well analysed subject in the discipline of urban studies. Maurice Halbwachs and Aldo Rossi are almost iconic in this subject and formulate several theories regarding this heritage in cohesion with value and collective memory. However the initial theories were meant for the relative bigger city and urban surrounding, still are, as a reasoning very interesting for the remaining’s of the NBDS line. The objects along the line that reminds of a certain period or event in history is interesting for the cyclist to experience. Both its legacy and stories keep preserved as a physical resemblance in the current surrounding of the cycling path. Abstract interpretations are an addition in the same approach since the lack of certain objects that could represent a story or event could be added. For example the twisting rail tracks that remind of the de-railing in 1940 of the German panzer train which invaded the Netherlands in the first period of the Second World War.
Repose & cycling
Nature Area Typology

part    Recreational

Time x Distance Medium

Maas terrace

picknick
rest, entrance to nature
The bicycle highway as a typology evokes at first sight mostly the idea of high speed cyclist rushing by. The use from cyclists on a cycling highway also consist of a dynamic between resting or stopping and fast transportation. Several parts of this bicycle highway cross nature area’s and have a more recreational character in use. It’s evident to incorporate this as part of the bicycle highway and adds value to the experience and program on and around the line.
Nature area the Vilt is an old nature area that emerged about 12,000 years ago. As a bypass of the river the Maas it was cut off and several small lakes remained. Due to contamination by the agrarian sector the lakes were full of algae and not very attractive for animals and people. Since 2010 the lakes are dredged and shores defoliated. It is an excellent place for storks and human recreation since the recent improvements. There is no strict policy in animal/ ecology protection yet with the interference by humans improving the water quality. These nature areas along the bicycle highway provide the ideal surrounding for the cyclist to stop and rest. The bicycle is a quiet and clean device which doesn’t harm the nature. Nature area De Vilt can become a unique and qualitative place both for the ecology and quality of living in the medium size region of Brabant.
Scenery & the Maas

LEGEND
- Former NBDS Line
- Existing cycling route
- Water
- City Center
- Residential Area
- Work & Industry
- Nature
- Agriculture
- Objects NBDS
- Focal points along the route
- Locations of sections
Re-use of the Maasbridge

Water crossing
Typology

connection between provinces

View over the Landscape

Maas valley

Landscape Speed Typologies

connection between provinces

Typologies Speed

Time x Distance Medium

Maas valley

part Recreational

section Location

roadway

roadway

roadway
The Maas bridge and its scenery is the last section as an intervention in this re-design project. The old bridge that before 1950 only was used for train transport switched after the Second World War to a car bridge. However, the train part vanished, the pillars standing in the river are still present, wide and strong enough to support a possible new bridge. For the bicycle highway this is an important object since it connects the province of Brabant with the province of Limburg. Secondly, due to the historical value and the parallel invasion of the Germans by this bridge in the Netherlands with a Panzer train make it even more important.

A strip along the current road on the south side makes it possible to overcome this river with the same dimensions as the rest of the bicycle highway does. A platform in the middle of the bridge is added for cyclist to stop and rest, enjoying the view over the river and landscape. This intervention will be the most expensive one, but solves the currently missing-link to Gennep.

Biker friendly benches make cyclist to park their bikes easily and sit on the other side. Also the use of industrial steel and wood resemblance the material associated with an old train line. The platform is ten centimetres elevated from the bicycle highway.
Conclusion

In review of the analyses and the translation of it into the concept and design in general, we could consider the NBDS train-line and its current situation as a very interesting piece of heritage. It cuts through several landscapes and urban settlements; it reminds people of a certain time and period of the region. With all the artefacts still present and the unsecure situation of its future there clearly is a need to come up with a solution for the line as it is now.

The re-use of the former NBDS train-line as a bicycle highway could, with the given advantages and opportunities for the future, be considered as a suitable new use. It is clear that fast cycling due to e-bikes and a high speed infrastructure suits the medium size network of East Brabant. The average estimated distance an e-bike user is able to cover is in the same range. The analyses and the design show that the cycling route will contribute to improvement of the medium size network as well as preservation of the value of the historical remainings of the railway.

This new bicycle highway gives in two ways an answer to the demand and opportunities that come with high-speed cycling. Firstly a more sustainable way of transportation for people in this region that relieve an amount of the pressure on the current system. Secondly as a solution for the issues concerning the medium size city approach. It creates a functional backbone from historical perception and a more collaborative project for the region (instead of competitive).

This region, together with the rest of the Netherlands, does have the highest amount of bicycles per inhabitant. This makes it also logical that pioneering with an infrastructure that is bike friendly emerges. Simultaneously, a development and innovation for more high speed cycling goes hand in hand. With the development of this bicycle highway residents of Boxtel, Schijndel, Veghel and Uden could easily cycle from one place to another.

With the development of the other bicycle highways (S’Hertogenbosch-Oss) and the absence of high-speed cycling in the middle region of East-Brabant a substantial addition could be created.

The poly-centric city structure gives the opportunity to travel to and from the medium size city (medium size network). The bigger city network is currently still too far apart for the e-bike.

If we look to the more local conclusive results and opportunities of this new use we see the possible catalytic effect it could have on the remaining’s of this line. Most of the interventions will consist of the change of the rail track towards a double lane cycle path. However this regional intervention, as well as several characteristic locations on the line, have a potential value for re-use on a more local scale. The collective historical value can be preserved for the future in a more holistic way. Next to preservation, a development from the catalytic effect will likely stimulate recreation around the monumental artefacts. The surrounding of the line with several vacant places, for example the former train station could have a new function in its existing urban surrounding. Place-making on 6 new spots as illustrated in this project give content both to preservation of the collective memory and contemporary developments in mobility and spatial planning.

Improvements reach for the medium size city as far as future developments considering the growth of people using e-bikes as a relatively new typology.

The experience of the landscape as a section cohesively is
an important value and quality. It once was an infrastructural backbone for the medium size industrial city, but with the development of bicycle highway it can again serve as a backbone contributing to the regional value and suit the linear and historic character.

- High speed cycling is highly suitable/matches the medium size

The former NBDS line provides a logic infrastructural line (collaboration / competition)

High speed cycling as a network

- Differences in speed - functional & recreational - different experiences surrounding

- Concept allows opportunities for Heritage and other Spatial Development (Catalyst)
Other applications

This project is intended as a specific solution for the former NBDS line. During the analysis also other applications of the same formulated concept were found.

The NBDS line did run further than the 50 kilometre's in the re-design project. On German grounds more remainings can be found and are also from historical and esthetic value. The remainings are still present in the landscape and the design of this line could therefor in a further development have a more international application.

Beside the decay of the former NBDS line many other similar train or tram lines lost their original function but are still present in the urban and rural landscape. The value of the legacy of these lines and the spatial opportunity of these relatively linear elements in the landscape between places naturally fit the typology of the bicycle highway.

In the most South region in the Netherlands a old tram-network is positioned in the landscape. The pressure on the roads is very high due to high amount of recreational cyclists. The scenery and the terrain of the landscape make that it’s a popular place to cycle. Similar to the NBDS line its positioned in a medium size city polycentric region. Secondly there is the ambition to improve the connection between the city of Aachen and Maastricht by cycling. Both the concept and the translation into local interventions could be executed in a similar way.
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Feasibility study GGA Regio ‘s Hertogenbosch Fietssnelweg F59, Goudappel Coffeng


Elzendoorn, B. Omroep Brabant, Goederenspoorlijn tussen Boxtel en Veghel, 16 march 2015


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Gennep in current situation  
NBDS-line on general station website.  
German Archive information trains.
Images

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Image 13 | derailing of the German panzer-train, beeldbank bhic
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Image 75 | cargocaps, received from cargocaps.com
Image 76 | Re-use high speed cycling, redesign, city-data.com
Image 77 | Thailand, Railway Track Market in Samut Songkhram, trekearth.com
Image 78 | Cyclingpark, Re-use, city-data.com
Image 79 | Noordkade CHV Veghel, summer festival, chvnoordkade.nl
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Image 81 | Netherlands Strava application cycling, strava.com
Image 82 | Europe Strava application running, strava.com
Image 83 | Region East Brabant, Strava application & openstreetmap.com
Image 84 | Region East Brabant Strava application
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Image 90 d| CHV noordkade 1920, chvnoordkade.nl
Image 91,92| NBDS-line remainings, brabant centrum, duitslijntje.info
Image 93,94| remainings in Veghel former station, Dioni Gallardo Heijen, oct 2015
Image 95| allotment yards near track, Tuinvereniging Het Zonneveld 2009
Image 96| allotment yards near track, Tuinvereniging Het Zonneveld 2009
Image 97| allotment yards near track, Blankenstein & Tweeloo 2008
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Image 105| Derailing monument in Mill, made by artist: J. Veenstra, Tunnis.nl
Image 106| Defence canal near Mill, peelaamstelling, panoramio.com
Image 107| Nature area de Vilt received from wordpress.com
Image 108| Remainings of the Eisenbahn in Germany which connected with the NBDS
Image 109| The former tram-network in cities in south-Limburg, M. van der Linden 2011

Software used during this project:

Cs8 Adobe Creative Photoshop
Cs8 Adobe Creative Indesign
Cs8 Adobe Creative Illustrator
Adobe premiere element 9
Adobe fireworks cc
Excel 2010
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Poem made for the begin-colloquium/graduation proposal in June 2015
Re-use of the former NBDS railway
Cycling | as a strategic & spatial design in the medium size region of Brabant |

Graduation Report: Master ABP Tu/e

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Summary

This graduation project researches the re-use of the former NBDS railway which runs through East part of Brabant in the Netherlands. In parallel, the medium-size city terminology is considered as an approach for future improvement of the region. Since the NBDS line has lost its original function over time, but still present and visible in the urban and rural landscape makes it an interesting object. Secondly, actors and residents underpin the importance of the former line as a historical collective value. Both the situation of this heritage and mobility questions make the consideration of re-use a multi-disciplinary research. Using explorative scenarios results for the re-use as a bicycle highway as a new suitable and sustainable successor to the former railway.

The distance between places on the former line, together with the network of the medium size city fit the potential cycling distance improvement. The original connection between the places due to the former NBDS line as a backbone for the medium size city of Veghel, Uden, Boxtel, Schijndel, Gennep could be restored. The heritage and the experience of the variety and diversity within the surrounding landscape are bearers of the experience of this route.

The new typology of ‘high speed cycling’ gives people the opportunity to travel fast, flexible and individually between places. However with the existing cycling routes, this new typology demands a safer and straighter route. The combination of these variables makes the concept self-evident as it logically fits each other.

Secondly, the scale and distance of the network in the medium size city structure suits the average distance that could be practicable increased with high speed cycling. The parallel growth in sales of e-bikes makes for another argument to construct an infrastructural network that answers society’s demands.

Analyses of the historical remainings and different landscape represent the variety of the cycling route. As a backbone, the user can easily travel in two speed differentiated lanes towards other connections in the cycling network of the region. The former railway is already positioned with a minimum of interruptions which makes the execution of the cycling lane much more feasible. Other locations with a comparable straight cycling lane face generally considerably more obstacles and barriers.

Its easy to reuse this already linear element in the landscape in a function that demands the same linearity.

In addition to traveltime and distance improvement secondary benefits and opportunities arise with the come of a high-end cycling connection between the medium size cities.

Improvement of the local economy, recreation as well as the possible catalytic effect on the un-used spaces that are near the rail track which could develop over time with it. Spatial developments on several locations on the line are inseparable, connected with the project and potential of it. To receive a good image of this development a categorization is made. The categorization is based on typologies that represent the former railway in pieces. Secondly, speed difference and landscape types are incorporated. All these preconditions formulate 6 different representative locations. These 6 locations have been worked out to give a clear impression on the potential of the former railway as a cycling route.