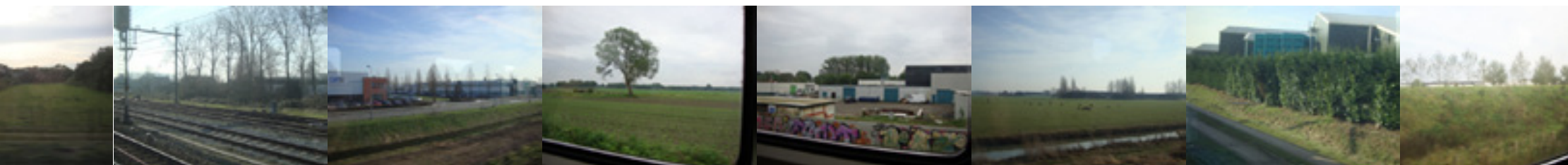


RAILWAY PANORAMAS

A high-speed train, likely a Dutch Thalys, is shown in motion on a railway track. The train is yellow and blue. In the background, a traditional Dutch windmill stands prominently against a sunset sky with soft, orange and yellow clouds. The landscape is flat and green, with some trees visible in the distance. The overall scene is a panoramic view of a railway landscape.

MASTER THESIS LANDSCAPE ARCHITECTURE WAGENINGEN UNIVERSITY

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SUMMARY

The problem this Msc landscape architecture thesis deals with is cluttering of the landscape near infrastructure. Cluttering is visible in urban agglomerations all over the world, particularly on places where infrastructure and urbanisations meets eachother. The definition of cluttering used in this thesis is as followed: cluttering is a spatial development or process that leads to a negative experience of random functions, structures and elements which are not in proportion or coherence with the esteemed image of the landscape on a place. For the Dutch motorway network, a solution is devised several years ago: the selection of motorway panoramas to keep the view open towards characteristical open rural areas. But the problem of cluttering also occur near the railway network and the experience of the landscape is better when sitting in the train. So the research gap this thesis deals with is the use of railway panoramas to upgrade the cluttered view from the train towards the landscape.

This leads to the following objective for this thesis: to decrease the experience of cluttering of the landscape near the railway network, by means of the motorway panorama method. This objective consist of two sub-objectives: first, to design a method to determine panorama locations and cluttering zones near a railway alignment that crosses several landscape types. Second, to upgrade panorama locations and cluttering zones by designing with use of design principles. Based on these sub-objectives, this thesis can be divided in two parts. With thee objectives, three main reseach questions come forward: what are the railway panorama design principles to decrease the experience of cluttering

of the landscape near railways? What are the locations of the existing panoramas and cluttering zones near the alignment Utrecht-Eindhoven? How can these principles lead to an upgrade of the panorama locations and cluttering zones? The main analysis methods used for this three parts are a film analysis and a questionnaire.

The main results in first part, which consists of chapter three about cluttering and chapter four about the railway panorama method, are: a method to determine cluttering zones using a gradation based on the number of annoying elements and the visibility of landscape characteristics. This comes forward from a comparison between cluttering near motorways and railways, which shows that the type of cluttering is different and the experience of it is even worse near railways than near motorways. Another result in this part is a method to determine panorama locations in 4 steps using several criteria.

The second part, chapter five and six, is about creation and testing of the design principles for upgrading panorama locations and cluttering zones. The topics of the seven design principles are legibility, verges, size, fronts, landmarks, rhythm and furniture. In chapter six, these principles are tested using three cases: business area Wildeman near Zaltbommel, the brook valley of the Essche stream near Esch and an urban-rural transition zone near Geldermalsen. These cases show the way of applying the principles to a landscape design. Particularly in this step, the role of the landscape architect comes forward.



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INTRODUCTION

Each day, 1,1 million travellers choose to travel one of the 5200 alignments between 388 railway stations in the Netherlands (NS, 2006). We all have been one of these travellers. The most common activity of the railway travellers is look outside to the work field of the landscape architect: the varied Dutch landscape. As along the motorway, this view towards the rural landscape is under threat of urbanisation. Functions like business areas, industrial areas, utility areas and housing areas together with elements like offices, showrooms, factories, fences, flats, etcetera, care for a view that becomes similar for the railway and motorway surrounding area all over the Netherlands. Not only the Netherlands deals with this problem which is called cluttering in this thesis, but this problem is visible in urban agglomerations all over the world. For the Dutch motorway network, a solution is devised several years ago: the selection of motorway panoramas to keep the view open towards characteristic open rural areas. But near the railway network, the problem of cluttering also occur. So it is time to upgrade the cluttered view from the train towards the landscape.

This leads to the following objective in this thesis: to decrease the experience of cluttering of the landscape near the railway network, by means of the motorway panorama method. This objective consist of two sub-objectives: First, to design a method to determine panorama locations and cluttering zones near a railway alignment that crosses several landscape types. Second, to upgrade panorama locations and cluttering zones by designing with use of design.

In this thesis, chapter one is about the problem, context and the introduction of railway panoramas. Chapter two discribes the research design, where things like the location, the focus, research questions and stragey come forward. Chapter three and four is the research part of this thesis and deals with the first sub-objective, which is the problem of cluttering and the railway panorama method. Chapter five and six, which is the design part, deals with the design principles and the testing of these principles on three cases. The end of this thesis consists of the conclusions and some discussion points for further research and design.

For larger maps, which are included in this thesis report, see corresponding posters.





CHAPTER 1: PROBLEMS, CONTEXT AND INTRODUCTION RAILWAY PANORAMAS

1.1 Development of urbanisation

There is much pressure on space all over the world. All kind of functions require this scarce space. Particularly in the Netherlands, a country with almost seventeen million inhabitants living on an area of forty thousand square kilometres, there is much discussion about the relation and integration between urban and rural areas. This nonlinear process of urbanisation is going on for hundreds of years. Because of economic growth, population growth, globalisation and innovation in history, there are several waves of urbanisation distinguished. Despite periods of low urban growth, suburbanisation between 1960 and 1975 and de-urbanisation between 1975 and 1980, the main development are the periods of high urban growth, urbanisation until 1960 and re-urbanisation in 1980 and later (Hidding et al 2002). At expense of agriculture and nature, the land use for urban functions and infrastructure increased from 4% in 1890 to 14% in 1996 (CBS 2009). Compared with the historical urban-rural relation, where isolated urban settlements are located within the open rural landscape, the result of urbanisation is that open rural areas are now located within large urban agglomerations (Barends et al. 2000). In other words the Dutch rural areas become more and more urban fields where the distinction between the urban and rural landscape disappears (Anonymus 1977) (Hidding et al 2002).

1.2 Urbanisation in planning and politics

As many processes in spatial planning, there are two main approaches for urbanisation: the first one is the morphological approach, which includes physical functions like housing areas, business areas and infrastructure. The last decades, these functions are expanding and are seen as evil for the rural area (Lemaire 1970). The second approach is more socially, economically and culturally focussed. It contains the experience of an urban area. Noise, pollution, stress and busyness are examples of this experience and are in contrast with the openness, nature and rest in the rural area. In the field of spatial planning, the morphological approach of urbanisation is an important topic in all vertical political levels: the regulations on European level, the “Nota Ruimte” and WRO on national level, regio-

nal plans on provincial level, structure plans and zoning on municipal level (Hidding et al 2002). For this thesis, it is most interesting to look at the goals and strategy of urbanisation on the national level. The main goals concerning urbanisation, according to the Nota Ruimte 2004, are: A) The combining of economics, infrastructure and urbanisation. B) The development of national urban networks and urban centres. C) The improvement of urban accessibility. D) The improvement of the urban living environment quality and socioeconomic position of cities. E) The preservation and enhancement of variation between urban and rural areas. The strategy to reach these goals is by creating a national spatial network with several main ingredients: 1) National urban networks: Randstad, Brabantstad, South Limburg, Twente, Arnhem-Nijmegen, Groningen-Assen. 2) Urban bundled areas.¹ 3) Buffer zones. 4) Main connection axes within the infrastructure network. When combining these ingredients in one map (figure 1.1), it is remarkable to see how the urban bundled areas are developed alongside the network of infrastructure. So infrastructure is an important guidance for urban development. This special phenomenon was already mentioned in the spatial-economic policy documents in 1999, which noted lots of spatial activities on city edges and development axes between cities that lead to a spatial-economic network in the Netherlands.

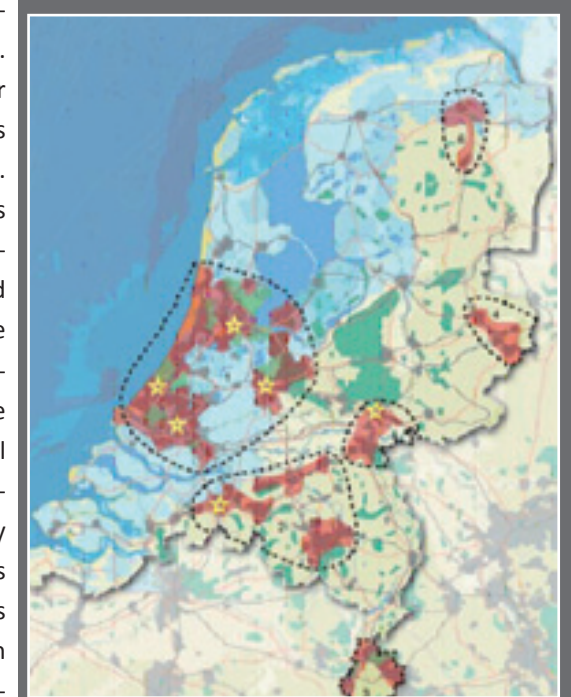


Figure 1.1: Urbanisation on National level (Nota Ruimte 2004)

¹ In Dutch: stedelijke bundelingsgebieden.

1.3 Networks

Let us explore the connection between urbanisation and infrastructure as an urban development guidance from the field of landscape architecture and spatial planning. The system of infrastructure is part of the network layer, using the spatial planning layer model (Lengkeek 2002). This network layer consists of urban networks, virtual networks and physical networks or infrastructure (Vroom 2005). Infrastructure can be described as lines which connect points, which form a hierarchical network and which is the carrier of people, goods, water and energy (Motloch 2001). In spatial planning and landscape architecture, these lines are often seen as cross sections which split the landscape and cut it into pieces (Albers 1990). Landscape fragmentation by infrastructure is a huge problem and designing infrastructure is even compared with disaster control because it always has a negative impact on the landscape (Guinee, 1977) (Hamels et al. 2009). However when designing the landscape, infrastructure has to be taken into account because motorways, waterways and railways are part of the landscape and are even main structures for urban and rural development (Pohl 1983), as shown in the previous paragraph. Nowadays not the infrastructure is adapted to the landscape, but the landscape is adapted to the infrastructure (Schafer 1998). Examples of this adaptation are spatial concepts like: green buffer zones between cities, bundling of urban functions, “Het Groene Hart”, the indication of national and regional urban networks, the ecological main structure (EHS) and the concept of green corridor (Hidding et al 2002).

1.4 Problems of urbanisation near infrastructure

The adaptation of the landscape to the network of infrastructure leads to spatial problems concerning urbanisation. Several international examples of these problems, which all touches each other, are:

1) A huge problem is the development of **urban sprawl** and the development of suburbs. According to Bruegmann the definition of sprawl is: ‘low density, scattered urban deve-

lopment without systematic large scale or regional public land-use planning’ (Bruegmann 2006). Looking at the connection with the infrastructure network, it is good to mention that sprawl and the development of suburbs was first visible in ancient Rome, where slums were built alongside roads outside the city walls (Glaudemans 2000) (Bruegmann 2006). Nowadays, it is a term that focuses on the large car-oriented city expansions in the rural area. These expansions, called suburbs, were first located near infrastructure nodes. At the end of the nineteenth century, in a time when infrastructure like railways became important for the suburbanisation, the landscape changed rapidly in the Netherlands. Inhabitants from Amsterdam moved to Bussum or Hilversum, places which were easy accessible by train. The landscape on these places changed towards large residential areas with English landscape style gardens and winding roads. Later, in the twentieth century, the same development was visible for cars in North America. Project developers built huge car oriented suburbs outside the city. For example: the project developers Levitt built Levittowns, including Hempstead New York, which consist of endless rows of cheap and similar houses with own gardens near winding roads. The main critics on this type of urbanisation was the monotony architecture, lack of public spaces and the use of common facilities. In fact, because of the common facilities, the social cohesion in these areas was higher than expected. Between 1970 and 1990 there was an expansion of sprawl in cities like Brussels, Copenhagen, Frankfurt, Hamburg, Munich, Melbourne, Zurich, Mexico City, Beijing and of course fast growing North American cities (Figure 1.2) (Kenworthy et al. 1955). The modern type of sprawl and suburbanisation is the development of exurbs. These exurbs are places in the rural area with inhabitants who used to live in cities. Exurbs are detached from the city, but still depend on it because most inhabitants work there. This results in a new type of rural landscape where the urban culture and mobility is visible on the countryside (Hartog 2006).

2) Another problem which occurs when discussing the connection between networks and urbanisation, is the creation of **non-sites**, or non-places, wastelands and in Dutch “tus-

senland” (Frijters et al. 2004). Between urban and rural areas, near infrastructure nodes, many small undefined areas appear. These areas concern small scale undefined scattered areas or large scale temporary empty areas. The main cause of the creation of these areas is the landscape transformation; the change of functions near infrastructure. Also because of a lack of maintenance, these places look unused. The problem of non-sites is much discussed in the field of landscape architecture, which shows that it is a huge problem and also offers opportunities.

3) When the contrast between urban and rural expires near infrastructure, the problem of **landscape levelling** comes forward (Hamels et al. 2004). This problem occurs all over the Netherlands and particularly in areas where the hard border between the urban and

rural landscape changes to a zone with all kind of different land use. These insipid and amorphous urban areas have a similar look all over the Netherlands and affect things like parcellation patterns and natural relief, which result in a less differentiated Dutch landscape without differences in landscape identity like historical characteristics (PLB 2011).

4) A fourth important problem is **corridor development**. Many cities are part of a conurbation – a region where cities are merged together – which growth and urban development is due to the infrastructure network. This use of infrastructure: motorways, provincial roads and railways, as a leading network to expand cities and business areas is called corridor development. In numbers this means that in the Netherlands 50% of the houses are within 2.500 meter from an motorway entry or exit. With lots of new urban development



Figure 1.2: Urban sprawl and suburbs in Atlanta, Saint Louis and Washington

comming, this percentage is rising (Veldhuis et al. 2009). In other words, cities are turned inside out towards motorways (Windén 1991). In the conurbations all over the world, like the Randstad in the Netherlands, the Ruhr area in Germany, the triangle Antwerp, Gent, Brussels in Belgium and the area between Hong Kong and Guangzhou, this corridor development is visible. More and more neighbourhoods are planned on locations near motorway exits. Business areas want to establish at so called “sight locations” near motorways (Figure 1.3). Functions that belong to corridor development like urban neighbourhoods, road traffic noise reducing barriers, business areas and offices on road sides, have negative influence on the perception of the open rural landscape and dominate the landscape near

motorways and city edges. Whose borders are constantly updated at expense of rural and natural landscape areas.

Of course, there are much more planning problems which occur when urbanisation and infrastructure comes together. The term cluttering is most comprehensive and as is used as an umbrella term in this thesis². Cluttering of the landscape came up in a time when people realized that developing city extensions near motorways derives an identical and similar landscape perception

² Cluttering is a translation for the Dutch word “verrommeling” and is translated by VROM as cluttering



Figure 1.3: Business areas near Nederweert (left) and Rozendaal (middle). Right, the problem of corridor development near motorways.

1.5 The motorway panorama method

For this problem of landscape cluttering near infrastructure, one of the solutions that is devised, is the panorama method. This method contains the creation of motorway panorama areas to resist to cluttering and corridor development near motorways. The definition of a motorway panorama can be described as the high ability to have wide open views from the motorway towards the surrounding landscape. The term panorama is latin for “all”, which is pan, and “what is visible”, in latin horama. Panorama is first mentioned by the Irish painter Robert Barker at the end of the eighteenth century (Piek et al. 2006). Barker painted Edinburgh on a cylindrical surface and viewed from the inside. It was seen as a new spectacle: a 360 degree painting that extended from the foreground to the distant horizon (Miller et al. 1996). In China, the panorama was already earlier invented. A good example is “Along the river during the Qingming Festival” by Zhang Zeduan which was painted in the early eleventh century. This painting shows scenes and events along the river from a suburb to the inner city and is 0,24 meters high and 5,28 meters long (Zheng 2003). Later, in the mid-nineteen century, so called “moving panoramas” were invented. This was a large painting of contiguous views of a passing scenery from a boat or a train window. Installed on immense spools, these paintings were scrolled past the audience behind a proscenium and a narrator, mostly a professor, explained the views (figure 1.4).



Figure 1.4: Diagram showing the mechanism of a moving panorama, from *Scientific American*, 1848

John Banvard for example, created a moving panorama of a trip up and down the Mississippi River in 1840. With this 800 meters long panorama, Banvard travelled all over the world to show people this beautiful landscape (Oettermann 1997). The Poole Brothers called it a “myriorama” when they showed people their story “Loss of the Titanic” and added music and light effects. After

the development of photography and later also the film camera, a new type of landscape panorama experience took place. The use of computers and digital photography techniques leads to more panorama experiences like “Google Street View” and other three-dimensional routes. So it has always been interesting for people to see the sequence of the landscape near boat, train or car routes (Zheng 2003).

Although the intention of motorway panoramas came forward from the problem of cluttering, these panoramas have also other purposes concerning the increasing experience of the wide open Dutch landscape. Some researchers think that the experience of the road and its surrounding landscape by the users does not get enough attention (Hemel 1997) (Houben 1999) (Schone et al. 1997) (Ibelings 1999), while the designing of the sequence of perspectives from the motorway towards the landscape is needed (Appleyard 1966).

Landscape cluttering was realised and mentioned in lots of reports and documents in the nineteen nineties. Also the importance of the environment near motorways was mentioned before. One of the first Dutch examples was A.H. Wegerif who pleaded for aesthetical laws for the motorway surrounding landscape in 1920 (Wegerif 1920). Later, Overdijkink made a statement that most Dutch people only know the Dutch landscape because of the roads. That is why Overdijkink thinks it is important roads do not disturb the landscape and the unspoilt landscape near roads remains the same (Overdijkink 1941). In 1941, Overdijkink published several aesthetical principles for road design, which are still used (Overdijkink 1941). The panorama method as a solution for the cluttering problem near motorways was mentioned later. In the beginning of this century, this connection was made in several studies. One of these studies was an analysis and future vision by Mecannoo in 2002 about all kind of motorway aspects in the Randstad, including a chapter about the connection between the road and the surrounding landscape. The word panorama came forward (Houben 2002) and several principles were formulated for these open landscape panoramas (Houben 2002). Looking at the perception of the

landscape among motorways, Van den Berg wrote “Is er wat te beleven aan snelwegen?” (Berg 2004). Which was attached to a study about route design of motorways, where the creation of panoramas also came forward. This attention resulted in a space and culture program by VROM, which included the route design of motorways and architecture of business areas (Boer 2005). Steunpunt Routeontwerp made a design for the A-12 route in 2005 (Steunpunt Routeontwerp 2005). In the meantime all kind of studies about the cluttering problem were done and it was included in policy reports. Veeneklaas looked at the definition and factors of cluttering (Veeneklaas et al. 2006), Boersma and Kuiper (2006) mapped the problem and showed the inconvenient landscape elements (Boersma 2006), Ruimtelijk Planbureau pointed out the problem of increasing urbanity near motorways (Hamers et al. 2006). Later in 2006, the Dutch motorway panoramas were defined by Ruimtelijk Planbureau (Piek et al. 2006) and explored on location (Beemer et al. 2009) (Anonymus 2008), participation of stakeholders (Bureau KLB 2007) (Jonge et al. 2008), political embedding (Anonymus 2007) (Geffen 2007) and future developments (Beemer et al. 2009). The nine national motorway panoramas are now embedded in policy. Which means that some developments are not possible on the panorama locations. It also results

in critics on the panorama approach by Vlonk and Crommentuijn (Vlonk et al. 2009). They doubt whether or not drivers realize the presence of the panoramas.

At this moment Steunpunt Routeontwerp helps designing motorway routes and the surrounding landscape (Steunpunt Routeontwerp 2008) in order of the ministry of LNV, ministry of transport, public works and water management, and the ministry of VROM. They also included “Mooi Nederland” in their program to resist cluttering using the “Structuurvisie voor de Snelwegomgeving” (Anonymus 2008). This vision focusses on the spatial quality in the motorway surrounding environment,



Figure 1.5: The focus of the National Panoramas is on the open landscapes in the west of the Netherlands. (Anonymus, 2008)

with special attention for the integration of infrastructure developments in the landscape and the conservation of the view on valuable landscapes, the coherence and the continuity within the route design (Anonymus 2008). Movares, another important actor and in former times called Holland Railconsult (Movares 2010), take the role of designers and innovators of infrastructure topics like railways, motorways, the electricity network and so on. So in the last few years, the ideas about beauty of the Dutch landscape in connection to the motorway network and its surrounding landscape by Overdijkink and Wegerif became popular again. In these years, most of the ideas for the design of the motorway in connection to the landscape are now bundled in the “Atlas van de snelwegomgeving” (Veldhuis 2009). In all the literature and research towards motorway route design and the panorama method there are to opposite sides:

- The implementation of the motorway in the landscape.
- The adaptation of the landscape to the motorway, which deals with the motorway panorama method (Windén 1991).

Looking at the tasks for the government concerning these motorway panoramas, based on the report “Zicht op mooi Nederland: the Structuurvisie voor de Snelwegomgeving” (Anonymus 2008), an action plan is made and partly executed. To start, a quick scan for route design by VROM and RWS in 2008. In 2009: architectonic specifications for motorways by RWS, guidelines for provincial vision by VROM and RWS, an team of experts on the fields of infrastructure and space, indicate Government Advisors, elaborate the innovation program Mooi Nederland by VROM, an exploration of financial possibilities by LNV and VROM. Between 2010 and 2013: monitoring and evaluation for implementation in regional plans of provinces and municipalities. So summarizing the panorama method:

To counter cluttering near infrastructure, the term panorama is taken over in several policy documents (Nota Ruimte, VROM 2004), research was done (Research Road Atlas, Holland Avenue by Mecanoo, Houben 2002) (Verrommeling in beeld by Milieu- en Natuurplanbureau, Boersma 2006) and nine national motorway panoramas where indicated to be implemented in future regional plans (figure 1.5).

The use of the panorama method has some advantages and disadvantages. An important advantage for protecting the panoramas is higher road safety; the presence of a panorama causes variations in views and keeps the driver awake (Appleyard et al. 1966) (Piek et al. 2006). Also the wide open, green and clean sights instead of a closed motorway are perceived as positive (Anonymus 2008). Another advantage, and also disadvantage, of creating and protecting the panoramas is that a lot of spatial development is not possible in the area. The main disadvantage is the attention level of the driver, which can be focused too much on the landscape, particularly when landmarks like ancient monuments are present, it can be dangerous. This is an important disadvantage according to 29% of the drivers. They think safety is the most important subject of infrastructure, according to a questionnaire by Crommetuijn (Crommetuijn 2010). The view towards the landscape is only mentioned by 5,3% of the car drivers as the most important subject, after solutions to counter traffic jams (23,9%) and speed (20,6%). This does not say that the view is not important for drivers, but it has no priority. In unsentimental literature, a critical remark towards the use of motorway panoramas, is that it does not solve the problem of cluttering, but only replaces the problem to a location that is not protected (Roncken, 2008). Of course this is true, but the goal of this method is not to stop urban development in the Netherlands, the goal is to think about the location of urban development so that the motorway surrounding landscape will not be cluttered.

1.6 The railway panorama method

The term railway panorama is a word that is derived from motorway panoramas. The selection of panoramas, has been done for motorways, but has never been done for railways. As described in the first paragraphs of this thesis, the process of cluttering is developed near all infrastructure and not only near motorways. While reading the last disadvantage for motorway panoramas, the decrease of the driver's attention level, the idea of using railway panoramas instead of motorway panoramas came up. For train users, this disadvantage is not an issue, simply because train users do not have to focus on driving the train. This is what Parsons called perceptual narrowing: the driver or traveller has

more attention for the landscape, when the driving tasks ask less attention (Parsons et al. 1998). From the railway travellers who react on the questionnaire (will be explained later on and in appendix x), 36% say that "looking at the landscape" is their only activity and there is no respondent that never looks outside. Also other aspects of a better experience of landscape panoramas can be in favour of the train users, like the window size, the visibility angle on the landscape, the traffic noise, the invisibility of the rail itself, the height of railways, the constant speed and the difference in views when travelling from A to B and from B to A (Houben 2002) (Piek et al. 2006). An extreme example where the landscape experience is high near railways is the famous Trans-Siberian Express or railways in Switzerland and Austria, where people pay money because they want to travel by train and enjoy the view on the surrounding landscape, not because they have to go from one place to another. There are even TV programs broadcasted about the experience of the landscape when sitting in a train^{3 4}. This is possible in the areas with lots of mountains and less urban activity. Also in the Netherlands, if you look at the beautiful open motorway-panoramas, it is possible to mark several railway panoramas and increase the views on, and awareness of, the variable Dutch rural landscape instead of the views on similar business areas and backside of urban areas. Would it not be nice to have a map during the train journey across several landscape types, which shows the existing locations of special views on the Dutch landscape⁵?

Looking at the differences between the experience of views from motorways or railways according to a questionnaire by Crommetuijn and the questionnaire in this thesis (appendix x), all percentages are in favour of the railway:

- 53 % of the railway travellers think that the landscape is better visible when travelling by train. Only 5 % of the railway travellers think the landscape is better visible when travelling by car.

- As mentioned in the description of motorway panoramas, only 5,3% of the car drivers
 3 - *Bahn TV in Germany 2001-2008.*
 4 - *Rail Away in the Netherlands 1994-2009.*
 5 Example: view on the Waal and Waalkade, Nijmegen and the view on wide open peat soil landscape, Woerden –Breukelen.

think the view towards the landscape is the most important subject of infrastructure. For railways percentage is 15%, after speed (60%) and safety (25%) (Crommetuijn 2010). The 15% for railways consists of 10% for the view towards the landscape and 5% of the maintenance of open areas.

- Around 67% of the railway travellers are satisfied with the view toward the landscape from the train. For car drivers, only 52% are satisfied with the view towards the landscape from the car (Crommetuijn 2010).

Later on, more findings from this questionnaire are mentioned in this thesis report. Keep in mind that the number of travellers is not in favour of the railway. The average for each day on the alignment Utrecht-Eindhoven is 55000 persons (Ministerie Verkeer en Waterstaat 2007). The vehicle average for each day on the motorway A50 between Renkum and Heteren is 95000 (Jaarsma et al. 2006), times 1,3 persons per vehicle (Province of Friesland 2007) is 123500 persons each day, which is more than double compared with railways. To Summarize this part:

Creating railway panoramas instead of motorway panoramas can be a better way to tackle the problem of cluttering near infrastructure because the ability for users to experience the landscape panorama is higher.

In literature, the term railway panorama is only mentioned once by Piek (Piek et al. 2006), when describing the quest for motorway panoramas: “Although we focus on motorways within this study, we look briefly at an panorama from the train. At four kilometres east of the motorway A27 near Houten, the railway crosses the island of Schalkwijk. Visibility calculations shows the railway surrounding landscape is easily recognizable. The alignment crosses the ribbon village Schalkwijk and within 500 meters of the railway, the landscape is recognizable by its components. So instead of a motorway panorama, there is a railway panorama near the island of Schalkwijk.” But, as Piek mentioned in the first sentence, the principles which are used in the motorway panorama method, as a solution to counter the problem of cluttering, are not similar for railways. Although the motive to create panoramas is the same, there are differences in level and type of cluttering

between the railway and motorway surrounding landscape (figure 1.6). As said, the way of experience these panoramas by the train users is different from the experience of panoramas by car drivers. To give an example of a difference in landscape experience: the continuity of speed is an important difference. While a car has to accelerate and decelerate within an alignment between two cities, a train has a constant speed. What results in a difference in landscape scenography (Houben 2002): because of a slower acceleration and deceleration of trains before and after a stop, the views on the city and its edges – where landscape cluttering takes place – takes longer and is different from the views on the rural landscape in between. So briefly said, the research gap this thesis focus on is:

The use of railway panoramas towards the surrounding landscape to decrease the experience of landscape cluttering and to improve the recreational value of travelling by train.



Figure 1.6: Cluttering (top) and panoramas (below) near the railway alignment Oss-Nijmegen.

CHAPTER 2: THESIS RESEARCH DESIGN

2.1 Tasks

According to the research gap mentioned in the previous chapter, some research and design tasks can be made up.

The first task deals with the difference between motorway and railway panoramas. As said, motorway panoramas are used in policy and railway panoramas are not, while the problem of cluttering and corridor development is going on near both networks. The panorama method to solve these problems is used for motorways. For railways, the view from the train towards the landscape is only taken into account when designing a new alignment or upgrading old ones (Houben 2006) (Warmerdam et al. 1996) (Drijver 2005). In these cases, the designing of panoramas is done from the perspective of the alignment design and less from the problem of cluttering near railways. Later in this thesis, when the principles are mentioned, some more information about the relation between railway design and the landscape will be given. The task is to compare the ideas and principles of motorway panoramas with the railway network, thinking from the problem of landscape cluttering and its negative experience to come to railway panorama principles.

For this first design task, the second task is important: a comparison between the problem of cluttering near railways and motorways. By comparing cluttering of the surrounding landscape near both networks, using one clear definition, the differences in elements and functions that are experienced as cluttered come forward. Questions which need to be answered are: when is a landscape cluttered and what are the differences of landscape cluttering between the motorway network and the railway network?

To come to the third task, it is good to look at comments on the method used for the selection of the existing nine national motorway panoramas. Within these nine panoramas, the views on urban landmarks are left out of consideration and the focus is on the characteristic open rural landscape in the Randstad (figure 1.5). But why focusing on these nine

extreme wide views in a similar landscape type - the west peat landscape - , while smaller views in different landscapes can also be perceived as beautiful? For example, a view on a historical church in the higher sand grounds or open heath land in a closed forest landscape. Now, only the landscape cluttering in the west of the Netherlands is partly tackled, while it is also an important topic in the landscapes of North Brabant, Limburg, Overijssel, North Holland and Gelderland. For selecting several railway panoramas, the task is to look at the qualities and characteristics of other landscape types (Alterra 2003) (Barends et al. 1986) (Veldhuis et al. 2009). A reason why the choices in selecting motorway panorama locations is not clear, is because the technical analysis to the location of the motorway panoramas is not included in the reports of VROM, in contrast with the analysis methods used by Mecanoo in 2002 (Houben 2002) (Piek et al. 2006). So the third task consists of designing principles for the panorama method, which are applicable on railways in most Dutch landscape types that deal with cluttering.

Designing with railway panoramas have to lead to an increase of the recreation value of travelling by train. Looking at the satisfaction of train users, the appreciation for aspects like safety and on-schedule performance increases, the appreciation for a clean train is decreasing but the recreation value isn't mentioned in most surveys. While there is a huge opportunity to increase this recreation value by using the surrounding landscape, looking at examples like the Trans-Siberian Express or railways in Austria and Switzerland (figure 2.1). To increase the recreation value and the legibility of the railway surrounding landscape, it is necessary to know what train users see and think of a panorama and whether or not they notice the presence of it. This is different from the way landscape architects experience these panoramas. A question where a part of this thesis will deal with is: what are the criteria for a panorama to let people notice it, to increase the recreation value and increase the legibility or orientation in the landscape? A method like a questionnaire for train users is an important source in this research to make sure average train users experience the railway panoramas in the future. While designing later on, the focus is on the views on the landscape from the train, but also keep in mind the experience of the

railway network by inhabitants outside. So the fourth task can be described as followed: to use railway panoramas to increase the recreation value of travelling by train, by integrating the landscape in the journey. In this task, the focus is on the experience of cluttering by the train users.

The last design task deals with the differences in scale. Important is that this research treat different scales. For the problem analysis, the indication of panoramas and the landscape scenography analysis, an entire alignment on a high scale is needed on one hand. But analysing the scenography of the entire railway network in the Netherlands will not lead to a qualitative analysis of the current railway panoramas and a qualitative design later on. That is why an alignment has to be chosen. On the other hand, for the adaptations which have to be made to upgrade the landscape and create railway panoramas with use of railway panorama principles, designing on a low scale is needed.

2.2 Alignment choice

For the alignment selection there are two main criteria: the first criteria comes forward

from the critics on the motorway panorama selection, dealing with the landscape types the alignment crosses. The design assignment for railway panoramas is to take in account several Dutch landscape types. The second criteria deals with the location where the problem of cluttering occurs. A useful alignment to study is the connection between Utrecht and Eindhoven, which crosses 's Hertogenbosch, has a length of eighty kilometres and is one of the most busiest alignments of the Netherlands with almost 60000 people each day (Ministerie van Verkeer en Waterstaat 2007). This alignment has a variety of two landscape types, the river landscape and the sand landscape, both consists of several landscape units (Alterra 2003) (Barends 1986) (Veldhuis et al. 2009). This alignment also deals with problematic cluttering areas on the city edges and infrastructure nodes near Utrecht, Houten, Culemborg, Geldermalsen, Zaltbommel, 's Hertogenbosch, Vught, Boxtel and Eindhoven (figure 2.2). To study the cluttering zones on this alignment, an analysis about the different types of landscape cluttering near infrastructure will be made in an earlier stage.

Another interesting aspect of this alignment is that the motorway surrounding landscape



Figure 2.1: Examples of traveling by train with a high recreation value (Kers et al. 2007).

between Utrecht and 's Hertogenbosch is mentioned as one of the least attractive environments of the Netherlands (Boekhorst et al. 1986). Unfortunately, a similar research to the railway alignment does not exist, but the landscape types it crosses is similar.

2.3 Research objective

The main objective of this research project (Verschuren et al. 1999), which arises from the problem definition, research gap and design tasks is:

To decrease the experience of cluttering of the landscape near the railway network, by means of the motorway panorama method.

- To design a method to determine panorama locations and cluttering zones near a railway alignment that crosses several landscape types.
- To upgrade panorama locations and cluttering zones by designing with use of railway panorama principles.

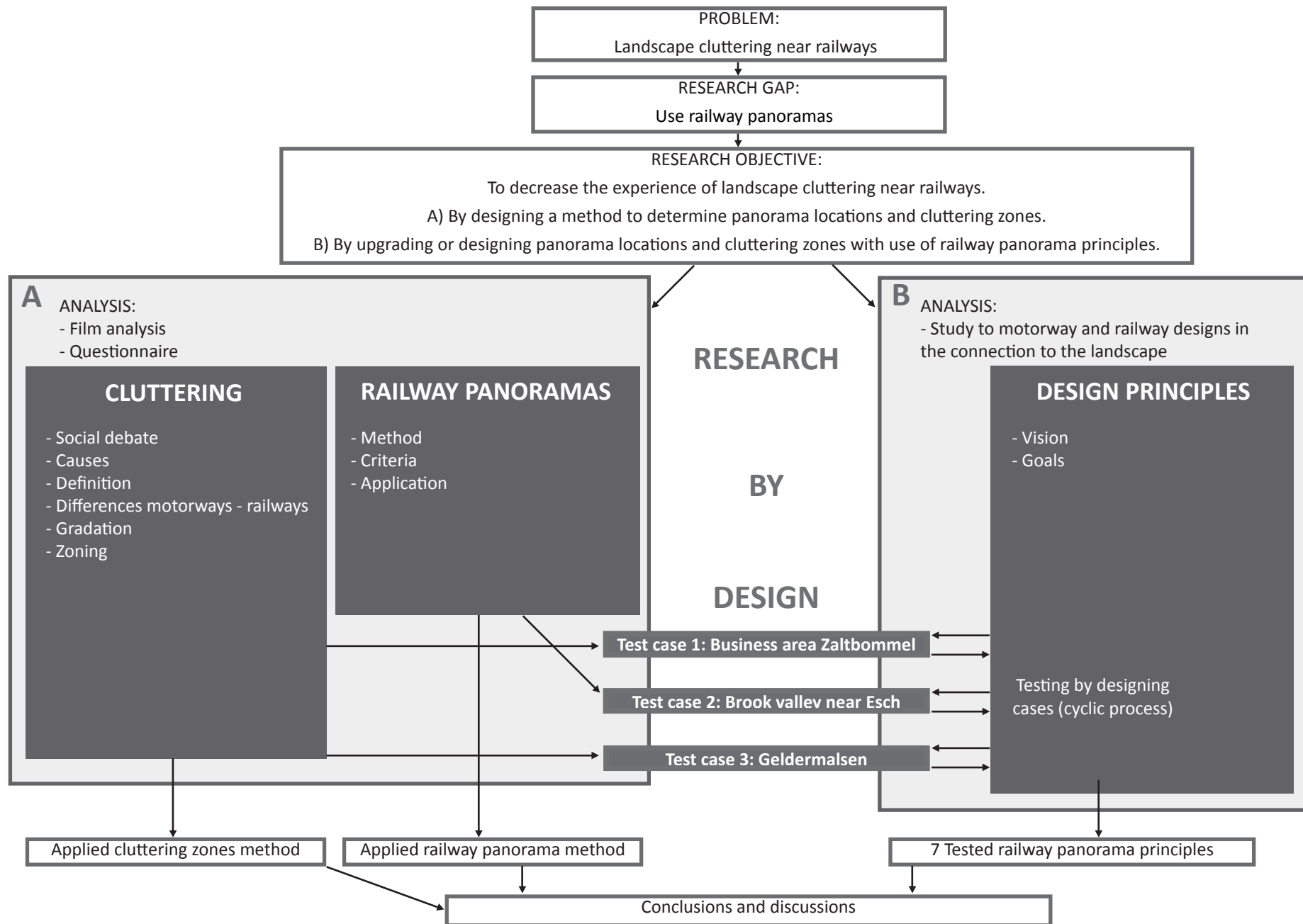
2.4 Research questions

Looking at the objective and perspective of this research, there are three main research questions to mention:

- What are the railway panorama design principles to decrease the experience of cluttering of the landscape near railways?
- What are the locations of the existing panoramas and cluttering zones near the alignment Utrecht-Eindhoven?
- How can these principles lead to an upgrade of the panorama locations and cluttering zones?



Figure 2.2: Alignment location.



Scheme 2.1: research strategy

2.5 Strategy and methods

On the previous page, a scheme is drawn to explain the strategy of this thesis research (scheme 2.1). Starting with the step of the problem definition, which is described in the previous chapter. This problem definition leads to the research gap, which consists of the method to create railway panoramas. From this research gap, the objective and research questions are derived. The objective consists of two parts:

A) The first part is the determination of cluttering zones and panoramas on a high scale. This part is based on an analysis of the landscape from the train, using a film camera. This is similar to a method used by Mecannoo (Houben, 2002) when they analysed the motorways in the Randstad and came up with principles to improve the environment near motorways. In this film analysis, the range of the view, the boundaries of the view, the landmarks and the legibility of the landscape comes forward. To analyse the experience of the landscape from the train users, an important analysis part is the questionnaire. After the analysis there are two main boxes. The first box deals with the problem of cluttering near motorways and railways. The main output for this box is a gradation of cluttering zones on the alignment. The second box is the design of a railway panorama selection method, based on the selection of the current motorway panoramas. The main output is a list of potential panorama locations on the alignment between Utrecht and Eindhoven. From these two boxes, three cases are chosen to test the output of the second part.

B) Upgrading or designing panorama locations and cluttering zones with use of railway panorama principles. Based on: a study about the connection between landscape and the design of motorways and railways, motorway panoramas principles, on a personal vision and on goals, several principles for the design of the railway surrounding landscape will be made.

The two parts come together in the design part of this thesis: the testing of the railway panorama design principles. This cyclic process of designing and reflecting on and with use

of the principles leads to a tested list of design principles. The three landscape plans at the end of the case designs, are not the main output. The main output are both methods and the tested design principles. In the end, a reflection to the main objective and research question leads to conclusions and discussion points.

2.6 Thesis criteria

According to Koh (Koh 2009) there are five main thesis criteria for landscape architecture:

- 1) Global and significant issue: the global problem where this topic deals with is urbanisation, especially cluttering and corridor development of cities near infrastructure. As said in the problem definition, lots of countries with a high population density are short of space and the problem of cluttering occurs. Examples of these areas are: the Ruhr area in Germany, the triangle Antwerpen - Gent - Brussels in Belgium, Milan - Verona in Italy, Hong Kong - Guangzhou and several American city agglomerations like Phoenix and New Jersey (Bruegmann 2006).
- 2) Concrete site, local application and accessible: particularly the first part of the objective deals with the high scale of the entire alignment between Utrecht and Eindhoven. The second part of the objective deals with three concrete sites within this alignment on a low scale, used for the testing of the cases.
- 3) Substantial research: looking at the research gap, this thesis will fill, the main output is the research to the term cluttering and the research of the relation between railways and its surrounding landscape. This research will come up with new insights for the field of landscape architecture, spatial planning and infrastructure design.
- 4) Eloquent communication: beside this report and the presentations, this criteria is visible by showing the maps on posters and creating an model.
- 5) Architectural image: by coming up with a set of principles, on different scales and in different landscape types. These deals with aspects like the length of a panorama in an open landscape type or the architecture of a landmark building in the urban area. By testing with use of design these principles the relation to architecture will be shown.

2.7 Research type

The description of the research type can be approached by the way other work fields define their research (Verschuren et al. 1999) (Creswell 2003), but for landscape architecture the connection between research and design in this thesis is more important (Lenzhölzer 2010). For this connection there are three propositions: Research on design means reflecting and comparing designs. Research for design means the study of the environment and the use of research methods to develop design guidelines. Research by design - or 'ontwerpend onderzoek' in Dutch - occur when the design process itself is used to generate new design knowledge (Lenzhölzer 2010). The different parts of this research, based on the research questions and perspective, can be compared with this trichotomy (table 2.1). Overall, looking at the connection between research and design for this thesis, research by design applies here because the design part or testing part is a mean for the research, but it is not the final result.

Research on Design	Analysis of motorway designs and railway designs in connection to the landscape.
Research for Design	Most of the analysis parts: Analysis cluttering, the questionnaire, the film analysis, the construction of design principles, the comparison of motorway and railway panorama principles, landscape analysis for locations cases and alignment etcetera.
Research by Design	Testing of principles on several scales and locations.

Table 2.1: Research perspective and the relation to research versus design.

On the other hand, a description of this research, based on the way how other work field define their research, can be made. This research project is practice oriented, which type consist of five main stages or steps: problem finding, diagnosis, design, intervention and evaluation (Verschuren et al. 1999). Although these five steps are not copied in this thesis, the intention and order is similar. Overall, it will be a research with mixed, both quantitative and qualitative, research methods. The focus will be on qualitative research and its application (Creswell 2003).



CHAPTER 3: CLUTTERING

3.1 Social debate

As explained in the first chapter, the Dutch term cluttering touches many international problems concerning networks and urbanisation. It is a term which is invented several years ago to deal with the urban-rural transition zone (Veeneklaas et al. 2006). Nowadays, it is a term used in policy to combine despicable developments in the landscape (Veeneklaas 2006). It is also a social debate because the definition used by different groups like politicians, scientists or inhabitants is different. Newspaper headlines shows these differences in the definition of cluttering and shows that it is mostly used when people want to say: 'something is going wrong with this landscape' (Figure 3.1).

The first time that cluttering was mentioned in policy was in the Fourth National Document of Spatial Planning (VROM, 1987). The document states that: "landscape will become cluttered if government does not respond to developments in rural areas; the areas, then, will become decreased landscape" and "to prevent the loss of characteristics, some areas need law enforcement; threats of uniformity, levelling out, degradation, pollution and cluttering need to be prevented." Reading these sentences, several questions arises like: What does it mean, physically and aesthetically, when a landscape is cluttered? What are the causes of landscape cluttering? What can landscape designers exactly do about it? It looks like cluttering is an topic that is embedded in policy but the real material landscape is undervalued (Hagens 2010) (Latour 2004).

3.2 Definition of cluttering

Looking at all the questions and debates about cluttering, a useful definition of the term is needed. Even though there is not one final general definition, the purpose is to find a definition that is useful for this thesis. In politics, LNV and VROM, keep distance from the phenomenon of cluttering and refer to specialists, who all have different definitions of cluttering (Veeneklaas et al. 2006). In this paragraph, the problem is explained in more detail, using the different definitions of cluttering, mentioned by these specialists (table 3.1).



(Figure 3.1: social debate: cluttering in newspaper headlines).

A broad definition of the cluttering is mentioned by Mooi Nederland (Anonymus 2008): "spatial developments that lead to social discord because of random new functions, structures and buildings which are not in proportion with the esteemed image of the landscape on a place." According to Wulp (Wulp 2009), Alterra (Alterra 2003) and Frijters (Frijters 2004), examples of these new functions, structures and buildings are: business areas, glasshouses, wind mills, car graveyards, radio pylons, camping sites, golf courses, allotments and so on. Using this definition, the result of cluttering is a less typical and legible Dutch landscape. Particularly in North-Holland, the Randstad, Limburg, Overijssel, Gelderland and North-Brabant, landscape qualities disappear and the legibility decreases because of cluttering (VROM 2010). To notice cluttering in the field, Veeneklaas (Veeneklaas et al. 2006) explored an operational definition of cluttering in the Netherlands,

Author	Definition of clutteration	Keywords
Mooi Neder-land (2008)	"Developments that lead to social discord because of random new functions, structures and buildings which are not in propor- tion with the esteemed image of the landscape on a place."	Social discord, random functions
Veeneklaas (Veeneklaas et al. 2006)	"Landscape clutter is an intrusive increase in the level of variety in a landscape, combined with a lack of coherence. Clutter is variety that does not suit the landscape, as well as the presence of elements perceived as intrusive." "Cluttering is a process perceived as unintentional, creeping, that is, as the unintended outcome of different people trying to pursue different interests, rather than the outcome of a well-defined plan or design. It is associated with neglect, degradation, untidiness and a general lack of concern for the quality of public spaces."	Variety, coherence, elements Process, unintentional
Spatial planning (VROM)	Cluttering or suburb development: "The threat to green rural areas by the expansion of parcels and buildings for housing and non-agricultural activity."	Urban pressure on rural area, suburbs
Hagens (Hagens 2010)	"Cluttering is an landscape concept which refers to a process in which Dutch open and rural landscapes get a fragmented and urbanised character."	Fragmentation
Policy: VROM (VROM 2010)	Addition to the definition of Veeneklaas (2006) : "In outlying areas, one notices an increasingly cluttered landscape in which the horizon is increasingly obstructed by develop- ment."	Horizon obstruction or pollution
Boersma and Kuiper (Boers- ma et al. 2006)	"Cluttering consists of two essential factors: one is the prevention of potential disturbing elements, which explains about three- quarters of the cluttering, the other factor is the heterogeneity of land use, which explains about one-quarter."	Potential disturbing elements, heterogeneity of landuse

Table 3.1: Definitions of cluttering

mention the observation of cluttering in an area on three levels: 1) The level of the object: intrusive elements are ugly, does not fit in the landscape identity or openness and does not fit in the dominant land use. 2) The level of the landscape: the coherence, diversity, scale contrasts, orientation and degree of cluttering. 3) The level of the process of cluttering. According to a method to measure cluttering by Alterra, 36% of the analysed grids are perceived as cluttered (Veeneklaas et al. 2006). Because of the difference in levels

and factors, this number is just a sample. But what can be concluded: it is hard to notice cluttering in the field, thinking from the observer. From this perspective, Veeneklaas adds; the disturbing increase of landscape variation and the lack of coherence, to the definition of Mooi Nederland. In the field of spatial planning, cluttering is mostly connected to the pressure of urban activities on rural areas, which definition is different from the definition by Mooi Nederland and Veeneklaas.

As the different definitions show, cluttering is a problem that touches many other problems and topics in landscape architecture and spatial planning (table x). To come to a useful definition for this thesis, it is possible to split up the aspects in the definitions mentioned above. This distinction is also made when explaining the term urbanisation, which consists of a morphological approach and a socially, economically, culturally approach. Cluttering can be distinguished in actual clutteration on one hand. This type contains the physical functions and elements, which are hard to measure because it is not defined what these functions and elements are. This is also the reason why the government keep distance from landscape cluttering. On the other hand, “something is going wrong with the landscape” also deals with the question: what to we like or dislike about the landscape and why? According to Appleton (Appleton 1996), this question has to do with the interpretation and experience of the landscape. The experienced cluttering is about the interpretation and experience of a cluttered landscape, which is also the focus of Veeneklaas. Because of the obscurity of cluttered functions and because of the intention and perspective of this thesis research, the focus is on the experienced cluttering. Important to mention is when investigating the experienced cluttering, the actual clutteration must be kept in mind. So for this thesis the definition of cluttering could be formulated as followed:

Cluttering is a spatial development or process that leads to a negative experience of random new functions, structures and elements which are not in proportion or coherence with the esteemed image of the landscape on a place.

3.3 Critical remark

The definition is based on the objective, which is to decrease the experience of cluttering. For this thesis this definition and the type of cluttering near railways is set similar for everyone. But, as said before, cluttering is a broad term which definition is different for each work field. Als this definition differs for each person. For example, one likes to see business areas with advertisement or the backside of housing areas and another consideres it as cluttered. Or according to Roncken (Roncken, 2008): “clutter is between the ears” in his

column about the term cluttering and critics to solutions to the problem. An important statement he makes is that each type of cluttering also has its charm. Because of the lack of time and knowledge, analysing could be an entire thesis topic for social spatial analyst, this difference between persons and the personal charm of cluttering is not taken into account. This thesis does not deal with aesthetic research to questions like: what is the charm of cluttering? How much cluttering can we handle to see it as charm? On what personal background aspect is this charm based? In this these, current research (Veenenklaas et al. 2006) (Boersma et al. 2006) and questionnaires (Vlonk 2008) (Crommentuijn et al. 2010) (appendix: questionnaire) are taken as a starting points. Keep in mind that these researches used and and leaded a average landscape perceiver that not exist because each landscape perciever is different. Later, in the paragraph about the experience of cluttering, this will be explained a little more.

3.4 Causes of cluttering

Beside the already mentioned causes of cluttering: urbanisation and interfaces with other problems, other causes are important. On a high scale, demography, globalisation or international competition and even climate change are causes of cluttering (VROM 2010). Another cause is that because of innovations, functions like housing areas are no longer related to the physical situation of a location as it was hundred years ago. For example, nowadays it is even possible to build a house in the floodplains. Another main cause comes forward from the definition of cluttering by Veenenklaas, who described that the process of spatial development is an important factor of cluttering, which indicates the spatial development in time. Looking at this process, cluttering can be a result of a failure of the Dutch spatial planning system or it can be a result of the failure of landscape itself. According to Derksen (Derksen et al. 2007): “cluttering of the Dutch landscape is often presented as a decline of the spatial planning system, rather than as a decline of the landscape itself”. Of course, the landscape itself is fully depended on the spatial planning system and the planning system is based on the landscape itself. As mentioned in the definition, the focus is on experienced cluttering of the landscape. Even if the main cause is

the spatial planning system, the result is visible in the landscape itself. The experience of cluttering by people is not the planning system what people see but the landscape itself. So within the analysis to cluttering and the comparison between cluttering near motorways and railways, methods are used to analyse the landscape itself and not the entire history of the Dutch planning system.

Looking at the cause of a failure of the planning system, cluttering is often an unintended process and consequence of pursuing different interests of involved actors instead of a preconceived regional plan (VROM 2010). Other things that are mentioned for allowing cluttered functions along infrastructure are: it is often the result of a choice for the easiest solution, lack of creativity and lack of coordination (VROM 2010). On this scale, there are four causes for the process of cluttering (Veeneklaas 2006):

- 1) Insidious cause within spatial planning: not the intended result of a design.
- 2) Struggle between different interests of individuals or groups.
- 3) Cluttering can be a result of the transition of functions.



Figure 3.2: The urban development between 1900 and 2030 (red), the location of current and future business areas (purple) in relation to the A2 motorway and railway alignment Utrecht – Eindhoven.

- 4) The ownership of an area is unclear.

Because of the spatial arrangement and land consolidation in municipalities (Hidding 2002), spaces are filled and functions are planned until physical and political borders of that space. Railways, waterways and motorways are important types of these physical borders.

3.5 Differences between motorways and railways

Having a clear definition of cluttering, it is time to use and explore the problem near infrastructure between Utrecht and Eindhoven. To come to a typology of cluttering, and look at the differences of this problem near motorways and railways, three main aspects or parameters of cluttering come forward from the definition (Veeneklaas 2006) (Anonymus 2008): 1) The spatial development or process, 2) the negative landscape experience and 3) the random functions, elements and structures. The differences of these aspects of cluttering are now explored and described separately. Keep in mind that all analysis material is only made for the alignment between Utrecht and Eindhoven.

1) Process and spatial development

Comparing the spatial development of urbanisation near the railways and motorways, a shift in the leading network for the planning of urban expansions is visible (figure 3.2: urban development near infrastructure between Utrecht and Eindhoven) (Nirov 2010). Cities are first located near important rivers and streams, later in the second half of the 19th century, cities expanded towards the railway station outside the inner city. Nowadays and in the future, the focus of the urban expansion is on main motorway exits and nodes (Hamers 2006). This is visible when comparing the surrounding environments of these two networks: a railway crosses much more urban area than a motorway. The city of Utrecht is a good example of this development. For both networks the rail or road is used as a spatial border for functions. This is best visible for motorways, looking at the urban borders of Eindhoven and 's Hertogenbosch.

For motorways, intensive used cluttered functions and elements are all planned around important "sight" locations ¹, where the accessibility by motorway exits is a reason of development of functions on a place. Compared with railways, the motorway network is the most important axis for the development of business areas and industry.

For railways, extensive and unimportant - in Dutch called *tussenland* - or waste areas consists of similar functions but are less planned (Frijters et al. 2004). Cluttered functions and elements in the urban-rural transition zone are developed in time. The development is independent of railway exits and there is no single reason for development of cluttering on a place, than that it are unused waste-areas.

- Keywords motorway: intensive, sight locations, accessibility, at the border of urban areas, as a border of city extensions, planned.
- Keywords railway: extensive, waste areas, less planned: developed in time, crossing urban areas.

¹ Translated from the Dutch word "zichtlocatie".

2) Negative landscape experience

First of all, the appreciation for the infrastructure surrounding landscape depends on the user perspective. For example, 79% of the inhabitants, 70% of the people who recreate, 67% of the railway travellers and 52% of the car travellers thinks the infrastructure surrounding landscape is attractive (Crommentuijn et al. 2010). For this thesis, the focus is on the difference between the landscape experience by railway travellers and car travellers. Still, this experience of the landscape is subjective and hard to measure because observation, knowledge and valuation play a role (Boekhorst et al. 1986) (Alterra 2006). Personal preferences like travel motive are important (Eby et al. 2004). Veeneklaas describes the relation between the landscape experience and cluttering as followed: "The experience of the landscape is determined by three aspects: the characteristics of the landscape, the characteristics of the perceiver and the context to which these aspects are connected. Research towards the relation between the landscape characteristics and the perceiver shows that variety and naturalness are the most important qualities for landscapes. To much variety, and unnaturalness causes leads to disintegration and disorder which is called cluttering in broad sense. Variety in this case deals with the sense of coherence, unity and harmony" (Veeneklaas et al. 2006). The characteristics of the perceiver deals with the color of glasses we look at the landscape and give value to it" (Veelen 1991). This value is different for each person. For example, a nature lover sees the railway as a barrier which pollute the landscape and a commuter sees the railway as a fast method to go from A to B. Some general empirical law can be drawn from questionnaires, which are used for motorway environment analysis by Crommentuijn and Vlonk (Crommentuijn et al. 2010). From these questionnaires, the appreciation for landscapes and elements become clear. For example the appreciation for noise barriers: the more noise barriers car users think there are on an alignment, the lower they appreciate the motorway environment. Noise barriers are immediately experienced as unattractive and landscape disfiguring (Boekhorst et al. 1986) (Vlonk 2008). In reality, there are differences in noise barriers.

riers made of concrete are the lowest rated by car users (Kamphuis et al. 2004) (Schöne et al. 1997), while green noise barriers are higher rated than most urban landscape or infrastructure landscape (Berg 2004) (Kamphuis et al. 2004) (Schöne et al. 1997) (Vlonk 2008). Another remark that comes back in several questionnaires is the high value people give to plantings near infrastructure. That is why the view for infrastructure towards forests is higher rated than views on cities, open meadows or half open mosaic landscape (Crommentuijn et al. 2010).

An important point to keep in mind, when analysing these questionnaires, is that landscape is perceived by the reflection of light on elements on one side. On the other side, the perceiver appreciate or value elements with help of peoples knowledge of the landscape (Boselie 1996). In other words: the visual system of landscape experience is also a system of knowledge (Boselie 1996). More knowledge about the landscape leads to a higher appreciation (Vlonk 2008). For this research, the characteristics of the perceiver in connection to the landscape is analyzed by using a questionnaire (appendix: questionnaire). Remarkable answers from this questionnaire are:

- There is a huge difference in knowledge of people about the landscape. On the question: how do you know where you are located on the alignment answers 52% of the respondents the buildings and signs which passes the train. 42% of the respondents answers remarkable landscape elements and only a few people have the knowledge to orientate by type of landscape. Another question that confirm the huge difference in knowledge is whether people see and describe the difference between the landscape near Utrecht and Eindhoven. 58 % does not see any differences.
- According to the railway travellers, most annoying cluttered elements and functions are noise barriers, business areas or industry close to the railway, houses close to the railway and open views on business or industrial areas. Crommentuijn and Vlonk asked the same question in their questionnaire. The outcome is similar to the questionnaire in this thesis, but the main differences are that the visibility of greenhouses

and other infrastructure is appreciated low in the questionnaire of Commentuijn and Vlonk. Particularly greenhouses was not mentioned at all by the respondents of the questionnaire in this thesis. The reason for that could be that greenhouses are more visible or not belonging to the landscape type, within the alignment of Crommentuijn and Vlonk.

- On the question: what would you like to see more when looking outside from the train, the answers where: green structures, cattle, open landscapes, sunshine, funny advertising, coverage or ugly buildings, cleaner stations with new designs, removal of plantings close to the railway, the removal of graffiti, more variety and coverage of housing backsides.

Some aspects about the negative cluttered landscape experience, like the field of sight, the amount of noise barriers, visibility of urban areas and the visibility of business areas near the railway alignment, can be measured by deriving a map with use of a film analysis (figure 3.4: visibility range, visible functions and landmarks from the railway and motorway alignment Utrecht – Eindhoven). The method which is used is derived from Mecanoo's method to analyse motorways. By placing a film camera behind the car and train window, the views are set and ready to analyse. In this analysis the visibility range and the visible spatial functions are drawn in a map for the motorway and railway alignment. In these maps, the cluttering locations comes forward. Also positive qualities like the visibility of green, agriculture, nature and landmarks are included to come to possible panoramas in a later stadium. Particularly the landmarks are important for railways because of the absence of signs, compared with motorways, landmarks like churches or rivers are important for people to orientate. The next step was to compare these to maps. (figure 3.3: comparison of motorway vs railway on the alignment Utrecht – Eindhoven). After this comparison of the visibility range and visible functions near both infrastructure networks, several things according to the negative landscape experience can be made up. The number of noise barriers is much higher for motorways and functions which are experienced as cluttered, like urban and business areas, are more visible for railways.

Looking at the experience of cluttering near motorways, the large-scale cluttered functions - like business areas, industrial areas, recreation areas and utilities like infrastructure - look similar to each other and the term non-places is applicable because of the lack of historical and spatial binding to the landscape, or sense of place. These large scale functions on "sight" locations try to attract the drivers attention by using advertisement like showrooms and billboards.

Looking at the experience of cluttering near railways, a variety of small-scale functions

near railways are experienced as cluttered or as the backside of the landscape. The residual spaces and the concealed or hidden landscape is visible with in between a variety of elements which are perceived as cluttered.

- Keywords motorways: closed by noise barriers, similarity, non-places, advertisement, large-scale
- Keywords railways: variety, small-scale, backside, hidden landscape

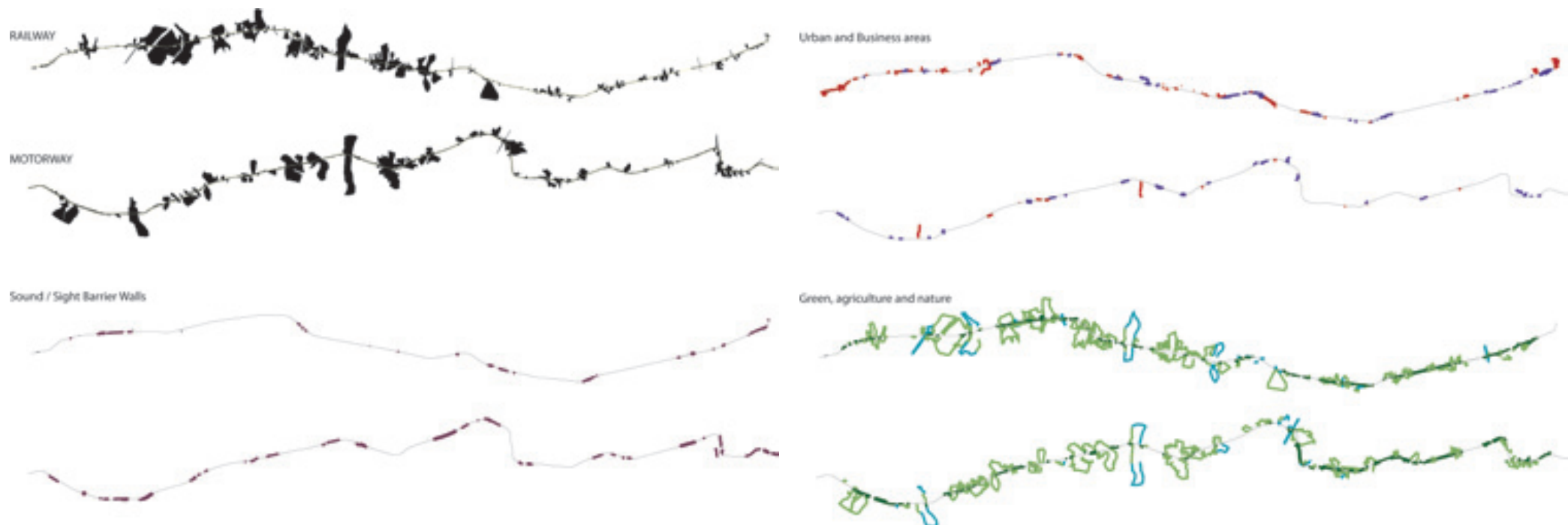
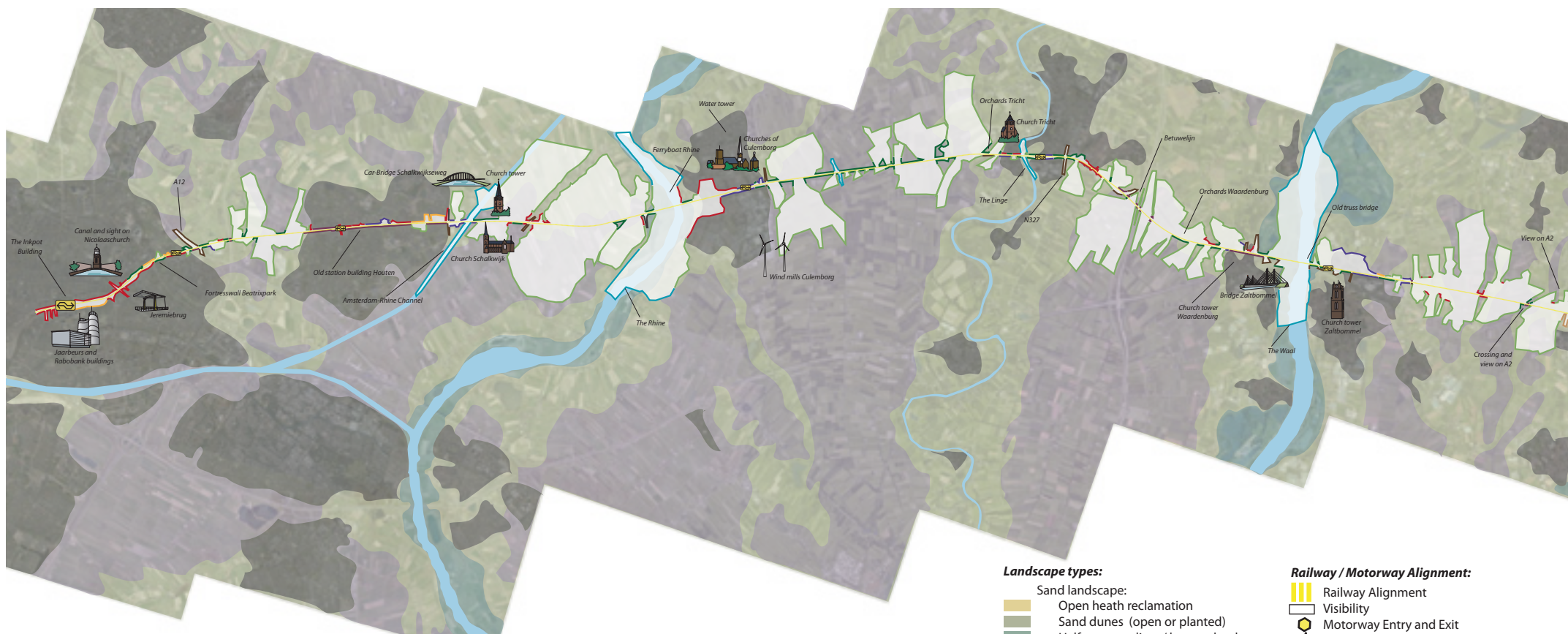


Figure 3.3: Comparison of motorway vs railway on the alignment Utrecht – Eindhoven.



Landscape types:

- Sand landscape:
 - Open heath reclamation
 - Sand dunes (open or planted)
 - Half open coulisse / bocage landscape
 - Brook valleys
- River landscape:
 - Levee (closed)
 - Basin (open, heavy clay soil)
 - Flood plains (open)

Other:

- Water
- Urban area

Railway / Motorway Alignment:

- Railway Alignment
- Visibility
- Motorway Entry and Exit
- Motorway Crossing or node
- Landmark / Orientation element
- Railway station (intercity)
- Railway station

Visible functions:

- Sound / Sight Barrier Wall
- Business area
- Grass and crops
- Greenhouses
- Housing / Urban
- Junction and Roadside Planting
- Tunnel
- Under construction
- Water
- Roads

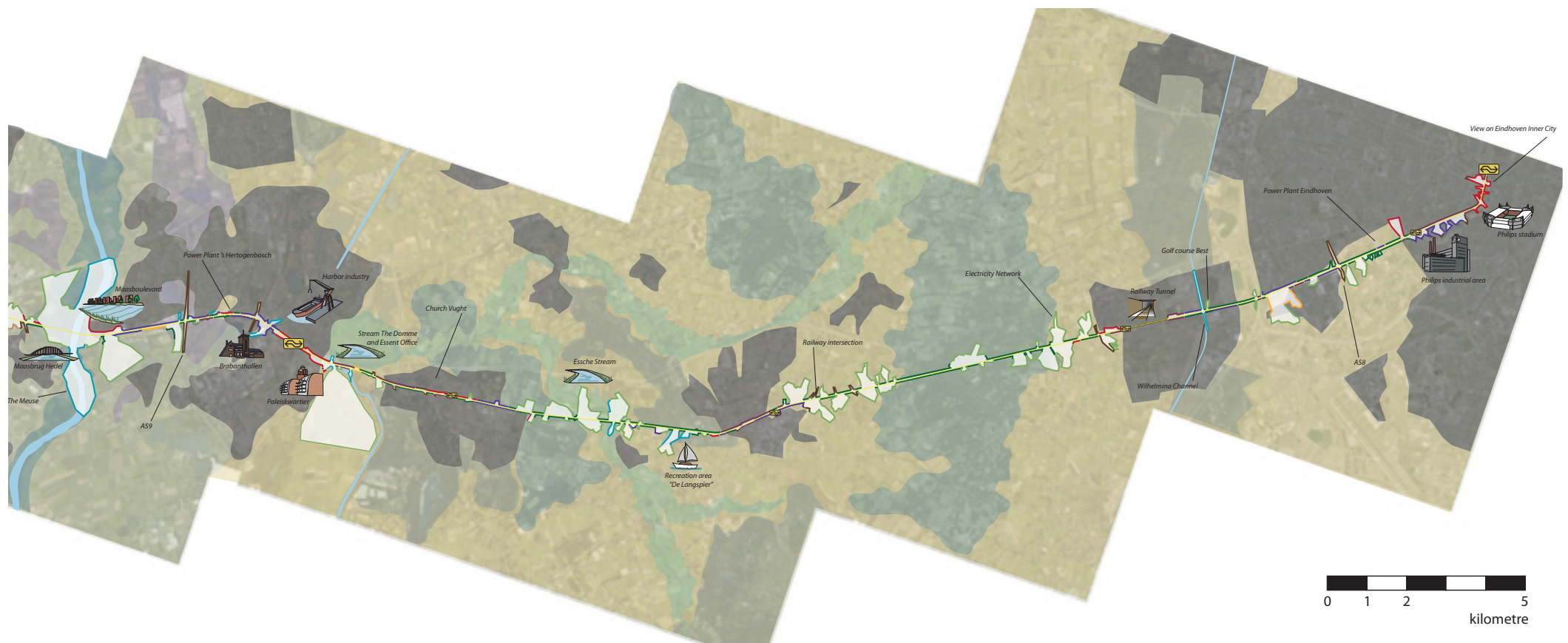


Figure 12: Visibility range, visible functions and landmarks from the railway and motorway alignment Utrecht – Eindhoven.

3) Functions elements and structures

In this part, the method used to come to conclusions about functions and elements near railways and motorways was simple: counting. Functions and elements, which are experienced as cluttered according to Veeneklaas (Veeneklaas et al. 2006), Boersma (Boersma et al. 2006) and Frijters (Frijters et al. 2004), are listed and summed.

Functions:

The term functions in spatial planning can be seen as landuse, because landuse is a function of space. So in this part landuse aspects, for example business areas and utility areas, come forward. Due to the complexness of the method to count the visible functions, multifunctional use of space is not included (Lynch et al. 1984).

Boersma and Kuiper (Boersma et al. 2006) used a list of annoying or disturbing functions to mark the locations which deals with cluttering. Looking at their definition and the definition used in this thesis, this method does not fit (Hagens 2010). For example, agricultural areas is mentioned as one of the annoying functions, while it also is characteristic for many landscape types. It depends on the context and the experience of functions whether it deals with cluttering or not. For this, it is crucial to know why a function is defined as cluttered and whether it is the function itself or, for example, related environmental problems that really worry people (Hagens 2010). The main point is that a general list of annoying functions is not possible because in each type of landscape, this list is different. The risk of using a general list is that in future, the result will be used and linked to rules or police without reconsidering the right definition of cluttering (Hagens 2010). When analysing the difference in functions near motorways and railways, only functions, used by Veeneklaas and Boersma (Veeneklaas et al. 2006) (Boersma et al. 2006), are mentioned which are experienced as cluttered in most landscapes and which do not show landscape characteristics.

The main functions, in order of most occurring near motorways are: business areas, industrial areas, utility areas (with bridges, tunnels, noise barriers, etcetera), small useless green areas and areas under construction. The main cluttered functions, in order of most occurring, near railways are: housing areas (particularly the backsides), industrial areas, business areas (the backsides) and recreation areas.

A remarkable function is “green” of plantings. It is not mentioned by in the lists of annoying functions or elements, but according to question number 11 in the questionnaire, 8% of the respondents thinks these are ugly parts of the landscape, but it is also 6 people wants to see more green, as mentioned in question 13. Important to keep in mind is that there are two types of green. The first one consist of robust ecological zones or corridors. The second one consists of small pieces of maintenance free green which are used to hide infrastructure, business or housing areas and without any ecological value¹.

Elements:

The term element can be described, according to most dictionaries (Houghton Mifflin Company 2000), as a fundamental, essential, or irreducible constituent of a composite entity. This composite entity in this case, is the railway and motorway surrounding landscape. So the elements are all constituents of this landscape. Of course, it is not possible to count all trees near the alignment, but the focus is on remarkable elements which are experienced as cluttered. An element is remarkable when the ability of an element to attract the attention is high, even when it is not the intention. Important factors for elements to be remarkable are: contrast, colour, form and movement (Anonymus 2002). For motorways, the focus is on several high scale elements without variation. Remarkable elements near motorways with respect to the railway surrounding landscape are: noise- and sight barriers, offices, motels, bridges/tunnels, showrooms, transport companies, storage areas, billboards/advertisement, construction areas. For railways, the focus is on a variety

¹ In Dutch unscientific literature, this is called “schaamgroen”.

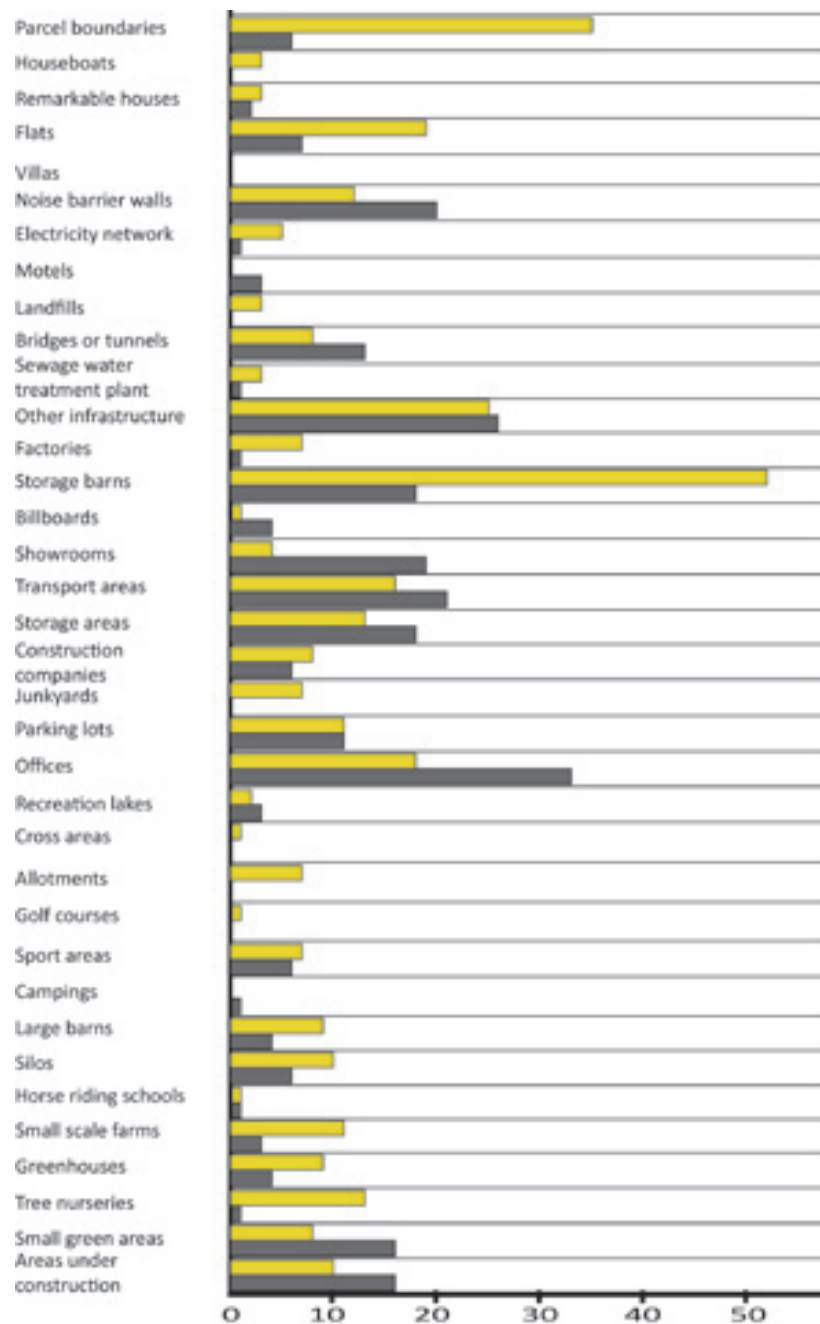


Figure 3.5: Amount of cluttered elements near the railway (yellow) and motorway (grey) between Utrecht and Eindhoven.

of small-scale elements. Remarkable elements near railways with respect to the motorway surrounding landscape are: Fences/railings, gardens, flats, factories, machine sheds, large barns, allotments, silos, greenhouses, plant nurseries^{2,3} (figure 3.5).

Structures:

Due to the confusion about the term structures, first a short definition. A structure is the way on which an entity, in this case the visible landscape from the car and train, is composed (Vroom 2005). This composition is the relationship between functions and elements within the visible landscape (Dijkstra 1985). The functions and elements are described above, but the relation to the landscape has to be explored. The last part of the definition of cluttering: “functions, structures and elements which are not in proportion or coherence with the esteemed image of the landscape on a place” refers also to the relation with the landscape. To compare the landscape with the functions and elements described above, a landscape typology, based on geology, cultural history and geomorphology, is added to the film analysis map. As you can see, the emphasis at the south of ‘s Hertogenbosch is on the sand landscape. This sand landscape consists of several landscape units: the open heath reclamation, open or planted sand dunes, half open coulisse or bocage landscape and brook valleys (Thorpe et al. 1957)(Veldhuis et al 2009). At the north side of ‘s Hertogenbosch, the emphasis is on the river landscape with three main landscape units: levees, open river basin or heavy clay soil and flood plains (Veldhuis et al. 2009). On places where occupation has prevailed over the original landscape, the landscape type occupation is added (see figure 12 on previous page). Based on this map, a table was made with the landscape types on one side and the visible functions on the other side (table 3.2: Functions vs Landscape types). From this table and the map, some

2 Comment: the list of annoying elements is made up by experts, which already has a some annoying elements in mind. In reality, as comes forward from the questionnaire results, some elements of which the expert thinks it is annoying, are mentioned by travellers as a quality. Examples are billboards and bridges.

3 In this part, the differences in landscape is not (yet) taken into account. All elements have the same value in each landscape type.

remarkable relations between these landscape types and the visible functions from the train on one side and the car on the other side, arise:

- There are more noise barriers near motorways, particularly in the non-urban landscape types. Near occupation, the amount of noise barriers is similar.
- Roads and other infrastructure functions in the non-urban area are better visible in the motorway surrounding area.
- Plantings in verges occur in the non-urban landscape types near motorways and in the urban area near railways.
- There are more open view on grassland, in the river landscape near railways. In the sand landscape the motorway is in favour.
- In relation with the first part of this chapter (process and development), the motorway crosses more non-urban landscape types and the railway crosses more occupied area. So the urban area, business areas and housing areas are better visible near railways.
- The most occurring relationships near the motorway are: verge planting in the sand landscape (9,4%), grass in the river basin landscape (9%), noise barriers in urban area (8,8%) verge planting in the river basin landscape (8,8%).
- The most occurring relationships near the railway are: grass in the river basin landscape (12,9%), business areas in the urban area (10,6%) and noise barriers in the urban area (8,7%)

Conclusions of the differences railway-motorway

After comparing the surrounding landscape near railways and motorways, based on the problem of cluttering near both infrastructure networks, some conclusions can be made. As mentioned in the three different aspects of cluttering there are many differences between the cluttering near railways and motorways. As well in the development of the cluttered area, the experience of cluttering, the visibility of functions, the visibility of elements and in the the relationship with the landscape types. Using the definition of cluttering above and the criteria of cluttering by Veeneklaas (Veeneklaas et al. 2006), Boersma (Boersma et al. 2006)

and Frijters (Frijters et al. 2004), the main conclusion is that also near railways, the landscape is in bad shape. The experience of cluttering is even worse near railways than near motorways, where solutions like motorway panoramas are in progress. This conclusion enhance the need for a method and principles to counter cluttering near railways. There is also a bright sight for railways: according to the current views between Utrecht and Eindhoven, there are plenty of opportunities to upgrade and enhance current view on the landscape.

3.6 Gradation of cluttering zones near the alignment Utrecht - Eindhoven

Based on these definitions, cluttered zones on the alignment can not simply pointed out. The problem with this complex term is that all kind of assumptions are necessary to make a gradation in cluttering of the landscape. Veeneklaas (Veeneklaas et al. 2006) counts the number of annoying elements to say whether an landscape is cluttered or not. Because of the tree main aspects in the definition, counting is not that easy. On one side, it is possible to count functions and elements, but when is it not in proportion or coherence with the esteemed image of the landscape on a place? This negative landscape experience depends on the identity of the landscape. At this point, there are some differences with the view on cluttering by Veeneklaas. According to Veeneklaas' report "verrommeling in Nederland", the list of annoying or cluttered elements is similar for each landscape. The list of Veeneklaas is based on new elements which does not show the landscape as it was in 1850 or 1900. For me, also new elements are part of the landscape and can be connected to the landscape. For example, new elements like greenhouses or three nurseries, which are annoying according to Veeneklaas, belong to the landscape on the levee. So in the landscape type levee, greenhouses and three nurseries are not annoying and not pointed out. Particularly the difference between an element in an urban area and the open brook valley is huge. So what is needed is a description of each of the crossing landscape types. This description contains several characteristics for each landscape type (Brinkhuijsen) (Harten, 1986) (Koomen et al. 2007) (Peek et al. 2006) (Linge et al. 2009) (Veldhuis 2009) (appendix 2: characteristics of the landscape types). With this description in mind, the connection between annoying elements and landscape types can

MOTORWAY in %	Under construction	Sound barriers	Business areas	Roads	Housing areas	Green-houses	Plantings	Grass	Water	Total % landscape types
Urban	2,5	8,8	3,8	1,3	0,6	0,0	2,9	0,0	0,0	19,9
Sand: Open heath reclamation	0,4	3,6	1,0	1,9	0,0	0,0	9,4	6,7	0,8	23,8
Sand: Sand dunes	0,0	0,4	0,2	0,0	0,0	0,0	3,1	0,2	0,0	4,0
Sand: Half open coulisse landscape	0,0	0,6	0,4	0,0	0,2	0,0	5,2	1,5	0,0	7,9
Sand: Brook valley	0,0	0,0	0,0	0,2	0,0	0,0	1,5	1,3	0,4	3,3
River: Levee	0,8	3,6	1,0	1,5	0,0	1,0	2,3	2,3	0,4	13,0
River: River basin	0,4	3,1	0,8	1,9	0,2	0,0	8,8	9,0	0,0	24,3
River: Flood plains	0,0	1,0	0,0	0,0	0,4	0,0	0,0	1,0	1,3	3,8
Total % of visible functions	4,2	21,1	7,3	6,7	1,5	1,0	33,3	22,0	2,9	100

RAILWAY in %	Under construction	Sound barriers	Business areas	Roads	Housing areas	Green-houses	Plantings	Grass	Water	Total % landscape types
Urban	2,1	8,7	10,6	1,8	10,6	0,0	5,2	0,7	0,5	40,2
Sand: Open heath reclamation	0,2	0,2	0,7	0,5	0,2	0,0	4,7	3,3	0,0	9,8
Sand: Sand dunes	0,0	0,0	0,0	0,0	0,0	0,0	1,8	0,2	0,0	2
Sand: Half open coulisse landscape	0,0	0,0	0,0	0,0	0,0	0,0	4,7	1,8	0,0	6,5
Sand: Brook valley	0,0	0,2	0,0	0,0	0,0	0,0	0,9	0,9	0,5	2,5
River: Levee	0,5	0,2	1,2	1,8	0,9	0,5	1,2	7,3	0,2	13,8
River: River basin	0,0	0,2	0,0	0,5	0,5	0,0	5,2	12,9	0,5	19,8
River: Flood plains	0,0	0,0	0,0	0,0	0,7	0,0	0,0	2,1	2,1	4,9
Total % of visible functions	2,8	9,5	12,5	4,6	12,9	0,5	23,7	29,2	3,8	100

Table 3.2: View on functions vs landscape types for the motorway and the railway alignment Utrecht - Eindhoven.

be made. As you see, most elements are annoying for all the landscape types, but there are some exceptions (appendix 3: overview of annoying elements). Based on this map, locations of the real annoying elements in different landscape types, can be pointed out. Having analysed the visibility of characteristics and number of annoying elements, it is possible to give a gradation of every second of the view from the train. This gradation is based on the number of annoying elements and the visibility of the landscape type characteristics (figure 3.6) (figure 3.7: cluttering zones near the alignment Utrecht-Eindhoven).

1) Heavily cluttered: Non of the landscape type characteristics are visible and lots of an-

noying elements.

- 2) To some extend cluttered: Some of the landscape type characteristics are visible and several annoying elements.
- 3) Almost no cluttering: Almost all landscape type characteristics and almost none annoying elements are visible.
- 4) No cluttering: all landscape type characteristics are visible and there are no annoying elements visible or the landscape type is unique.

There are some remarkable things to mention about this cluttering gradation map. First, most of the heavily cluttered areas are in the urban areas. Most of the areas which can be called “to some extent cluttered”, occur near city edges and in the urban rural transition zone. The areas with almost no cluttering, occur in the rural areas between villages and cities, but there are some exceptions to this empirical law. The rural area between Utrecht and Houten or between ‘s Hertogenbosch and Vught for example, is more cluttered compared with other rural areas. A remarkable comparison with question 12 for the questionnai-

re, is that 51 % of the respondents say that most of the ugly views are between Boxtel and Eindhoven. Only 3 % of the respondents thinks most of the ugly views are between ‘s Hertogenbosch and Culemborg. Looking at the map, the difference is not so clear. What has to be kept in mind is that the parts of the alignment with open rural views and bridges is best scaled by the respondents. Worst scaled is the area Best-Eindhoven and Utrecht-Houten.



Figure 3.6: impression of the gradation of cluttering.

Looking at the annoying elements, most of them are visible in the city edges and urban-rural transition zones. Because of noise barrier walls, annoying elements are not in the cities itself. Particularly in the half-open coulisse landscape and the open river basin, there are almost no annoying elements visible, which not means that the landscape characteristics are highly visible. According to question 11 of the questionnaire, elements which are experienced as annoying are: noise barriers and elements which belongs to business, industrial areas urban areas. The location of these elements corresponds to the locations of the annoying elements in the map.

Later in this thesis, a design will be made for a location which deals with cluttering, using the principles to counter cluttering. The choice of this location depends on the gradation. It should be an area which badly gradated, category 1 or 2. Also the opinion of the traveller will be taken into account, using the answers mentioned in the questionnaire. Several areas near the alignment which ask for a design to counter cluttering are:

- Utrecht-Houten: At this locations, there are no urban extensions planned, but because the alignment crosses two motorways in the urban rural transition zone, the landscape is fragmented and experienced as cluttered. The original open landscape and historical structures like the “Nieuwe Hollandse Waterlinie” are not visible at all.
- Zaltbommel-east: Because of an extension of business area “De Wildeman” at the east side of Zaltbommel, the experience of the river landscape is disappearing. The current solution for this business area is hiding it by using plantings and only showing one large wall of abusiness area backside. Are there, with help of the principles, no other solutions which shows the landscape?
- ‘s Hertogenbosch-Vught: Instead of using the opportunities of the area, the hard city edge of ‘s Hertogenbosch, the entrance, the city-silhouette, the open “Bossche Broek” in the east and the open polder “Honderd Morgen” in the west, noise barriers are placed and ‘s Hertogenbosch and Vught are growing towards each other.

- Best-Eindhoven: Large scale motorway changes ensure that business areas extend and partly due to other recreational functions like golf courts and lakes, the characteristics of the sand landscape at the entrance of north Eindhoven are not visible. An good example can be taken to the motorway A2, west of the railway, where the characteristics are visible. In this case, the question arise: how to combine motorway panoramas and railway panoramas.
- Best north: According to the gradation on the map, this area is not heavily cluttered and a lot of typical landscape characteristics are visible. The reason why in this area a design is needed, is because there are 3400 new houses planned between Best, Aarle and the motorway A2. Within this huge urban extension, there is one line which crosses it: the railway (Gemeente Best 2010).
- Geldermalsen: In the area between the crossing with the Betuweline and the Linge, the main problem is that the landscape characteristics of the river landscape, inparticular in the Linge or Betuwe identity, is not visible.

For the design later in this thesis (chapter X), the area in the east of Zaltbommel will be designed in more detail on a smaller scale. Because of the future plans of the larges business area extension near the railway alignment: the Wildeman, 122 hectares, and the challenge to show the characteristics of the river landscape (SVP 2003) (Anonymus 2004) (Gemeente Zaltbommel 2010). The goal of this design is to see to what level the principles to improve panorama locations, are also applicable to places which deals with cluttering.



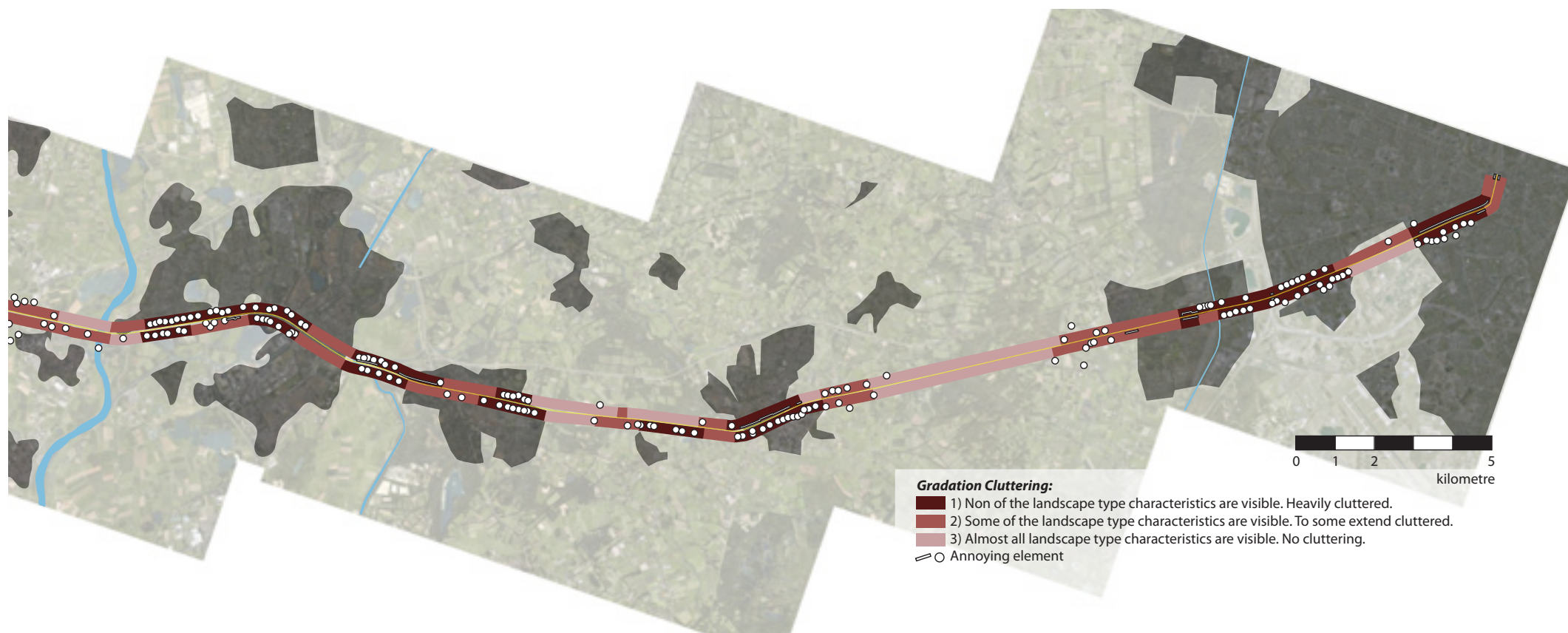


Figure 3.7: cluttering zones near the alignment Utrecht-Eindhoven



CHAPTER 4: RAILWAY PANORAMA METHOD

Thinking about the method and criteria to indicate or create railway panoramas, a first remark has to be made based on a quote from the method of motorway panoramas by Piek (Piek et al. 2006). “45% of the total length of the motorway network has a view. An important criteria for creating a motorway panorama is that the problem of landscape cluttering occurs.” A starting point where this research is fully consistent. There is doubt about next step Piek made: “Only half of the total 1.753 views near motorways are threatened by urban plans.” The analysis towards cluttering shows that cluttering is not only the threat of urban plans, which is the development part, but also the experience, elements, functions and structures has to be taken into account. As shown in the analysis and goals, these aspects are all connected to the characteristics and qualities of landscape types. In this chapter, a method is drawn to indicate railway panoramas based on the problem of cluttering as described in chapter 3.

To start, there are a five categories of panorama views on landscapes (Piek et al. 2006):

- I) The first category consists of unique views on unique landscapes, which only exists once, like the view from the motorway on the Afsluitdijk.
- II) The second category consists of views on a landscape with a high variety.
- III) The third category consists of views where the change between landscape types makes it special, for example the urban railway entrance of Nijmegen in the north.
- IV) The fourth category consists of views which are special because of their context. For example an huge open grassland within a closed urban area.
- V) Finally, the most important category when looking at the problem of cluttering: the view on landscapes that are more common, but witch characteristics are visible and not many annoying elements are present.

The method in this research, which is based on the problem of cluttering, focuses on the quest for this last category of views.

4.1 Method and criteria

The method to indicate panorama locations on an alignment can be done in several steps (Piek et al. 2006) (Jonge et al. 2008):

Step 1) Defining the visibility of the landscape from the train.

As mentioned in the context chapter, a view can be a panorama when the landscape is legible and has the experience of an open landscape from the railway. The landscape characteristics need to be clear visible within the space and its boundaries of the open view. There are two different methods to show this visibility. For both methods, the visibility angle for train travellers is from 40 to 140 degrees (Piek et al. 2006) (figure 4.1).

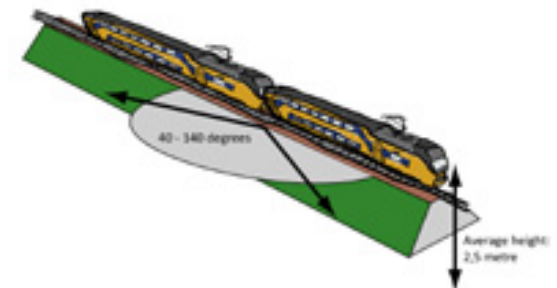


Figure 4.1: visibility angle.

- The first method is based on the distance between the observer and the boundaries of the open view (Staats 1988). Houben (Mecannoo) was the first who used this method for motorways in “Research Road Atlas, Holland Avenue 2030” (Houben 2002). To measure the reach of the view towards the nearest boundaries over an entire alignment, an film analysis is useful. After analyzing the film - what are the boundaries and on which distance - a line can be drawn near the boundaries of the view (figure 17). The advantage of this method is that it is easy to do without knowledge of GIS programs because it is based on reality and not a 3 dimensional landscape. Based on the objective, to find locations which can be a panorama, another advantage is that looking at the end result for an entire alignment, it is clarifying and not too complicated where the locations are. The third advantage is that the result is best useful to measure distances for the criteria in this step. A disadvantage is that the quality of the analysis depends on the quality of the film and the landscape on

particularly moment. Another disadvantage is that it is less useful on a small scale compared with the other method. The third disadvantage is that the effects on the visibility of adaptations in the landscape must be speculated and can not be measured beforehand (see map in previous chapter: x).

- Within the second method, time is also taken into account. Although it is hard to measure for all the railways in the Netherlands, the time of which an element is visible is also important. It is possible to measure this time and draw a map with the information. For this map, several things has to be combined using GIS (viewshed). First, the visible field from one point has to made clear in 3D. A general height has to be given to al physical elements on the topographical map, for example: 7 meter for all buildings and 15 meter for forest. This has to be combined with the heights of AHN and a general height of the viewer (which is 2,5 meter). After having clear the 3 dimensional landscape, the entire map has to be divided in a grid. The size of this grid depends on the scale of the map. The computer can calculate which parts of the grid are visible. Depending on the train speed, this calculation can be made for each second. The sum of the seconds a grid is visible, can be categorized by colour (figure 4.2). This method is used in most of the reports concerning motorway panoramas (Piek et al. 2006) (Anonymus 2008). The advantage of this method is that the computer can make the calculations, instead of a manual film analysis. Also the effects of landscape adaptations to view can be calculated very easy. The main disadvantage is that this method is complicated for the overview of an entire alignment, with its possible panorama locations. Only on a small scale, with a small scale grid, this method is useful to analyse a panorama view in detail. Another disadvantage is that values, like the height of the railway, are fixed. According to the film analysis, it is a huge difference whether the view is on ground level of from a bridge.

For this thesis, the first method is used because I do not have the knowledge of GIS programs to come to a map explained in the second method. The fist method is sufficient

because when searching for the best locations, the several measurements in the criteria below, which are needed to come to panorama locations, can be gathered using the fist method. Finally the argument that reality, or the film, shows a different landscape that a 3 dimensional computer model, is another reason to use the first method. From this map, there are two criteria where the panorama locations should meet.

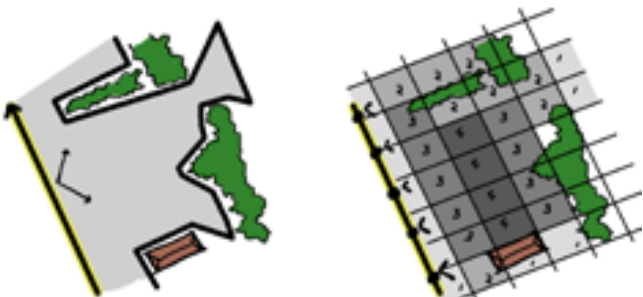


Figure 4.2: method 1 left and method 2 right

Landscape type	Minimal length
River landscape	1350 m
Sand landscape	1430 m
Urban	765 m

Tabel 4.1: panorama length.

Criteria a) This is the criteria for the minimal length of a panorama (table 4.1). The length of the composition of open views is different for each landscape type. The table above is based on the minimal length of motorway panoramas, calculated with the train speed ¹ (Piek et al. 2006).

Criteria b) The criteria for the minimum distance, parallel to the railway, from the railway to the boundary of a view to be a panorama is 500 meters. This number is derived from the fact that around 90 percent of the visible part of the landscape is within 500 meters ² (Piek et al. 2006). Its value of this limit depends on two things:

1 In this thesis, the train speed used in calculations is 150 km/h. which is the average of the high speed train DD-IRM: max 160 km/h and the slow speed train Mat '64: max 140 km/h (source: NS). Important to mention is that the maximum speed is only reached in-between cities without stops, so the estimated speed depends on the location of the train.
2 A visibility of round 90 percent is based on an photo analysis by Piek (2006)

1) The height of the railway: a visibility of 90% of the landscape is measured with a rail on ground level. You need more than 500 meters to see 90 percent of the landscape within views from a railway on a higher level in open landscapes (700m) or on a bridge over a river (>1000m) ³. After this distance, landscape elements are not longer separate visible, but only its contours, of which you can not see which element is in front of another. 2) One of the characteristics of a landscape type is the openness. The value of this number is different in an open landscape type than in a closed landscape type.

Step 2) Is the problem of cluttering applicable to the view?

As mentioned in the introduction of this chapter, according to Piek only half of all views can become a panorama because the problem of cluttering has to be there. The difficulty with cluttering is that it is not possible to draw a line between cluttered and not cluttered. But cluttering is the main cause to come up with panoramas and all goals are based on the problem of cluttering.

The first thing to do in this step is looking at the gradation of cluttering within the visible railway surrounding landscape. This can be done by drawing a map with the visibility of landscape characteristics and annoying elements, as done in the first chapter. Again, the gradation is as followed:

- 1) Heavily cluttered: none of the landscape type characteristics are visible and lots of annoying elements.
- 2) To some extent cluttered: some of the landscape type characteristics are visible and several annoying elements.
- 3) Almost no cluttering: almost all landscape type characteristics and almost none annoying elements are visible.
- 4) No cluttering: all landscape type characteristics are visible and there are no annoying

³ Measured with own film analysis near Schalwijk and the bridge over the Lek near Culemborg.

elements visible or the landscape type is unique.

Before going to the criteria for the location selection, also future plans have to be taken into account. Looking at the plans on “De Nieuwe Kaart” (NIROV, 2010), new annoying elements and functions are drawn and the view on characteristics can be changed. Also the problem of corridor development in the future, which is part of cluttering, is visible in when you look at “De Nieuwe Kaart”. So the task within this step is to include future plans within the map about cluttering.

Criteria c) A view can only be a panorama when the gradation is two or three. Views which are in the fourth category, like the Afsluitdijk and the Veluwe, are unique and already a famous panorama. Views which are in the first category do not have the potential to become a panorama because none of the landscape characteristics are visible. It is also desirable to choose locations which are treated by future plans.

Step 3) Detailed analysis.

For further planning and design with the remaining views, the visible characteristics must be described. When mapping the cluttered areas near the alignment in the previous step, the landscape types, units and its characteristics have to be explored already. For this step, a landscape analysis for the remaining potential panoramas is needed in more detail, using the following criteria:

Criteria d) A description of the characteristics of the landscape type in which the view is located. Make clear for each landscape type (for an example: see appendix x):

- Relief
- Geomorphologic elements and patterns

- *Land use*
- *Type of parcellation*
- *Pattern of ditches*
- *Urban characteristics and the transition zone between urban and rural.*
- *Historical elements (points, lines and planes)*
- *Openness*

Criteria e) Map the boundaries and entrances of the view. Do they show the characteristics of the landscape type or not? Do the boundaries consist of functions mentioned in the characteristics (for example greenhouses, plantings or ribbon villages) or do they consist of other non-landscape bound functions (for example business areas, areas under construction or infrastructure).

Criteria f) Map other remarkable elements. This can be landscape bound landmarks like churches, mills, dikes and historical farms. It can also consist of non landscape bound landmarks like historical defence lines or channels, which crosses the borders of landscape types.

Criteria g) Look at other large scale connections which cross the alignment like the core areas and its connection zones within the ecological main structure or EHS (LNV 2010).

Step 4) Use the panorama principles to upgrade panoramas

The last step is to look at the railway panorama principles. Try to use the 7 principles to upgrade the panorama. These principles will be discussed in the next chapter.

Application of the method on the alignment Utrecht – Eindhoven

The steps and criteria in this chapter to come to some railway panoramas, can be applied

to the alignment which is used in this thesis: the railway between Utrecht and Eindhoven. In figure 4.3, the 4 steps are followed which results in some potential railway panorama locations.

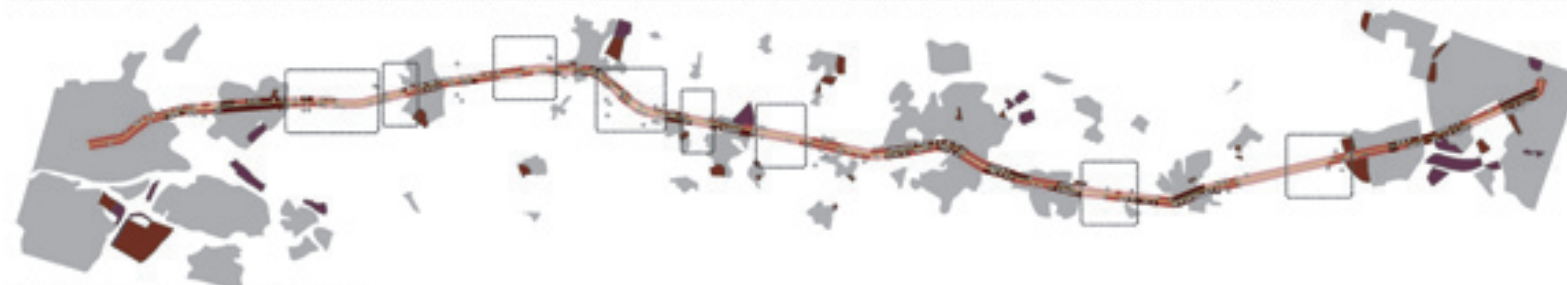
For a design later in this thesis (chapter 6), one of these eight possible railway panoramas will be chosen to design on a lower scale level with help of the railway panorama principles. In the selection of motorway panoramas, only the openness of the peat and river landscape is used for panoramas (see comments on motorway panoramas). According to the objective in this thesis, to counter cluttering, the landscape characteristics of all landscape types must be shown by using different principles in different landscape types. That it is why it is interesting to choose a part of the alignment surrounding area in an landscape that is not yet mentioned before in the panorama method. A panorama like the brook valley of the Essche stream in the sand landscape between Vught and Boxtel is very useful because in the questionnaire, it is mentioned a lot as a beautiful part of the alignment (question number 10) (Essche stroom beweging, 2010). Looking at the cluttering map and the questionnaire (question number 6 and 12), it also asks for an upgrading design because there is no awareness of a brook valley on that place.



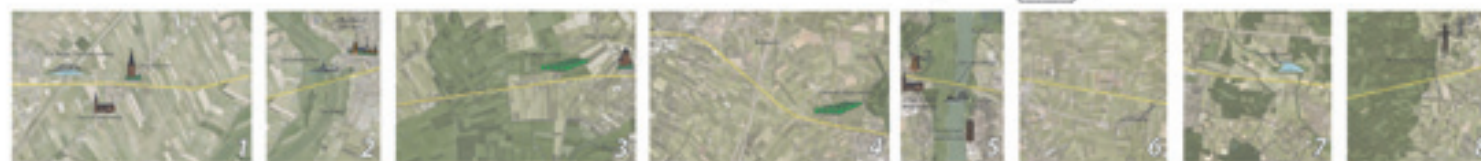
START: Alignment and visibility map



STEP 1: Range and length of views



STEP 2: Gradation cluttering and future plans



STEP 3: Up: Landscape characteristics (appendix 2), boundaries,
Down: landmarks, EHS

Figure 4.3: Panorama location in steps
on the alignment Utrecht-Eindhoven.

4.2 Consequences and policy

The main criteria for the selection of motorway panoramas was: 1) a large visible open view from the road and 2) the treat by urban development (Piek et al. 2006). Looking at the consequence for making it a panorama, restrictions for urban development are applied on the panorama locations. On this abstract level, it looks like these areas are only renamed to counter current urban development which is already drawn on the “Nieuwe Kaart”. In reality the consequences for making a view a panorama, also includes other aspects. The main aspect to focus on for the railway panorama method, and also for the motorway panorama method, is that the goal is not to resist against urban development but to maintain and strengthen the landscape characteristics, which is also one of the main goals for the principles (Jonge et al. 2008). But the question is how to reach this goal in policy?

None of the provinces are in favour of a separated planning policy for panorama areas (Jonge et al. 2008). For them, the panorama policy is similar as the policy for the National Landscape areas, which also are focused on the maintenance of landscape characteristics, like openness (Jonge et al. 2008). Table 4.2 shows the involved actors and their means, when using the panorama method. In the panorama areas, where it is not the intention to lock all spatial planning, the “yes-under the condition that”⁴ approach applies here (Beemer et al. 2007). This means that spatial development is possible under the condition that the landscape characteristics are maintained and improved. How this is possible in reality depends on the panorama area and the landscape characteristics. So for each panorama area there is a different planning task, using the “yes-under the condition that” approach (Jonge et al. 2008). The use of the “yes-under the condition that” approach result in vitality of rural areas, where spatial development is possible under the condition of good landscape management, which is necessary to maintain landscape characteristics (Jonge et al. 2008). For this approach there are lots of spatial developments which are included. To analyse the spatial developments within a panorama, there are several groups

⁴ In Dutch, this is called the *ja-mits-afwegingskader*.

(Beemer et al. 2007): urban development - like new residential areas or compact ribbon development -, business areas, non-agricultural development, agricultural development, agricultural activities or changes, natural barriers, spatial elements, infrastructure and the ecological main structure. Within these developments, different aspects are important:

- What are boundaries of the panorama area which influences the view? For this aspect, developments parallel to the rail have the same impact but for developments perpendicular to the rail it is different. In within these developments, things like distance, height, colour and so on play a role (Jonge et al. 2008). Because of these differences, it is not fair to draw a straight line for the panorama borders.
- They can be divided in acute, short term and long term developments (Beemer et al. 2007). Acute developments, are things like the construction of a shed or the felling of a tree. Short term examples of development are the construction of a residential area or a noise barrier wall. An example of a long term example is the expansion and compaction of ribbon villages.
- There are always influences from outside which can influence a panorama view.
- Which instruments do policy have on different levels? The scheme in appendix X gives an idea which instruments are useful for the panorama areas on the different political scales (Jonge et al. 2008) ⁵.

⁵ There is no right translation for “*beeldkwaliteitsplan*”. According to the government, “*beeldkwaliteit*” is defined as: all aspects which influence the conceivability and experience of the spatial environment. So a “*beeldkwaliteitsplan*” are guidelines, recommendations and intentions to secure, create or enhance the “*beeldkwaliteit*” of an area. MIRT means in Dutch: *Meerjarenprogramma Infrastructuur, Ruimte and Transport (MIRT)* and ILG means in Dutch *Investeringsbudget Landelijk Gebied (ILG)*.

	Municipality	Provincial	National
Policy	<ul style="list-style-type: none"> - Gebiedsvisie (vision National Landscape) - Structuurvisie (municipal development vision) - Bestemmingsplan (zoning plan) - Landscape development plan - Welstandnota (urban aesthetics note) - Beeldkwaliteitsplan (Havik et al. 1997) 	<ul style="list-style-type: none"> - Structuurvisies (development plans, Nationale Landscape) - Policy for “beeldkwaliteit” and “landschapschoon” 	<ul style="list-style-type: none"> - Development plan Railwayen-vironment (like development plan motorway environment) - Architectonic specificatons alignment design - MIRT
Implementation	<ul style="list-style-type: none"> - Implementation of landscape projects - Residential and business areas 	<ul style="list-style-type: none"> - Implementation programme National Landscape - Incentives (beeldkwaliteit, landscape) 	<ul style="list-style-type: none"> - Implementati- ons alignment design
Financial	<ul style="list-style-type: none"> - Contribute or create gebieds- or regiofondos - Red-for-green-solutions - Local projects 	<ul style="list-style-type: none"> - ILG - National Landscape 	<ul style="list-style-type: none"> - Funds, Mooi Nederland - Incentives
Communicati- ons, knowledge	<ul style="list-style-type: none"> - Stimulate partners - Support for National Lands- cape 	<ul style="list-style-type: none"> - Publish knowledge about National Lands- capes - Quality team and design workshops 	<ul style="list-style-type: none"> - Reconciliation of policy on dif- ferent levels - Guideline align- ment design - Government advisors.

Table 4.2: Actors and means.



CHAPTER 5: RAILWAY PANORAMA PRINCIPLES

5.1 The development of railways

The first motorway designers were railway men, who learned their trade when grades were flat and alignments straight in the nineteenth century. In this time, the landscape was an obstacle to overcome and cost, power, and safety were questions far too urgent to allow though for looks (Appleyard 1966). In the Netherlands, the first railway alignment was between Amsterdam and Haarlem in 1839. Since 1839, there was an expansion of railways in the Netherlands. After the second world war, the number of railway alignments decreased. The last decades, only a few new alignments were constructed - like the Zoetermeerline, Flevoline, HSL South, Betuweline - and rails are only doubled on most alignments (Norg 2005) (figure 5.1). The entire railway network, with a total length of 6550 kilometres and 388 stations, is maintained by ProRail.

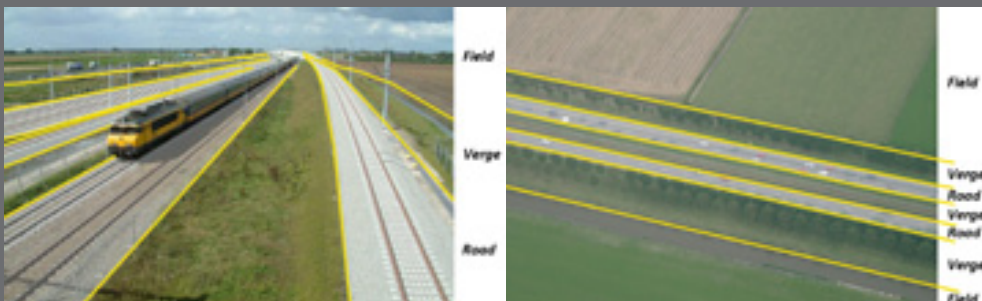
5.2 Infrastructure design vs. landscape

For this thesis, it is interesting to look at the connection between infrastructure design and landscape in more detail. Looking at this connection of infrastructure, there is a huge difference between the relation motorway-landscape and railway-landscape. For both, the landscape near infrastructure can be split up in the road or technical zone, the verge or transition zone and the field (figure 5.2) (Houben 2002) (Warmerdam 1996). Although the focus of this thesis is on the verge and field and less on the rail itself or the location of the alignment, it is necessary to keep in mind all these three aspects of the infrastructure landscape (Piek 2006). Before explaining the vision, goals and principles, it is good to look at examples of existing ideas and plans within the connection between landscape and infrastructure (table 5.1).



Figure 5.1: The development of the Dutch railway network.

Figure 5.2: The road, verge and field for railways (left) and motorways (right).



	Motorway	Railway
The road / rail or technical zone	<ul style="list-style-type: none"> - In the design of the height of the road, openness of the landscape is taken into account: road on ground level, higher level or lower level. Even the height of one direction can differ from the other (A50 Renkum, A4). - While designing the alignment and bend radius of the road, landscape characteristics are taken into account. For example: lots of arches on the sand grounds (A50 Veghel) and straight roads in open polders are based on landmarks (A6 Oostvaardersplassen). - Coherence in road furniture like signs, guardrails, fences and lighting columns (A12, Rainbow-route) (Weebers 2006). 	<ul style="list-style-type: none"> - The focus is on the experience from the landscape towards the railway furniture, using the coherence and architecture of things like catenary masts, maintenance entrances, viaduct deck, fences etcetera (HSL, Warmerdam 1996). - When designing renewal or renovation of stations, the coherence and landscape within an alignment is taken into account (stations Barendrecht, Dronten, Kampen). - Visibility and influence of the rail on the environment is decreased by moving down the rail or using tunnels (Tunnel Best, Betuwelijn, Botlektunnel Groene Hart-tunnel and HSL).
The verge or transition zone	<ul style="list-style-type: none"> - The use of landscape bound plantings and patterns in verges (A28 Dwingeloo). - The use of characteristic water patterns in verges. - Coherence in architecture of noise barrier walls and security screens within an alignment, with a connection to the landscape (A2, A12). - Service areas are fit into the environment (Vossedal A2). - A connection with the identity of the landscape is made in the designs of viaducts and aqueducts (A12, Gouwe aqueduct, A50 Veghel) 	<ul style="list-style-type: none"> - The use of landscape bound plantings and patterns in verges (Iepenlaan, Betuwelijn Zevenaar, HSL). - Reduce the number of service buildings for security, electricity and communication by combining them (Hanzelijn). - Coherence in architecture of noise barrier walls, bridges and road viaducts within an alignment, with a connection to the landscape (Hanzelijn) (Anonymus 2009), using elements like bridge columns, land abutments, wildlife passages, retaining walls etcetera (Warmerdam 1996).
The field	<ul style="list-style-type: none"> - Before designing the road, the differences between crossing landscape types are described so that the road is different in each landscape type (A12, A4, A50). - Landmarks, old and new ones, and city-silhouettes are taken into account when designing a new road (A50). - The indication of motorway panoramas (A1, A7, A12, A4, A5, A2, A28). 	<ul style="list-style-type: none"> - The railway creates lots of unusable pieces of land which become nature, to increase the legibility of the landscape (Warmerdam 1996) (Drijver 2005). - Within a design, the most important thing is the minimal influence of the rail to the environment and the maximal use of the railway for nature development (Hanzelijn, Drijver 2005) (HSL, Warmerdam 1996).

Table 5.1: Differences between motorway design railway design

The main difference between the connection motorway-landscape and railway-landscape is that the landscape is part of the motorway design - landmarks, panoramas etc. - and that railway design focus on the minimal influence of the rail to the landscape. In other words, for motorways design, the focus is on the experience of the landscape from the motorway. For railways, the focus is on the experience of the railway from the landscape. The railway focus is on not on the landscape that people experience while sitting in the train, like landscape legibility, but on the experience of the railway itself for people in the landscape, like bridges. A good example is the HSL railway line. The main goal is as followed: "The integration focuses on preventing the disruption and preserve the original landscape identity" (Warmerdam 1996). So reducing distortion is the main goal for the design of the HSL, with subgoals: reducing space, limiting railway as a barrier, connect and strengthen the characteristic of the cross-sectional area, create a specific design in which the character of the HSL is expressed with adoption of transparent materials and slender structures (Warmerdam 1996). From this it is possible to say that the landscape is subordinate to the motorway and railway is subordinate to the landscape. Some other examples can be mentioned:

- The maintainability of the rail and furniture is most important (Drijver 2005).
- Some of the keywords for railway design in connection to the landscape are transparency, compactness and bundling (Warmerdam 1996).
- The height of the rail and its foundation depends on security and not on aspects dealing with the surrounding landscape (Drijver 2005).
- The focus on coherence within an alignment for the view from the window is on and near stations (Sporbouwmeester 2010) (Drijver 2005).
- Railway alignment designers are aware of open landscape views (or panoramas), but they do not make adaptations in the landscape to strengthen them (Drijver 2005).

5.3 Railway design and the principles

The next step is the question what the railway panorama principles can add to the railway design, and the design of the surrounding landscape. The goals for the implementation of a railway in the landscape are based on the adaptations to the railway which are best for the experience from landscape, like the HSL. What is missing, is the inverse: the adaptations to the landscape which are best for the experience from the railway (figure 5.3).

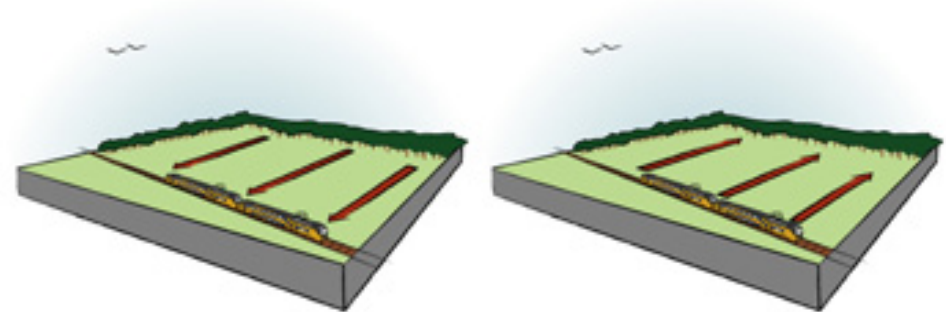


Figure 5.3:
Left: railway design is focussed the experience of the railway from the landscape. Right: the railway panorama principles are focussed on the experience of the landscape from the railway.

An example: showing the characteristics of the landscape is a goal for railway design and railway panorama design. The difference is the way how to reach this goal: for railway design an idea is that the materials of tunnels fits in the current landscape. For railway panorama design, the materials of a business area near the railway are more important, because a business area is beter visible for railway travellers than the outside of a tunnel.

5.4 Vision

The selection of principles comes forward from some goals. Of course, the main goal is to counter the experience of cluttering of the railway surrounding landscape, but more goals are needed to come to some clear design principles and possible adaptations in the landscape. This personal vision explains the main goals later on.

An important aspect of the perspective of this thesis research is the focus on train users and their experience of the landscape from behind the train window. This is different from the way landscape architects experience the view from behind the window. So this vision is based on the questionnaires (appendix 1) (Commentuijn et al. 2010) and the starting points of the motorway panorama method. Looking at principles for the railway panorama method, new railway specific topics and common topics within landscape architecture come in. These are necessary because when the focus is only on the experience of the railway traveller, it is hard to give professional comments to improve views. For example: according to the questionnaires, the attractiveness of a view depends on the amount of forest because the validation for the landscape type “forest” is higher than for “meadow” or “mosaic” and much higher than for type “urban” (Commentuijn et al. 2010). But the solution to counter cluttering using the panorama method is not changing all verges into forest. On the contrary, the vision within this thesis towards the design of the railway surrounding landscape is to show and enhance the differences between the landscape types in the Netherlands. Looking at the motorway panorama method, the existing nine national motorway panoramas the focus is on the characteristic open rural landscape in “Het Groene Hart” (figure 1.5, motorway panorama locations). Also in the landscapes with more green elements, like the mosaic landscape, the problem of cluttering occurs as described in chapter three. So why focussing on only wide open areas while the travellers think the closed green areas are attractive too. It is not the intention for the principles to focus on upgrading only one or several landscape types, but to show the differences between them by strengthen the contrasts and transitions between landscape types.

5.5 Goals

As said in the vision, the main goal for the railway panorama principles is to counter the experience of cluttering of the railway surrounding landscape¹. This can be done on three ways:

- 1) Prevent new cluttering zones, like new business areas near the railway.
- 2) Clean up current cluttering zones where characteristics of the landscape are not visible or annoying elements dominate the landscape.
- 3) Create or upgrade potential railway panorama views, so that each alignment has several highlights.

Based on this main goal, on the way this could be done and on the earlier research in this thesis, the next goals for the principles came up.

- To increase the legibility of the landscape: clean up cluttered gradual urban-rural transitions zones, show characteristics, strengthen contrasts on several scales and show the front of the landscape instead of the backside.
- To maintain and strengthen the experience of an open landscape from the railway using views that reach further than closed verges.
- To create visual uniformity of railway furniture², attractiveness of rhythm and size of elements, strengthen the visibility of landmarks³.

1 The goals and principles are focused on the main objective to counter the experience of cluttering. Other principles are not included. Two examples of principles which are not included are:

- Railwind is an idea of ProRail and Envelop Eneco, to put wind turbines on top of the railway alignment to create sustainable energy.

- Based on trains outside the Netherlands, an idea is to create a landscape train compartment. This principle is a combination of ideas from other trains in other countries can lead to new train classification: like larger windows (Glacier Express, Switzerland and Rocky Mountaineer, Canada) and the orientation of seats (Sunset Limited, USA). For pictures of these trains, look at the book of Kers, Bouwman and Bouman (2007).

2 Railway furniture, in Dutch “meubilering”, are all elements on, in or near the railway which do not belong to the constituent elements of the rail itself.

3 For this thesis, there is no time for an analysis to landmarks in detail. For the creation of principle about landmarks, some basic literature about landmarks in relation to infrastructure is used. The starting point is the current number and type of landmarks on the study-alignment, based on the film analysis and the questionnaire.

5.6 Seven design principles

Based on these goals, 7 principles are designed, dealing with legibility, verges, size, fronts, landmarks, rhythm, furniture. For each principle, a list of possible adaptations in the landscape and/or some design ideas are added. These adaptations and design ideas are based on motorway panoramas, the questionnaire, the analysis of cluttering, the film analysis and literature (Anonymus 2003) (Anonymus 2008) (Appleyard et al. 1966) (Beemer et al. 2009) (Berg 2004) (Boekhorst et al. 1986) (Boselie 1991) (Drijver 2005) (Hendriks et al. 2003) (Houben 2002) (Huls 1991) (Kers et al. 2007) (Kamphuis et al. 2004) (Kaplan 1975) (Loidl 2003) (Lynch 1984) (Neufert 2002) (Piek et al. 2006) (Schöne et al. 1997) (Spoor-bouwmeester 2010) (Veldhuis et al. 2009) (Vlonk 2008) (Warmerdam 1996) (Wildervanck 1988) (Williamson 1982) (Winden 1991).

1.7 Use of the principles

The list of principles has to be easy to read and to use. A list of dozens of principles for each landscape type is not easy to use. That is why only seven main principles are created, each with its own possible adaptations in the landscape and design ideas. The choice how to use a principle and which adaptations are necessary depends on the landscape type and the creativity of the landscape designer. It is not needed that each place has to deal with an enormous amount of rules and principles. It is better that a designer can choose from some good landscape adaptations or design ideas. Of course, the type of landscape (appendix 2) has to be the leading factor for designers to choose. That is why behind each adaptations or design idea, which is as a little drawing, there is a reference to the landscape type to which it is applicable. For this thesis only the two landscape type and landscape units which occurs on the alignment Utrecht-Eindhoven are used.

- a) Urban landscape
- b) Sand landscape: open heath reclamation
- c) Sand landscape: sand dunes
- d) Sand landscape: half open coulisse, mosaic landscape
- e) Sand landscape: brook valley

f) River landscape: levee

g) River landscape: river basin

h) River landscape: flood plains

The way of using these principles is as followed. Examples will be given in the chapter 6.

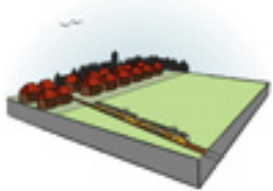
- Hierarchy: start with principle number one and end with principle number seven.
- On top of the page, the principle is shortly described in one sentence.
- In small birds-eye view perspective drawings, some adaptations to the landscape and design ideas are given. The number and hierarchy of these drawings depends on the principle.
- Finally, some examples are given at the end of each page.

5.8 Motorway principles versus railway principles

Looking at these seven design principles for the railway surrounding landscape, there are some differences compared with the motorway surrounding area. A conclusion from chapter 3 was that the the type of cluttering is different and cluttering near railways is even worse than near motorways. The result is that design principles are different to tackle both types of cluttering. The focus for motorway panorama design principles is, indirectly, on things like openness, sight locations, similarity and intensity of business areas, utility areas, green areas and deals with elements like noise barriers, offices, showrooms and other infrastructure etcetera (Houben 2002)(Piek et al. 2006). Particularly ensuring that the open areas stay open in the future is an important point. For railways this is different. For example, because the development of railways was earlier than motorways, the railway crosses more urban area. These and the other things mentioned in chapter 3, leads to design principles that are more focussed on the size, small scale, rhythm, backsides, variety of housing areas, industrial areas, business areas, recreational areas and deals with elements like fences, gardens, flats, sheds etcetera. Of course, there is some overlap when comparing both infrastructure networks. There are principles that are visible in both principle boxes, like verges or furniture, both elaborated in a different way.

1 LEGIBILITY

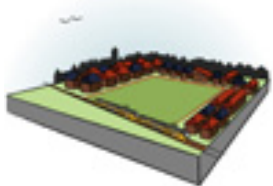
Urban - rural contrasts and entrances



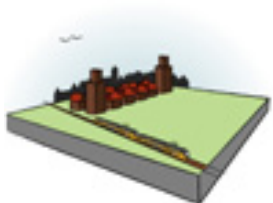
(All): Create clear city edges and urban entrances by designing (new) hard city edges or by cleaning up gradual urban-rural transition zones.



(a,b,d,e,f,g): Locate new urban extensions on landscape type specific places to enhance the cultural historical legibility. For example, new buildings in the river landscape should be build on the levees and not in the flood plains.



(a): Create hard edges to show open closed contrasts within the urban landscape.



(a): Mark transitions. For example by making clear the urban borders and entrances with a landmark.

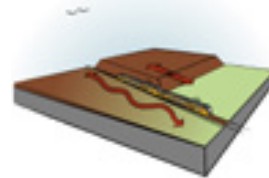
Principle 1: legibility

Increase the legibility of the landscape, by strengthen contrasts on several scales, using edges, entrances and characteristics.

Treat the scales in the following hierarchy:

- 1) Strengthen urban-rural contrasts and create urban entrances.
- 2) Be aware of different transitions between landscape types.
- 3) Show the (differences between) characteristics of landscape units within a landscape type.

Landscape types



Make different transitions between landscape types visible by choosing on of these transitions:

- Make clear gradual transition by showing both characteristics (for example river landscape - sea landscape)
- Strengthen hard transition as entrances of a landscape type (for example river landscape - sand landscape with ice pushed moraines).



Urban-rural transition.



Transition foodplain landscape and levee landscape.

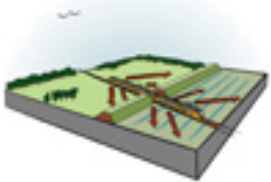


Urban border with landmark.

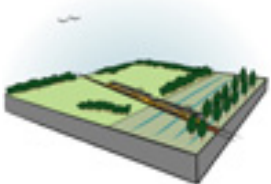
Show the characteristics of landscape units



(c,d,e,f,h): Create hard edges in the rural area to show open-closed contrasts between landscapes. For example the edges of a brook valley.



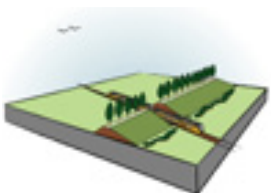
(All): Narrow views down at visible barriers like dikes, ribbon villages, lanes or infrastructure crossings and start with a new view in a new landscape.



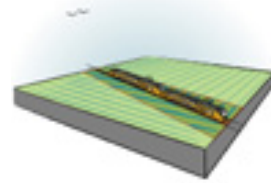
(All): For plants which are visible from the train, use landscape-bound species and patterns; in groups, in lanes or solitaire trees.



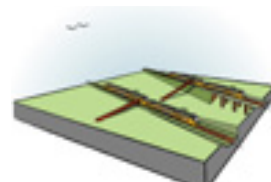
(All): Care for continuity of landscape characteristic lines - like dikes, brooks and old lanes - by making the railway subordinate to these lines. Strengthen these lines with new elements and, if possible, improve the ecological and recreational value.



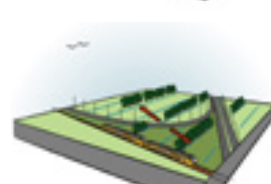
(c,d,e,f,h): Show existing reliefs within the view from the train. For example: strengthen reliefs by using vegetation on different height levels and show slopes by using different vegetation or (land-) art.



(b,d,e,f,g): Use the characteristic ditches pattern in verges as close as possible to the rail. Use the orientation on the parcel pattern for example to steer views towards landmarks.



(All): To show openness and to decrease the effect of the railway on the environment, the height of the rail should be as low as possible (keep in mind technical requirements). Place the rail lower or higher than ground level when the continuity of the landscape is more important than the view from the train (higher: a wider view on special places or in urban areas).



(b,c,d,e,f,g,h): Show landscape characteristics and materials in "tussenstroken" at infrastructure bundles and nodes.



High rail on special places.



Relief of old sand dunes.



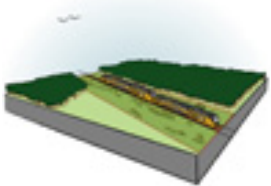
Landscape bound tree pattern and species.



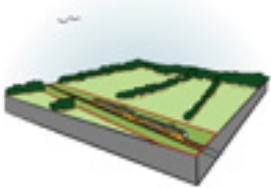
Principle 2: Verges

Keep verges open to:

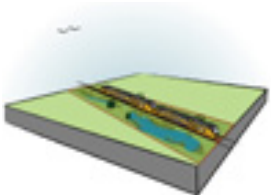
Show the landscape and its characteristics behind the verge.



(b,c,d,e,f,g,h): Do not use high green nature in verges of in all non-urban landscape types, particularly in large closed forests. The minimal distance to green elements is about 30 meter, which depends on the type of vegetation. Important is that the entire tree is visible.



(c,d,e,f): In closed and half-open coulisse landscapes, create windows towards the landscape by removing green in verges.



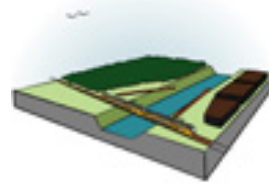
(All): Use verges multifunctional:

- Ecology in the form of landscape type specific nature: connect ecological qualities as habitats, corridors, spreading areas and refugia of the verges to the EHS network.
- Water storage. Slope banks and other relief should be at least 1:3.
- Recreation.



(b,c,d,e,f,g,h): In agriculture areas, open verges to strengthen the openness and the experience of seasons (show cattle in summer, orchards, variety in agriculture and the use of solitaire or groups of trees).

Enlarge or create views:



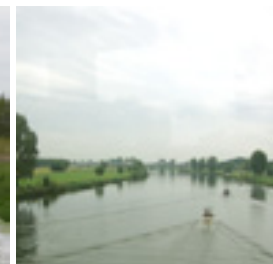
(All): Open up verges near other infrastructure to create or improve lines of sight, like channels, motorways, the electricity network etcetera.



(a): Show clear city edges or the city silhouette by opening up the view towards edges. Minimal distance of the verge to buildings is 40-50 meter.



Nature in verges.



Open view towards other networks.



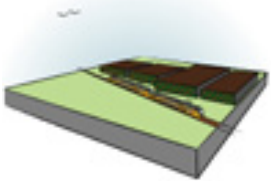
Verge needs to be more open near Nuland.



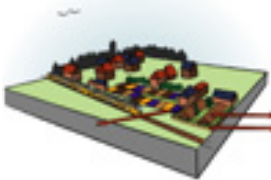
Principle 3: Size

Near the railway, keep the size as large as possible of:

Elements



(All): Care for unity in elements close to the railway and connect them to landscape characteristics. For example: because of the high speed, a view on several small buildings with different size and colour is annoying.



(All): Decrease the number of visible small scale elements, like storage places, private gardens, parking lots, junk yards, fences, gardens, factories, sheds, barns, allotments, silos, greenhouses, plant nurseries and so on.

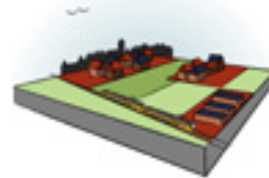


(All): If it is not possible to remove small scale elements, hide them, see the "furniture" and "front" principles for more ideas.

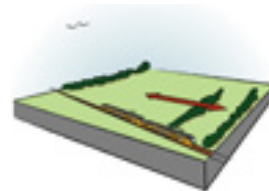


(a,d,f): Use the small open-closed contrasts and gradual urban-rural transition to fit new urban elements near the railway.

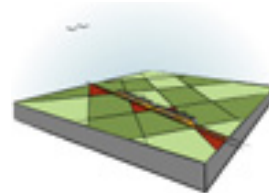
Planes



(All): Bundle functions in urban-rural transition zones, to decrease the number of small scale elements in rural areas near cities.



(b,c,d,e,f,g,h): Add views together which are smaller than 266 meter by removing obstacles in between (this is the minimal length for people to notice a view, using a speed of 120 km/h).



(b,c,d,e,f,g,h): Avoid high elements like plants or buildings in "overhoeken". Use them for functions which are connected to the surrounding area.



Small scale elements.



Design of large scale elements in Houten.



Two views which can be combined in Nijverdal.

4 FRONTS

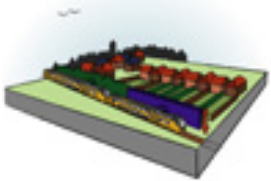
Principle 4: Fronts

Show the front of the landscape instead of cluttered backside.

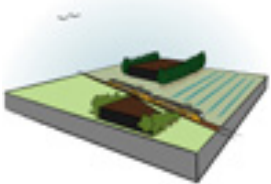


(All): Show attractive fronts of business and housing areas when designing the railway surrounding area (using the pattern of roads towards the rail-side).

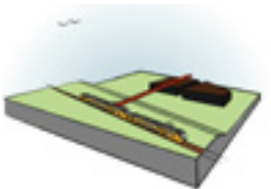
If this is not possible, hide backsides:



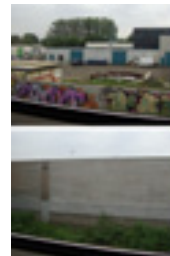
(All): Use high noise barrier walls or plants to hide backsides (particularly in unclear city edges) for people sitting in the train. Mind that there is difference in landscape experience up-stairs or downstairs in trains: the visible barriers should be at least 2m-2,5m high).



(All): Use landscape specific vegetation to hide elements.



(All): An idea is to use a (natural) difference in height, so that the annoying elements is lower than railway and does not constitute visual pollution (motorway example: Nesciolaan Haren).



Backsides near Wijchen.



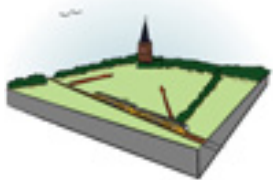
Housing front of Schuytgraaf
business front Almere.



Appartment front Wijchen.

5 LANDMARKS

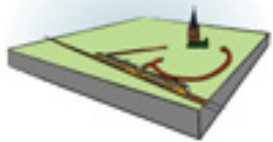
A sequence of landmarks



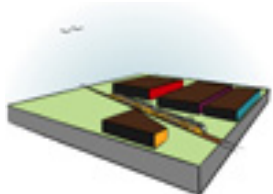
(All): A landmark or orientation point has to be visible at least 8 seconds.



(All): The type of landmark depends on personal preferences. So variety is needed. There are different types of landmarks like cultural-historical buildings, solitary trees, city-silhouettes, infrastructure buildings, wind turbines and so on.



(All): Show the growth and rotation of important landmarks by using the visibility on different distances (or temporarily hide landmarks, but avoid the 'schrikeffect').

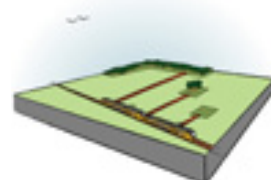


(a): Use different view directions; an element could be different from each of the 8 possible views, so that it is not the same journey each time. Example: difference in north-wall and south-wall of a building.

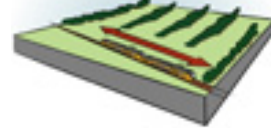
Principle 5: Landmarks

Care for a sequence of landmarks in the middle-ground or background of views.

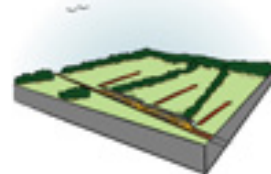
Focus on the middle-ground and background



(All): Focus within a view on the middle ground (around 70m) or background (around 300m) and not on the foreground (around 20m) because of the high speed of the train, to avoid the "schrikeffect" of buildings in the foreground.



(All): Remove the foreground to expand views: a view can also consist of several views together, the length of it is different for each landscape type, and should be at least 266 meter.



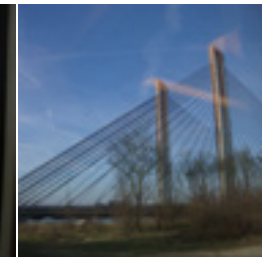
(c,d,e,f): Strengthen the experience of chambers, and the angle towards them, in half-open landscape. The depth of the chambers should at least reach to the middle ground or more (minimal 100 meters).



Landmark in the background.



Landmark in the middle ground.



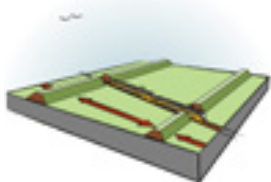
Zaltbommel, middle-ground landmark

6 RHYTHM

Principle 6: Rhythm

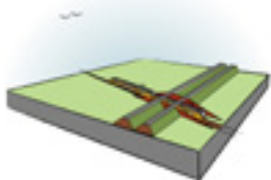
Care for a pleasant rhythm of:

High scale: landscape variation



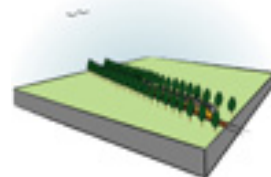
(All): Care for enough transitions or events on an alignment. At least each 30 seconds, or 1,25 km something should happen to avoid polder fatigue (in Dutch: 'poldermoeheid').

Small scale: infrastructure crossings

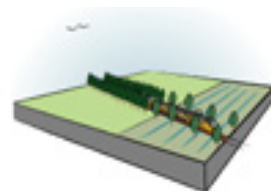


(All): Bundle infrastructure crossings and make bridges and tunnels long enough so that it not becomes a flash of darkness. Use a slow transformation towards tunnels and bridges (like in Best).

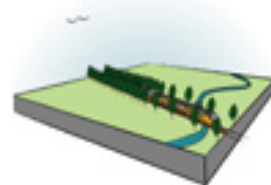
Small scale: parallel lanes



(All): Important is the distance between the rail and the parallel lane, which should be at least 30 meters. Care for enough distance to show entire trees and a large piece of the lane. Also use the right rhythm of trees to make it pleasurable to look outside.



(All): Each distance and each landscape type has a different rhythm that is connected to the differences in landscape types characteristics. For example, the distance between and towards trees in a lane of willows is smaller than a lane of oaks.



(a,c,d,e,f): Use the rhythm of trees to manipulate the optical speed of the train on special characteristic places. It looks like the train goes slower when frequency of trees is lower.

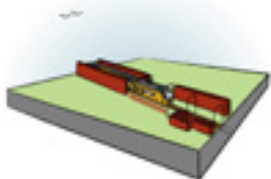


Small and large trees on a distance of 44 m from the rail near Culemborg.

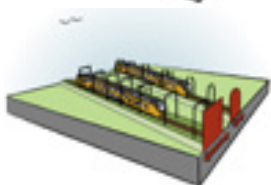


Small willow in river basin near Tricht (distance to rail is 30 m).

7 FURNITURE

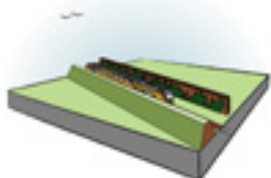


(All): Care for unity and coherence in design of the necessary furniture like maintenance buildings, safety fences, bridges and tunnels, particularly in the urban area where the train slows down. Use the same design of noise barriers within an alignment.

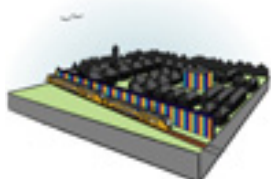


Keep the technical zone as small as possible, using the architecture of railway furniture like catenary masts and noise barrier walls.

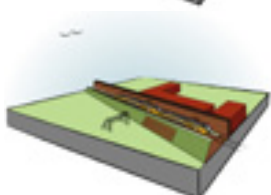
Design ideas noise barrier walls:



(b,c,d,e,f,g,h): To avoid graffiti, use green noise barriers, natural materials or sunken carriage-ways instead of concrete walls with an urban and industrial look.



(a,f): In the urban area, use art on noise barriers to show the identity of the city. For example: Delft Blue noise barriers near Delft.

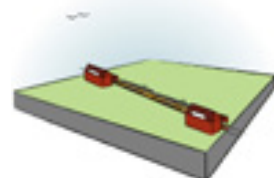


(All): Design with a multifunctional use of the slope of noise barriers. Examples: A2 noise barrier wall in Utrecht and sport tribune of Daring Brugge (Belgium).

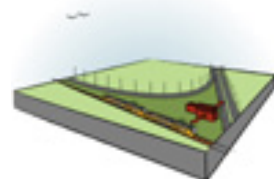
Principle 7: Furniture

Strengthen coherence within an alignment using an uniform design of railway furniture within the technical and verge zone without becoming an annoying element in the landscape.

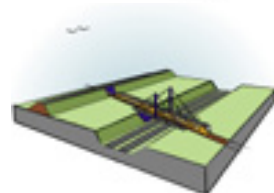
Other furniture design ideas:



(All): Connect furniture design to the general architecture principles like forms and colours used for the design of railway stations.



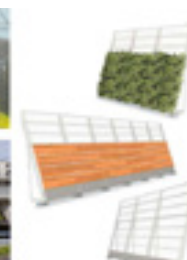
(All): Combine facilities near crossings with facilities of other (type of) infrastructure lines.



(All): Crossings and bundles with other infrastructure, each with an own alignment design, asks for an location specific solution, based on the visibility and intensity of both lines.



Uniform design of motorway furniture near the A2, A12, A27 and A50.



Railway furniture examples.



CHAPTER 6: TESTING BY DESIGN

Now that the 7 principles are complete, it is time to test them. By testing the principles on several cases and scales, a cyclic process with adapting the principles, is used. By doing this, things like the hierarchy and classification are updated each round. Another important result of testing the principles is that exact measures are needed when designing in detail. So the schematic drawings in the previous chapter shall be applied on a realistic scale. Looking at the locations of the cases, there are three ways to apply the principles to counter landscape cluttering near the railway, as said in the vision of the previous chapter.

1) Prevent new cluttering zones. For this case a location is found with a high gradation of cluttering in future plans: business area Wildeman in Zaltbommel.

2) Create or upgrade potential railway panorama views. For this case a potential panorama is needed where some adaptation can lead to a spectacular view: the brook valley of the Essche Stream near Esch.

3) Cleaning up current cluttering zones where characteristics of the landscape are not visible or annoying elements dominate the landscape. For this case is a location needed with a high gradation of cluttering focused on the invisibility of landscape characteristics: the landscape near Geldermalsen between the intersection with the Betuweline and the river Linge.

Because of the difference in these three goals, the assignment, approach and strategy for each case is different and will be explained in at the beginning of each paragraph.

6.1 Design principles for the landscape architect

An important question to keep in mind when reading the principles is particularly its testing, is: what is the role of the landscape architect? Or why is a landscape architect and not a farmer needed to use the principles on the right way? A difficult question because there is much debate about the need for and the application of principles in landscape architecture. Going further into this discussion takes too long for this thesis, so only a description will be given about the role of the landscape architect when using the 7 railway panorama design principles, based on the experience of the 3 test cases.

- A landscape architect keeps in mind the coherence of the landscape, the landscape struc-

tures and the landscape patterns on different scales and not only the area to design.

- A landscape architect combines the interest of the visibility from the train, which are the 7 principles, with other interests in the area, like size of parcels, infrastructure crossings or recreation routes.

- A landscape architect has the knowledge about landscape characteristics and the experience of public space design to come up with a good design on detail.

- When applying the principles in a design, a landscape architect could make an analysis and sketch the future situation for each principle. Because of the number of information in the principles, a landscape architect is needed to know which information is useful and how to apply this. In this step, the creativity of the landscape architect is very important.

6.2 Three test cases

Case 1: Business area Wildeman Zaltbommel

Approach

The main approach for this case is as followed:

Step 1: Analysing the current design by SVP and analysing the landscape near Zaltbommel.

Step 2: Defining the design assignment, based on current design requirements and qualities.

Step 3a: Using the 7 principles as 7 different building blocks for the design, each with an own short analysis. This order is not included in this report.

Step 3b: Using the 7 principles in a different order (figure 6.5).

Step 4a: Making a concept landscape plan of scenario 1 (figure 6.6).

Step 4b: Making a concept landscape plan of scenario 2 (figure 6.7).

Step 5: Choosing one scenario (number 2) and make a detailed landscape plan include details (figures 6.8, 6.9, 6.10, 6.11).

One of the main goals of this first case for the principle test was defining the hierarchy of the 7 principles. That is why two different scenarios are made. The main difference between the two sequences of principles was the scale: in the first scenario most impor-

tant was the scale low - the scale of the landscape units - while in the second scenario the scale was higher - the scale of the urban-rural contrast and landscape types -. How this difference looks in the landscape will be shown in this paragraph. Another important goal was to look at the differences between a business area design without using the principles on one hand, which is the current design by SVP, and a business area design using the principles on the other hand.

Current design

The current design for business area the “Wildeman”, made by SVP architecture and urban design, is based on the idea of fortified cities like Zaltbommel (figure 6.1). The main qualities of this fortified business area are safety - only one or two entries -, the expression to the outside as one entity and the green-blue environment used for ecological corridors. Safety is an important issue when design business areas and the idea of an fortified area is well chosen to create an area safe as possible. Thinking from the perspective of the railway traveller, there are some remarks. In reality the concept of a fortified business area results in several small business areas (called “bedrijvenhoven”) which are closed to the outside and the open inside is accessible using a gate (figure 6.1). The look of the inside of the business area, with the front sides of buildings, consists of attractive architecture with natural materials. The look of the outside, the backsides of buildings, consists of an unattractive architecture with industrial grey materials. Railway travellers only have a view on these monotonous backsides for 1,57 kilometres.



Figure 6.1: Design of business area Wildeman by SVP.

Design assignment

The main assignment is to design a business area that is integrated in the landscape, not focussing on sustainable or ecological principles for business areas, but following the principles for railway panoramas and using qualities of the design made by SVP.

From this current design for business area the “Wildeman”, a list of tasks can be made:

- Expansion of the current business area between the railway, Heemstraweg, new road the Wildemanweg and the N322 with 83 ha. The original plan was an expansion of 122 ha.
- A minimal water storage area of 5 ha, which is 6 % of the total area. According to “Nationaal Pakket Duurzame Stedenbouw” this should be 9% (Bijzendijk et al. 1991).
- Safety: it must be safe for companies to settle on the business area the “Wildeman”. Keep the amount of roads and entrances as efficient as possible.
- Green corridors towards the surrounding landscape. The only surrounding EHS area is the floodplain of the Waal, a connection to that area is not possible.
- Enough space for loading and unloading
- Enough space for parking, this can be planned using public parking places on streets or on the companies’ own site.
- Different sizes of parcels: 32 small, 32 middle and 8 large.

Based on the concept of green business areas in the urban rural transition zone (Kanter 2001), the following aspects can be added to the list of design tasks:

- No towers.
- The density of buildings has a maximum of 20 %.
- Improve the sustainable character by a setting up a cooperation between companies of the same scale to combine energy, transport and waste.

On a lower scale, other general requirements are taken into account:

- A road bend radius of at least 10 meters.
- Roads have a minimum width of 4 meters.
- For emergency services, the business area has to be accessible from different directions, the routes must be interconnected and dead ends are not allowed.



*Top left: figure 6.2, landscape units and soil.
Top middle: map x, visibility.
Top right: map x, spatial development.*

Lower left: figure 6.3, aerial view.

Middle: figure 6.4, foto impression with the passage-ways, current business area, current farms, electricity network, small size landscape and the view towards the open river basin landscape in the south.



Landscape analysis

The river landscape near Zalbommel consists of two landscape units and the following characteristics (appendix 2):
 Levee: closed, higher than surrounding kom or flood plains, intensive agriculture with orchards or crops, irregular parcellation, ditches pattern following (old) streams, urban development started with ribbon villages near the dike.
 River basin: open, flat without relief, extensive agriculture with grassland or crops, new urban development, straight block pattern of ditches, lots of important new infrastructure, high water level.

For further landscape analysis, see the following maps: figure 6.2: location landscape, soil, visibility and spatial development, figure 6.3: aerial view.

Figure 6.5: Application of the principles

Analysis for each principle:

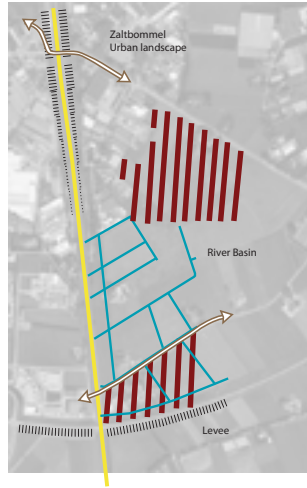
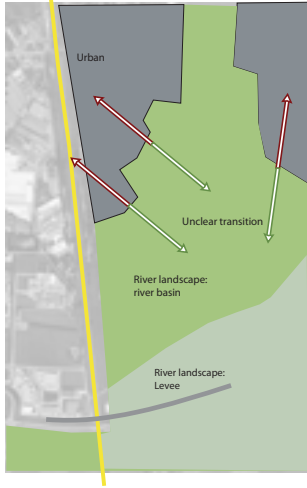
1

Contrasts

- Most important contrast is the urban-rural transition.
- If possible, create clear entrances at transitions from one landscape unit to another.
- Strengthen the continuity of lines

Legibility

- Ditches pattern in verges.
- Height of the rail as low as possible (special=Waal).
- River landscape specific tree species and patterns.
- Urban extensions on landscape specific places (urban landscape and levee).
- Show relief using plantings.



2

Verges

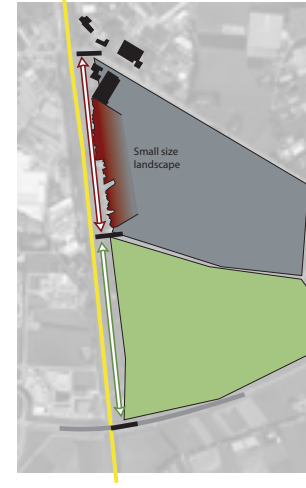
- No high green elements in the first 25 meter
- Open up the view on urban edge
- Use other infrastructure like the N322 to create views
- Nature in verges



3

Size

- A view should be at least 266 meter.
- Clean up areas with small scale elements.
- Bundling of functions.



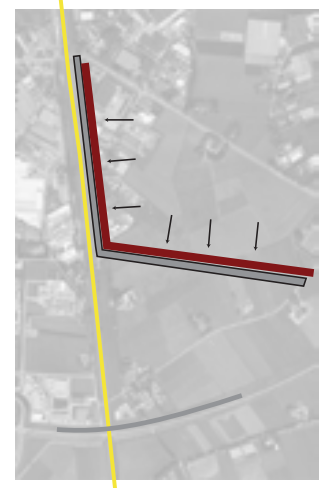
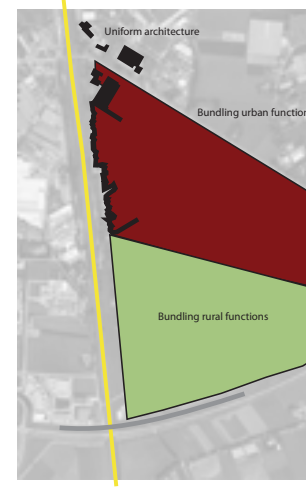
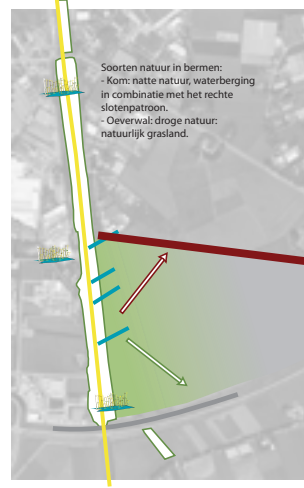
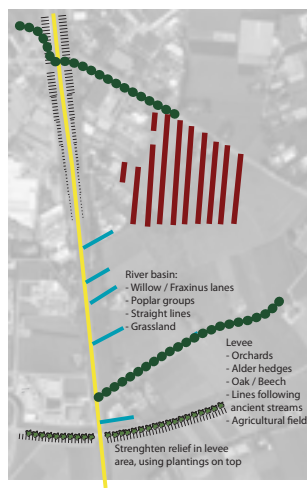
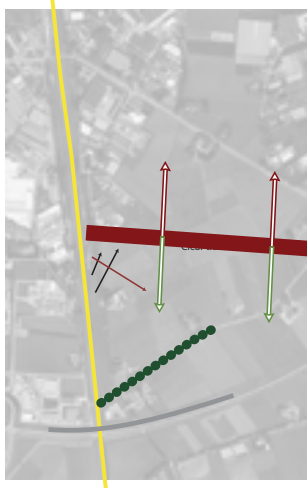
4

Fronts

- Show front side of the urban area, using a road pattern towards the railway.
- Remove (or hide) annoying elements.



Adaptations for each principle:



5

Landmarks

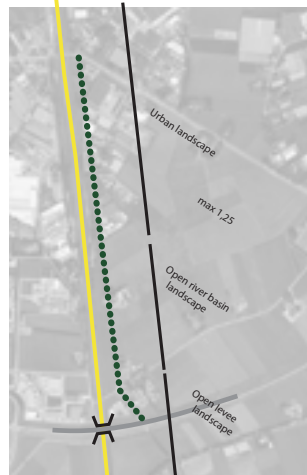
- Open foreground.
- Landmarks: no landmarks present (only the Waal).
- Possible new landmark in open area in the middleground, in the river basin landscape type: Group of poplar trees / remarkable new building on a corner.
- Landmark has to be visible at least 8 seconds.



⑥

Rhythm

- Bridges and tunnels should be long enough
- Plant distance of the parallel lane (minimum of 30 meters).
- Frequency of different landscapes



7

Furniture

- Elements marked of which the design can be uniform to the entire alignment. (for example: make them all blue because of the river landscape.

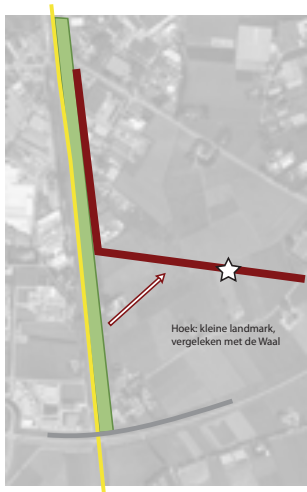


Figure 6.6: Concept map scenario 1

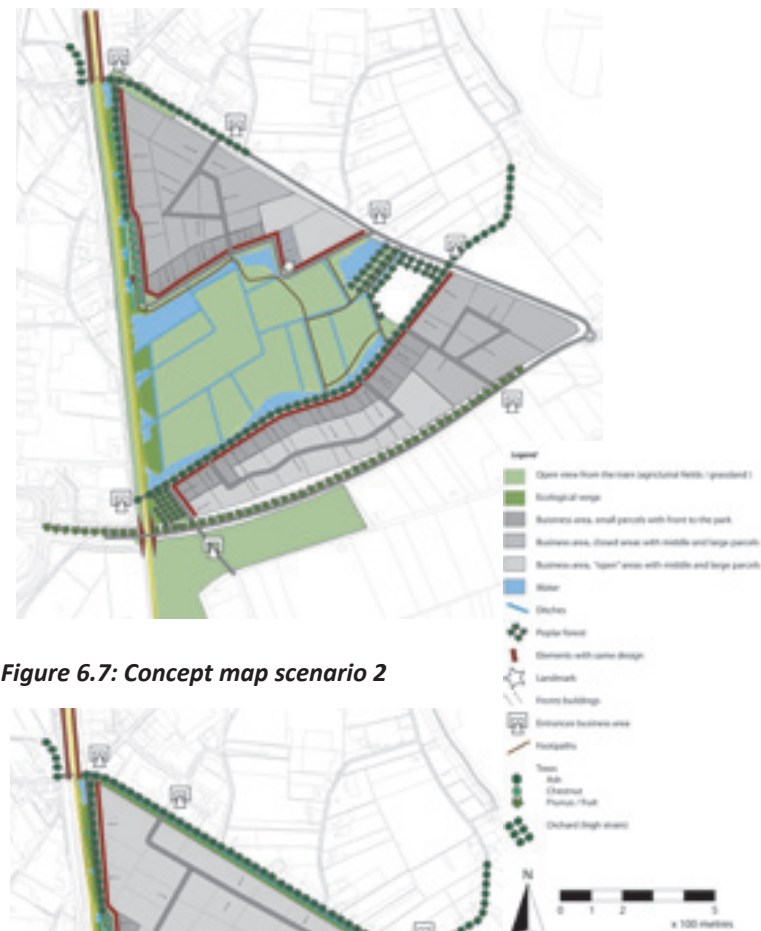


Figure 6.7: Concept map scenario 2



Figure 6.8: Landscape plan and details scenario 2



Legend landscape plan




















-  Verges
-  Slopes
-  Buildings
-  Parcels
-  Electricity network
-  Footpath
-  Roads
-  Water
-  Reed
-  Railway
-  Open grassland
-  Seating objects / quay
-  Landmark building
-  Fraxinus
-  Poplar
-  Groundcovers
-  Shrubs
-  Fronts
-  Parcel boundaries



Figure 6.9: Photoshop image of the urban edge, when looking towards the railway.



Figure 6.10: Photoshop image of the urban edge, when looking from the railway.

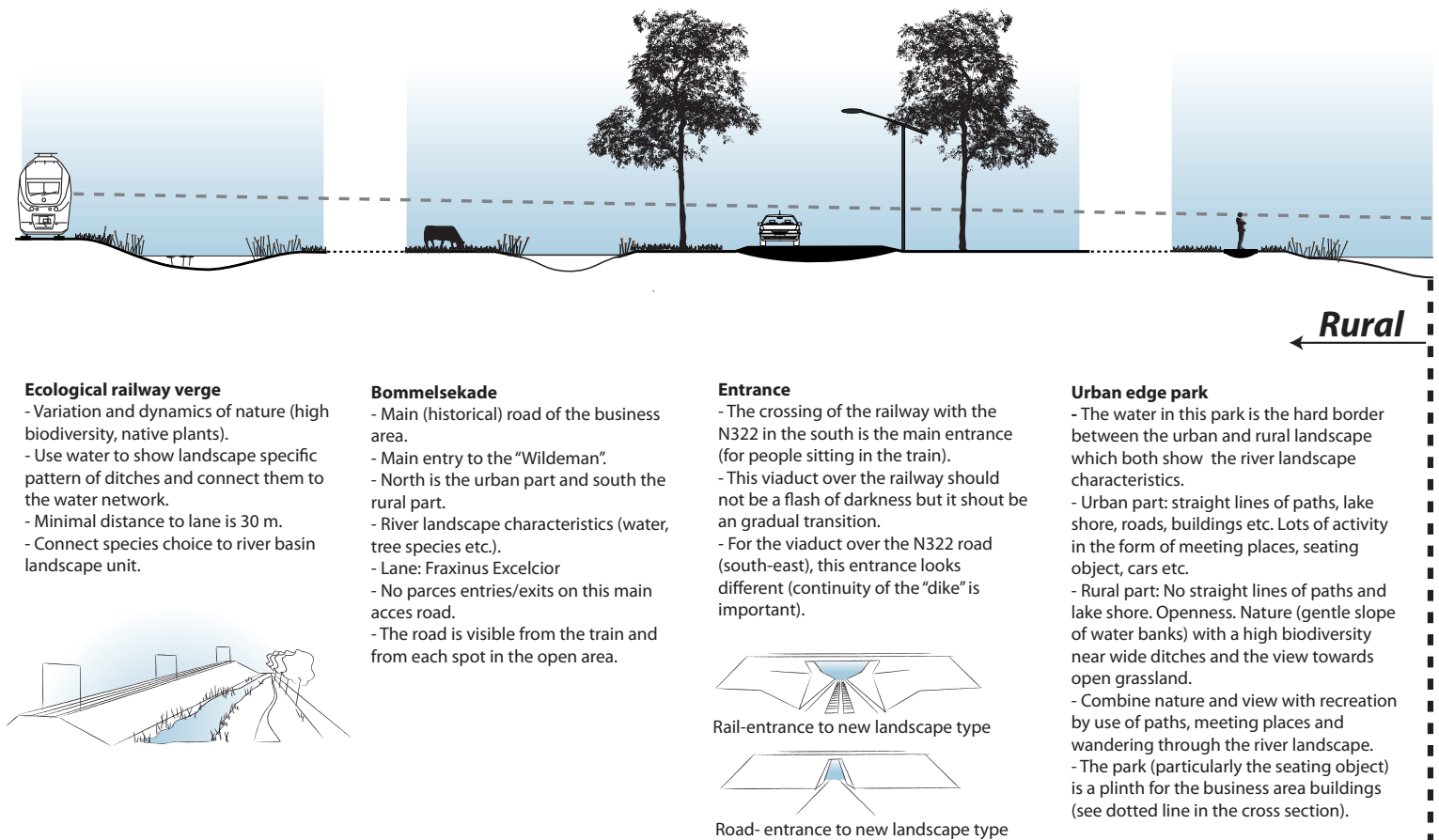
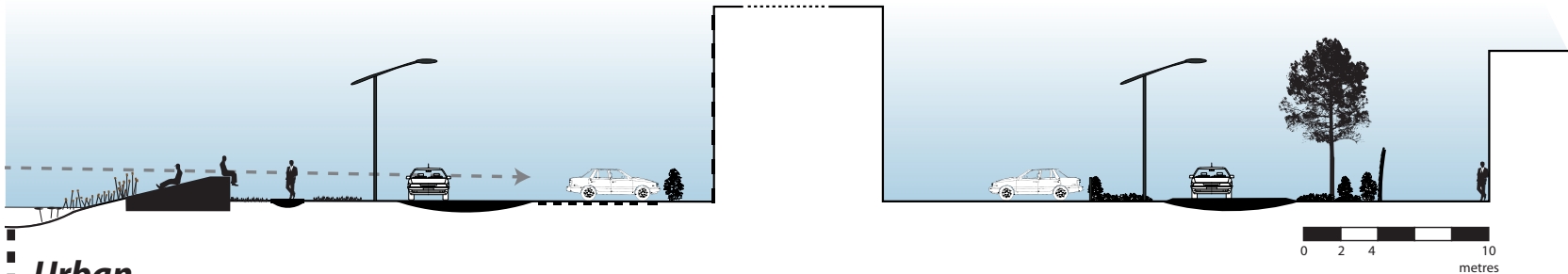


Figure 6.11: Cross section with specifications.



Urban

Urban edge

- The urban edge consist of small parcels containing offices with fronts towards the open area.
- Most important for the view from the train towards this edge is the coherence in the vertical direction. This means:
 - No high-rise buildings higher than 20m (except landmark).
 - Parking on "halfverharding".

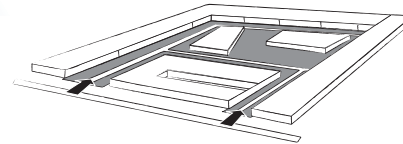
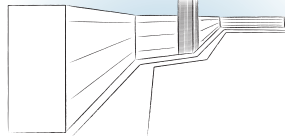
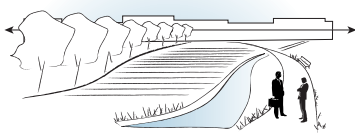
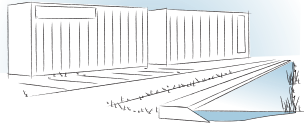
- Fronts of parcels should be built adjacent to each other (for parcels on corners, there could be two fronts).
- Equal "rooilijn".
- Same color and materials in the front facade (use of wood).
- Use dark colors of wood, for the contrast with grass and ash trees.
- Fit advertising in architecture.

Landmark

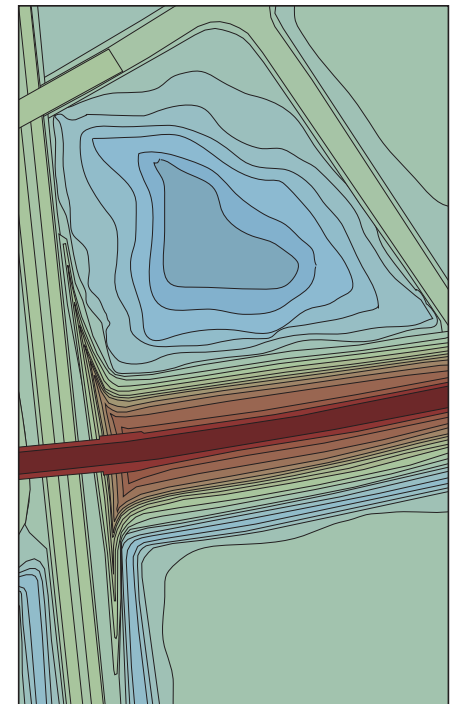
- The corner-parcel that protrudes from the urban edge should be used as a new landmark.
- This landmark is a building that differs from the applied using criteria such as height, color, material etc.

Safety

- Middle and large parcels on safe roads inside.
- Safety: only 4 main entrances which can be observed or even closed during weekends and holidays.
- On these closed areas, there is more diversity in architecture and freedom for companies on their parcels.
- A restriction for the parcel boundaries, which are visible from the roads (front / back), is that wood must be used to prevent an unnatural and industrial look.
- Parking on own parcel and not on the green verges.



Detail viaduct slope



Case 2: Brook valley near Esch

Approach

The main approach for this case is as followed:

Step 1: Analysing the surrounding landscape (figures 6.12 - 6.17).

Step 2: Using the 7 principles as 7 different building bloks for the design, each with an own short analysis (figure 6.18).

Step 3: Making a concept landscape plan (figure 6.19).

Step 4: Work out some main adaptations or sites in detail (figure 6.19).

The goal to test the list of principles using this case is focussed on updating the list of adaptations and design ideas. Some things that changed after this case were numbers - of plant distances for instance - , the order of adaptations, the removal or addition of adaptations etcetera.

Design assignment

Based on the panorama method and the questionnaire, the brook vally of the Essche Stream near Esch is a potential panorama. Looking at the cluttering map and the questionnaire (question number 6 and 12), it also ask for an upgrading design because the is no awareness of a brook valley on that place. So the main principle will be the first one about legibility. Looking at the current range of the view (figure 6.16), opening up the verges is also important.

Landscape analysis

The sand landscape near Esch consists of three landscape units and the following characteristics (appendix 2) (figures 6.12, 6.15):

- Brook valley:
- Low ground level compared with the surrouding landscape.
 - Open.
 - Wet or in other words: a high ground water level.

- Main landuse is grassland.
- Not much occupation, only some new farms.
- Irregular parcellation and ditches pattern.

Half open coulisse landscape:

- Closed.
- Small scale agricultural fields.
- Irregular parcellation and ditches pattern.
- Old villages with new urban extensions
- Plantings in form of lanes, wooded banks and small forests.

Open heath reclamation:

- High ground level compared with the surrouding landscape.
- Open.
- Large scale agriculture.
- Linear block pattern of parcellation and ditches.
- New villages and farms.



Figure 6.12: foto impression with the estate Eikenhorst, the hard edge of the brook valley, a solitaire willow near the brook, a row of willows in the valley, old farms, the canalized stream, alder in the valley and the railway bridge.

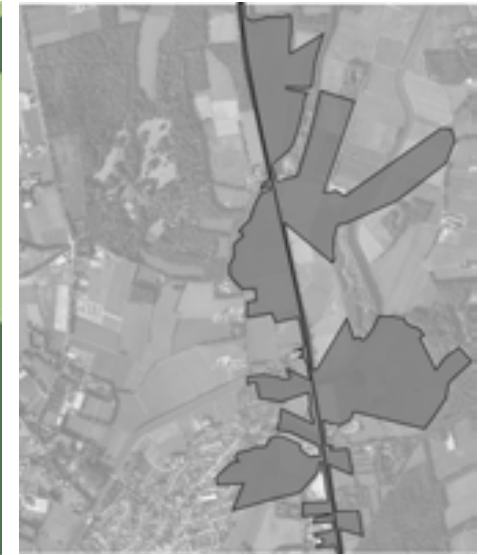


Figure 6.13: map left: aerial view.
 Figure 6.14: map middle up: soil types.
 Figure 6.15: map middle down: landscape units.
 Figure 6.16: map right up: visibility.
 Figure 6.17: map right down: ecological main structure.

Landscape types:

- Sand landscape:
- Open heath reclamation (straight)
- Forest
- Half open coulisse / Estates
- Brook valleys
- Urban area

EHS

1

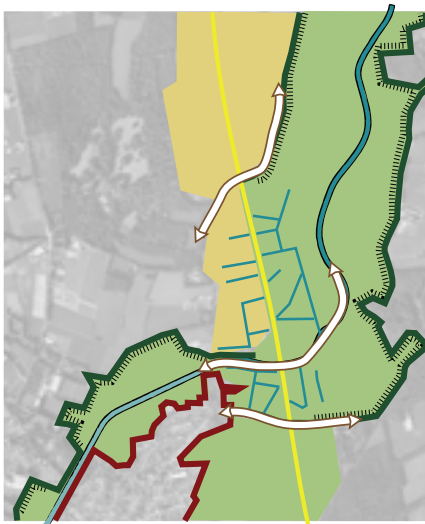
Analysis for each principle:

Contrasts

- Create entrances into the brook valley landscape.
- Show open-closed contrasts within the rural area: clear borders of the brook valley and clear landscape chambers in the coulisse landscape.

**Legibility**

- Continuity of lines
- Irregular ditches pattern in verges
- Height of the rail as low as possible, bridge over the brook is a special moment with a higher rail.
- Brook valley specific tree species and pattern:
- No urban extensions in the valley
- Show relief of the edge of the valley using plantings on the highest point.



2

Verges

- No high green elements in the first 25 meter
- Open up the verge in the brook valley (other infrastructure lines)
- Open up the view on the urban edge of Esch
- Nature in verges.
- Open up verges towards landscape chambers.



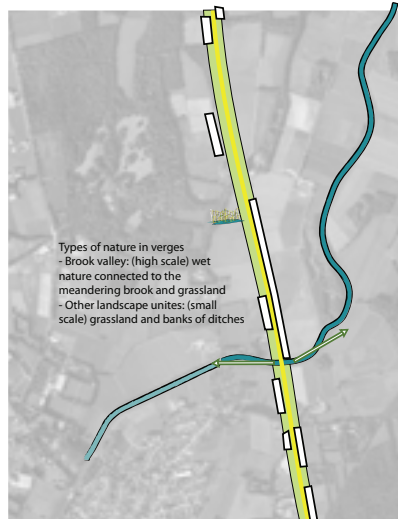
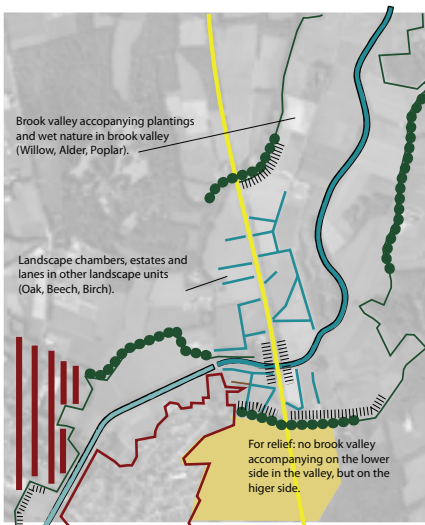
3

Size

- A view into a landscape chamber should be at least 266 meter.
- Clean up areas with small scale elements
- Bundling of functions: clear distinction of urban areas within the view.



Adaptations for each principle:



4

Fronts

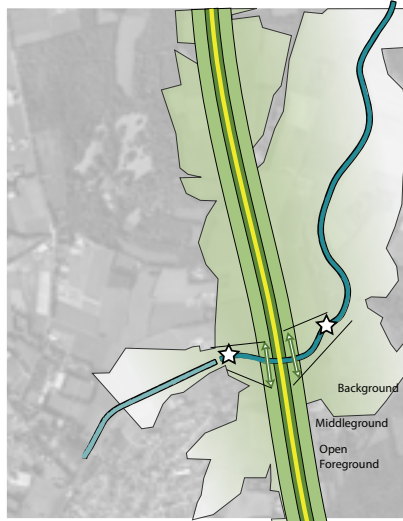
- Because of the existing road pattern, hiding backsides, using landscape specific plantings, is the best option.
- Remove (or hide) annoying elements: farms don't belong in open brook valleys, but the plantings which are needed to hide farms, also not belongs in a brook valley. Besides removing the farms, the best option for the landscape is leave them as they are.



5

Landmarks

- Open foreground.
- Landmarks: the brook: landmark in the middleground or background has to be visible at least 8 seconds.



6

Rhythm

- Distance of parallel lanes: no current annoying parallel lanes.
- Rhythm of different landscapes: left-right side is different.



7

Furniture













No elements (like: station platforms, fences, maintenance buildings, noise barriers etc.) present which needs to be adapted to the uniform alignment design. Only the small bridge over the brook can be such an element, but because of the speed, this bridge is not visible for people sitting in the train.

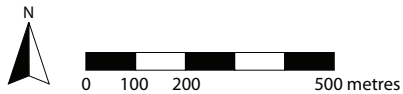
NA

Figure 6.18: Application of the principles

Figure 6.19: Concept landscape plan with details

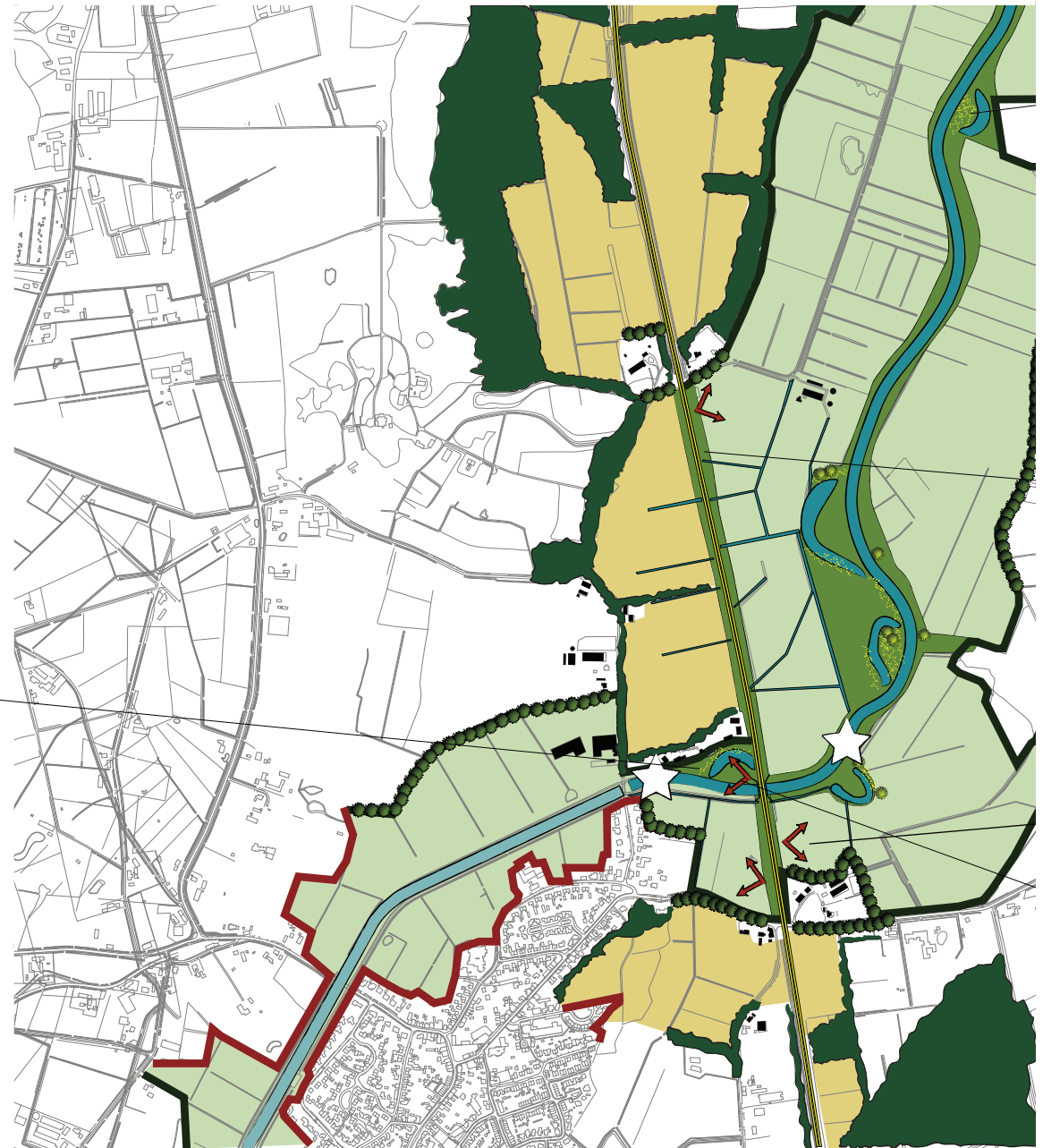
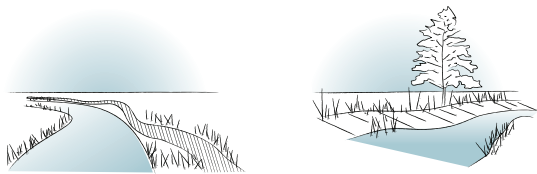
Legend

-  Open brook valley (meadowland)
-  Open agriculture areas in coulisse landscape
-  Forest / wooded banks in coulisse landscape
-  Water: Channel (urban river)
-  Water: Brook (natural river)
-  Nature (meadowland) in verges railway and river banks
-  Urban edge of brook valley
-  Green edge of brook valley
-  Entrance brook valley
-  Landmark: the brook
-  (New) Trees to strengten green edges (high ground: oak, beech etc.)
-  Solitair trees in brook valley (low ground: alder, ash, willow)



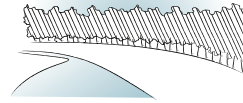
Ecological banks

- Open ecological banks without tall dense vegetation
- Use gentle slope of the banks: from 1:3 to 1:4.
- Use and show the dynamics of the brook (erosion, silting) for dynamic zoning of the transition of land to water: an underwater zone with aquatic plants and an "verlandingszone" with marginal plants like reeds, grassland or softwood.
- Show old meanders using nature.
- Vegetation type: "broekvegetatie": alder, willow, "bosbies", Scrophularia, "ruwe smele" etcetera.
- Important is the frequency of maintenance to simulate the development of pioneer vegetation and arid grasslands.
- Recreation is possible in these areas: path at the borders and the possibility for strolling near the banks.



Brook valley accompanying plantings

- Use closed plantings to create hard edges of the brook valley.
- On many places this edge is already present
- Use remarkable and large tree species like oak or beech.
- This edge is in line with the surrounding forest of the estates.



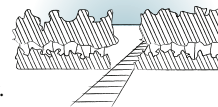
Ecological railway verges

- The railway verge is an ecological corridor in the coulisse landscape
- For maintenance, use extensive grazing or extensive mowing, which is once or twice a year.
- Stimulate pioneer vegetation (1-year species) and arid grasslands (species-rich, flourishing)
- Increase the biodiversity by creating varied habitats, for example, let ditches continue in the railway verge.
- Ditches in the verge have, like the banks of the brook, a gentle slope in contrast to the ditches on the agricultural fields.
- Differences in ecological zones using the frequency of mowing or grazing.



Entrances of the brook valley

- Use the hard edges of the brook valley as a transition from a closed landscape to an open landscape.
- The experience of openness of the eastern part of the brook valley is better than the experience of openness of the western part. So the entrances are different for the eastern or western part because the rail itself as an important edge of the valley.



Detail of the east side of the brook valley.



Case 3: Geldermalsen

Approach

The main approach for this case is as followed:

Step 1: Analysing the landscape (figures 6.20 - 6.24).

Step 2: Using the 7 principles as 7 different building bloks for the design, each with an own short analysis (figure 6.25).

Step 3: Making a concept landscape plan (figure 6.26).

Step 4: Work out some main adaptations or sites in detail (figure 6.26).

Step 5: Designing how to hide a backside on a small detailed scale.

In this last case, the main goal was to look at the application of the principles on different scales. That is why the fifth step, a design hidden backside, is taken. Another goal for this case was to look at the completeness of measures, the right order and the number of adaptations.

Design assignment

Starting with the problem of cluttering, the main problem in the area between the crossing with the Betuweline and the Linge, is that the landscape characteristics of the river landscape, in particular the Linge or Betuwe identity, is not visible. So the assignment for

this case is to counter cluttering by showing more landscape characteristics and clean up the non landscape bound elements.

Landscape analysis

The river landscape near Geldermalsen consists of two landscape units and the following landscape characteristics (appendix 2) (figures 6.20, 6.22):

- | | |
|--------------|--|
| Levee: | <ul style="list-style-type: none">- Higher than surrounding river basin or flood plains.- Intensive agriculture: orchards, crops.- Irregular parcellation and ditches pattern following (old) streams.- Urban development started with ribbon villages near the dike.- Closed. |
| River basin: | <ul style="list-style-type: none">- Open- Flat, no relief- Extensive agriculture: grassland or crops.- New urban development: new villages, farms, business area.- Straight block parcellation.- Straight pattern of ditches.- Lots of important new infrastructure.- High water level. |



Figure 6.20: foto impression with orchards, housing fonts, alder hedges, open river basin, infrastructure node with the Betuwe line, non landscape specific vegetation to hide elements, railway furniture with graffiti and the closed landscape of the levee.

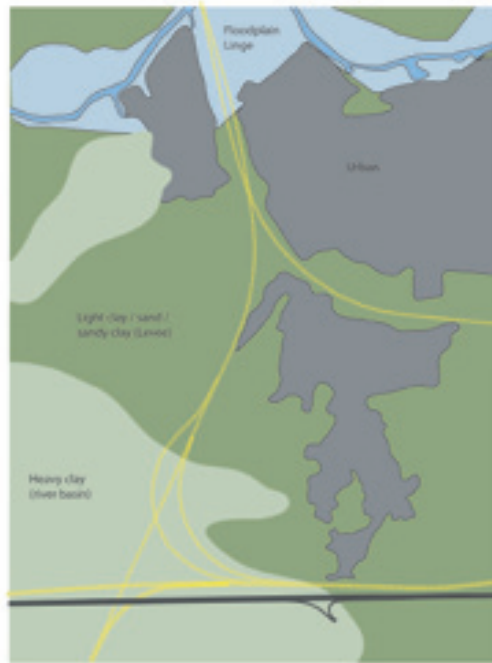


Figure 6.21: map left: aerial view.
Figure 6.22: map middle left: soil and landscape units.
Figure 6.23: map middle right: visibility range.
Figure 6.24: map right: spatial developments.

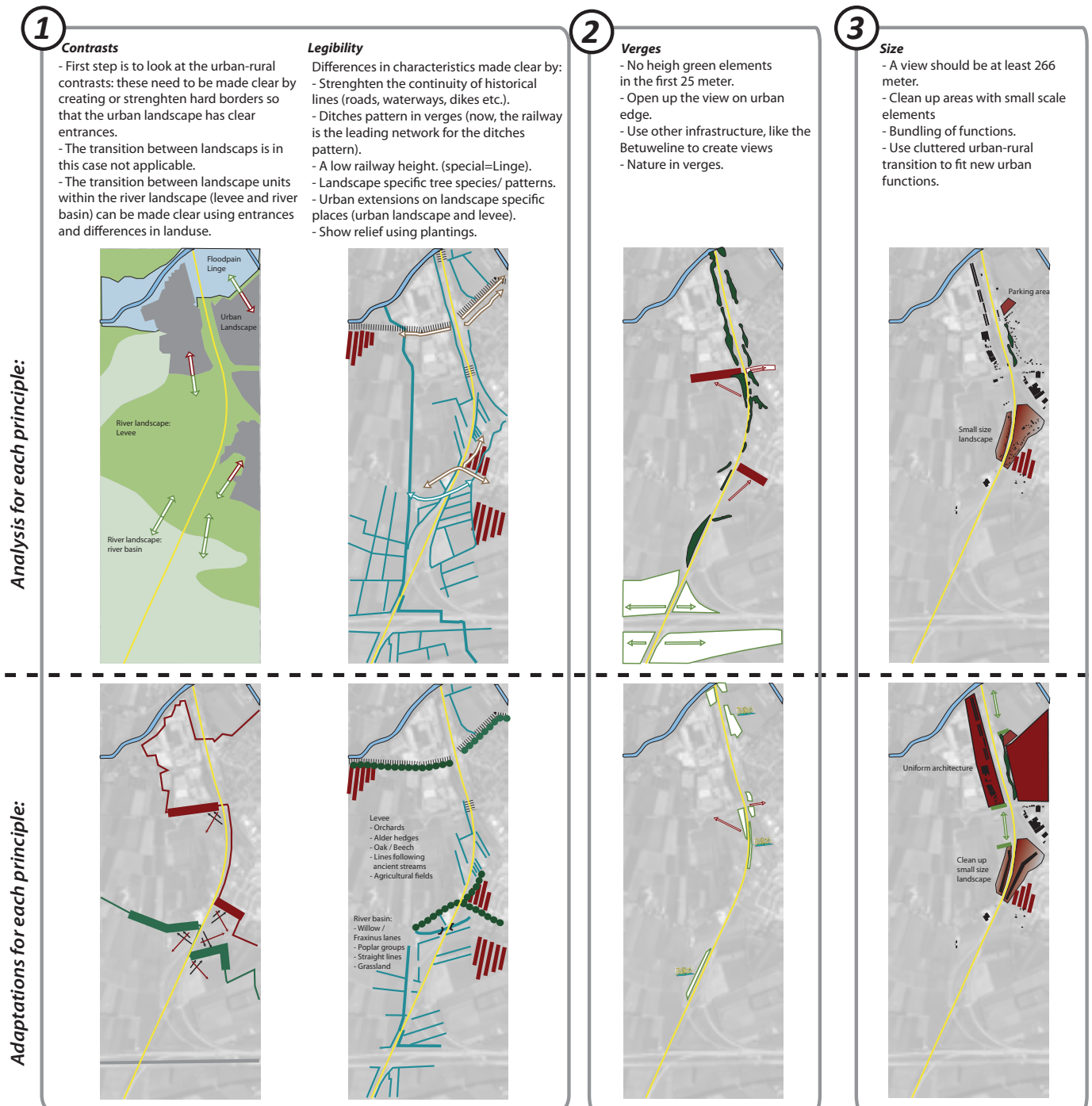
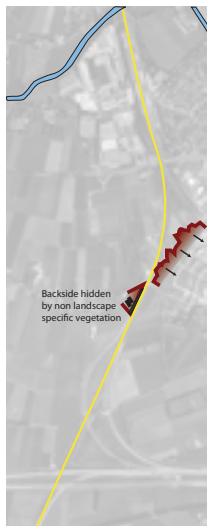


Figure 6.25: Application of the principles

4

Fronts

- A road pattern towards the railway to change the view from backsides to frontides is not possible because the main network of ribbon villages will disappear and the area is too small for an entire new road with new houses.
- If this is not possible with current backsides, use landscape specific vegetation to hide backsides.
- All annoying elements are already mentioned before.



5

Landmarks

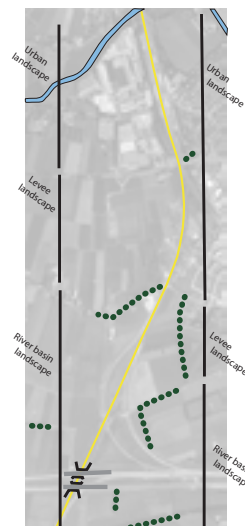
- Open foreground: no remarkable elements in the foreground but in the middleground or background.
- Landmarks: current landmarks have to be visible at least 8 seconds.



6

Rhythm

- Bridges and tunnels should be long enough: Betuwelijn / A15.
- Distance of parallel lanes: no annoying parallel lanes present.
- Frequency of different landscapes. At least each 30 seconds something should happen: only the view on the river basin area is longer. Because of crossings with other infrastructure, something will happen.



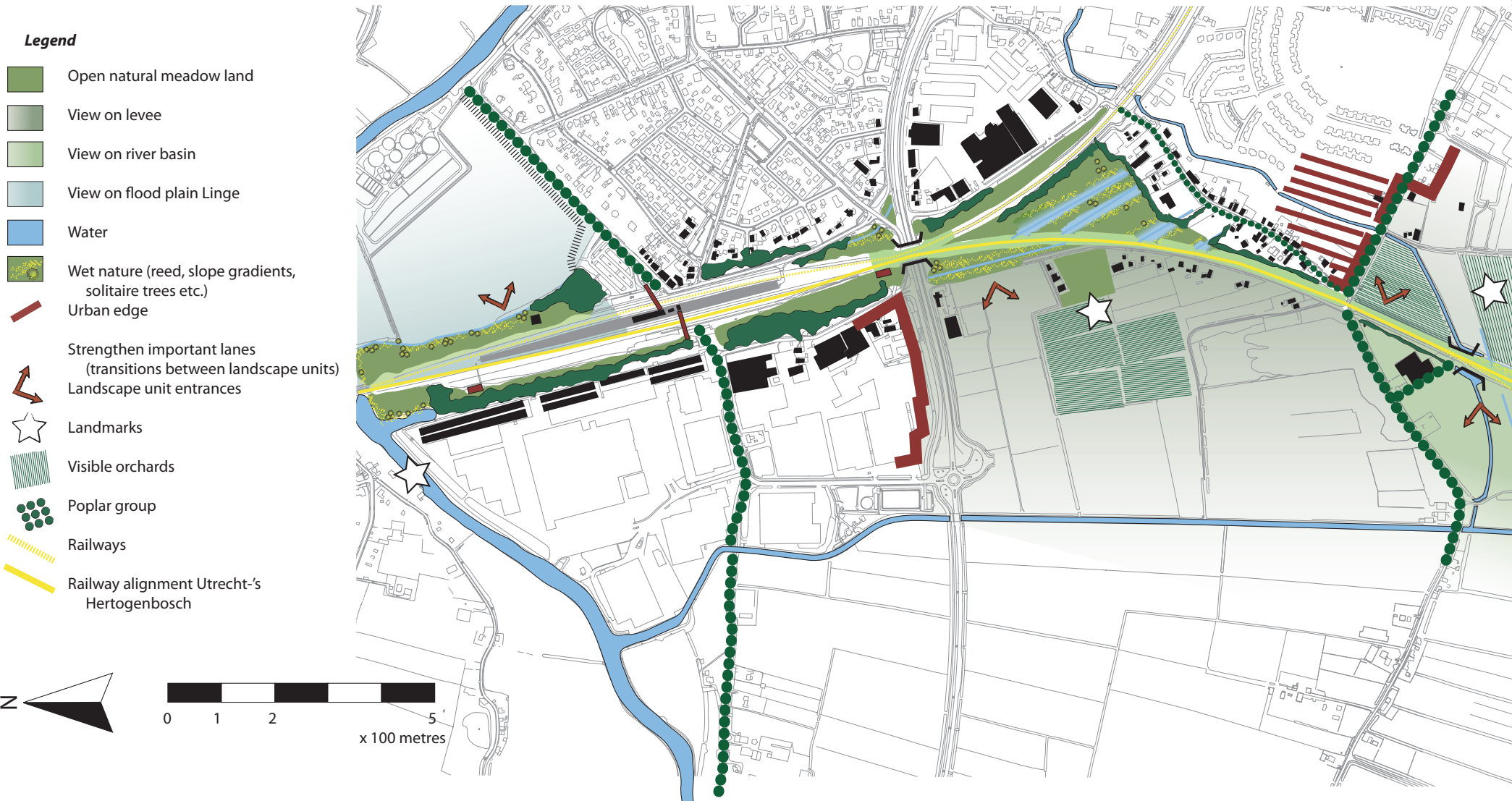
7

Furniture

- Elements marked which need to be redesigned:
 - Bridge over the Linge.
 - Station Geldermalsen (platform, stairs, roof etc.).
 - Several maintenance buildings.
 - Crossings (tunnels) with other infrastructure.
 - Noise barriers.
- Apply uniform architecture to the entire alignment.



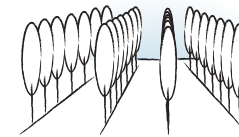
Figure 6.26: Concept lan





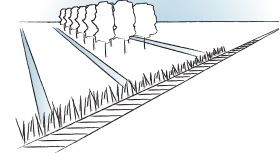
Orchards

- The orchard is one of the main characteristics of the levee landscape unit.
- Open up the view on the orchards.
- When designing, be aware of the differences in orientation of the orchards. Is the orientation perpendicular to the railway, the length and straight lines are visible. Is the orientation parallel to the railway, the rows, density and colors are visible.



Waste areas

- Use waste areas in infrastructure nodes to show the landscape characteristics. In this case for the river basin, it means poplar forests, grassland, straight lines and many ditches.
- The adaptations for the current design of these areas: the poplar forest not to close to the railway (at least 35 meter) and the original parcellation can be made clear in a better way using the pattern of ditches.



Railway furniture

- In this area near Geldermalsen, there are several elements which can be pointed out as railway furniture. For these elements, an uniform design creates a calmer view from the train.
- The design of the newest element, which is a pedestrian bridge near the station, consists of grey concrete with red accents. This design can be used for the other railway furniture or urban elements.
- The noise barrier wall in the southern rural area should have a natural look.



Detail plan of backside Laageinde

From previous step, the concept plan of the railway surrounding landscape near Geldermalsen, the next starting points come forward:

- The main goal is to hide the backside of the old ribbon village Laageinde. Why hiding: because for the option to locate new urban extensions, the area is too small.
- The characteristics of the levee landscape have to come forward (figure 6.27):
 - o Orchards ("hoogstam" and "laagstam") of fruit trees like pears, plums, apples and cherries.
 - o Alder hedges
 - o Lanes of fruit trees
 - o Many old landmarks: like farms, churches and mills (not in this area).
- Focus on the visibility from the train.
 - o Visibility of the levee landscape for people travelling between Utrecht and 's Hertogenbosch each day: the view should not be the same each day. So the differences between seasons could be useful.
 - o There is a difference in views between going north-south or south-north (figure 6.28).

There are also some new starting points:

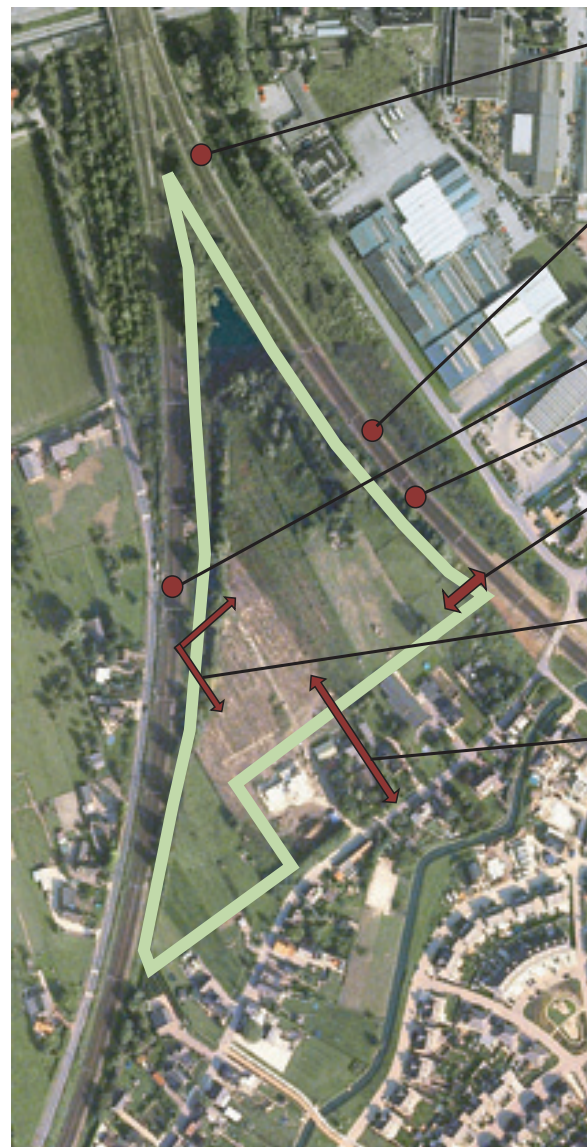
- Because it is a "tussenstrook" and not an important park in the middle of the urban area, the design has to be cheap and easy to maintain.
- Water storage (10-15% of the area).



Figure 6.28: difference in views



Figure 6.27: foto impression of the Linge landscape: fruit trees near roads, "hoogstam" orchards, view on landmarks, alder hedges and flowering fruit trees.



Because the rail crosses a road (Provincialeweg Oost) in the north, the rail is located around 2m above ground level.

In a gradual transition, the height of the rail goes back to ground level in the south.

The intensity Utrecht - 's Hertogenbosch is around 3500 persons per daytime hour.

the intensity Geldermalsen - Tiel is around 850 persons per daytime hour.

Distance between the rail and green elements should be at least 30 meters, or the entire element should be visible.

The minimal angle between the view and the rail is 40 degrees. So the entire angle of the view is 100 degrees.

The direction of parcels is perpendicular to the ribbon village.
The rail is added later and has no connection with the parcellation.

Calculations intensity:

- Utrecht-'s Hertogenbosch: 55000 p/d (from "Landelijke Markt- en Capaciteitsanalyse Spoor"). $55000 / 16 = 3438$ p/h (not /24 because at night, the railway is not used) (/ 16 is an estimated number of hours that the rail intensively used).

- Geldermalsen - Tiel: seats in Sprinter trains (2007) is 176 in the 2nd class and 40 in the first class = 216 seats. $216 * 2$ trains each hour * 2 (east-west and west-east) = 864 p/h

Figure 6.29: Analysis of the area between Laageinde and the railway

The concept for this plan is based on the original landscape structure on the levee area of the Linge: a main road or ribbon village with a view on closed alder hedges. Behind these hedges, there is an orchard, which is mostly invisible (figure 6.30). The concept for this plan is not to change this old landscape pattern, but to look at the railway as a new element that crosses the center of the orchard. So that the alder hedge is used to hide the backside of the ribbon village (figure 6.31).

Turn around the experience of the orchard.

- The use of the closed alder hedge to hide the backside of the ribbon village.
- The new experience: a rail that crosses the center of the orchard which is only visible for railway travellers.
- For people travelling every day: the experience of season of the orchard is important, using the colors of leaves and flowers.
- There is a possibility for new urban development of the ribbon village.
- The orientation of orchards is in consistent to the current parcellation.

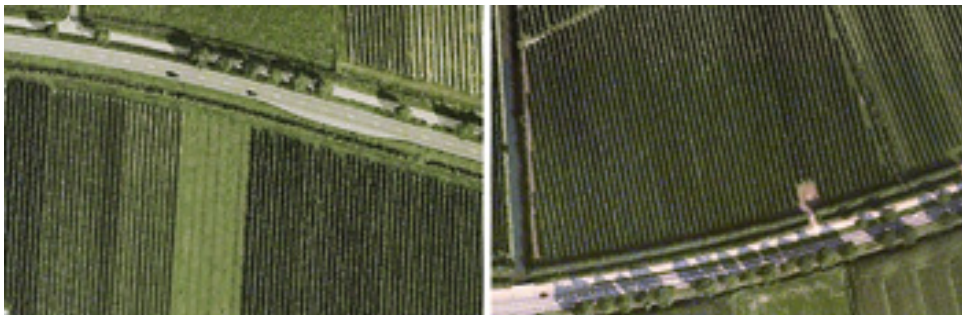


Figure 6.30: aerial view of the relation between roads, orchards and alder hedges near the linge.

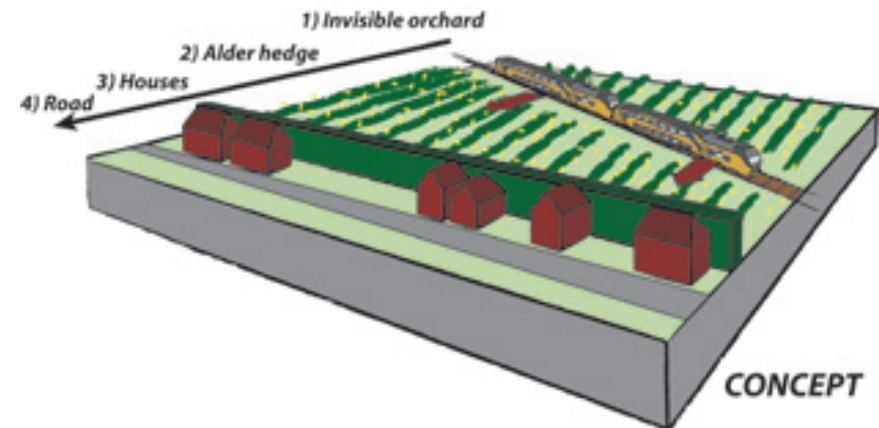
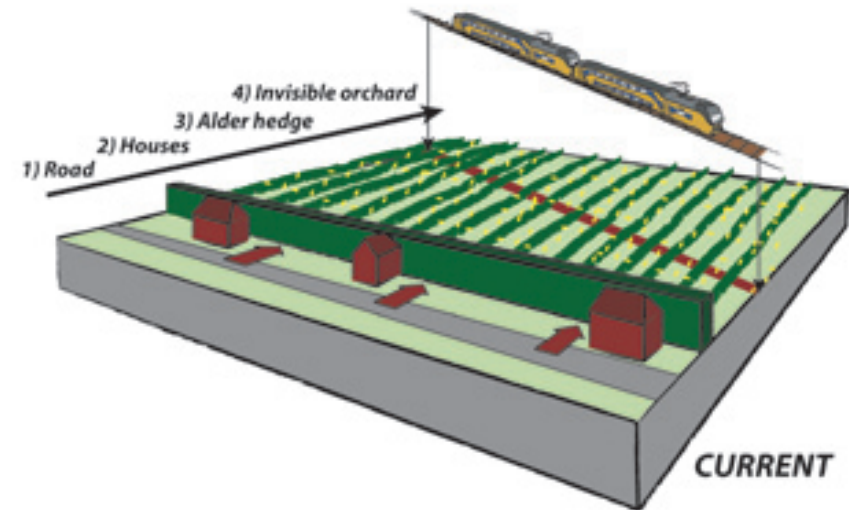


Figure 6.31: current landscape structure and the idea to turn around the experience.

This concept leads, with help of a model to find out the orientation of the orchard, to the following landscape plan (figure 6.32, 6.34). Some specification to this landscape plan:

Current plantings near the railway have to be removed.

Plant species:

- Alder hedge: *Alnus Glutinosa*.
- Fruit trees: pears (*Pyrus*), apples (*Malus*) or cherries (*Prunus*). In consultation with the residents of Laageinde and district Kalenberg.
- Oak lane: *Quercus Robur*.

Plant distances:

- Alder hedge: 1 m
- Fruit trees: 10 m
- Oak lane: 20 m

Ecological verge:

A gradual slope from high rail towards the water cares for different biotopes for animals and plants, which leads to more biodiversity. In combination with the extensive orchard, it is an attractive environment for breeding birds, mammals, butterflies and plants. Also the slope in the north, which is orientated to the south, is used for nature.

Entrances:

For the people of ribbon Laageinde and also for people of district Kalenberg, there are some entrances towards the orchard-park in the north and in the south, where the park touches the road.

Borders:

The borders of the park consist of water, the hedges and a low fence on the north side.

View from the train:

Horizontal coherence and the experience of season differences based on the colors (figure 6.33).

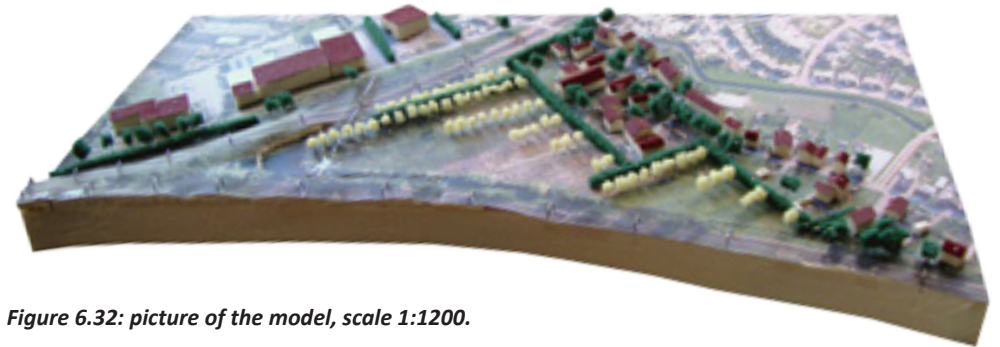


Figure 6.32: picture of the model, scale 1:1200.

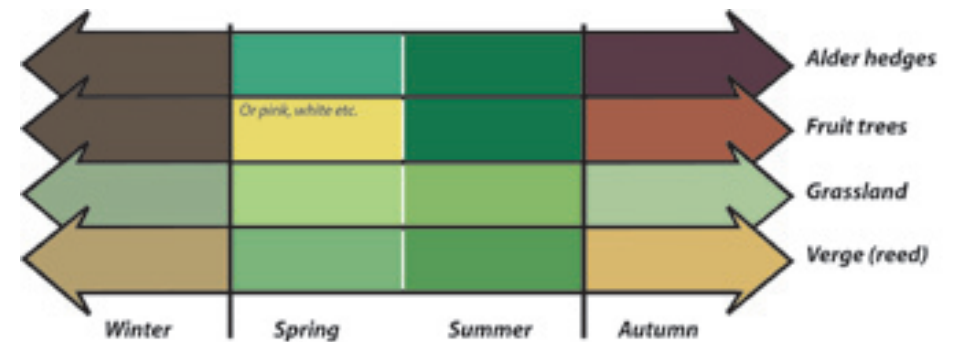


Figure 6.33: the color differences throughout the year.



Figure 6.34: landscape plan for the area between Laageinde and the railway

CONCLUSIONS AND DISCUSSION

Conclusions

Before starting with some concluding remarks, first a repeat of the objective of this thesis research. The main objective is to decrease the experience of cluttering of the landscape near the railway network, by means of the motorway panorama method. This objective can be divided into two different sub-objectives. A) To design a method to determine cluttering zones and panorama locations near the railway. B) To upgrade panorama locations and cluttering zones by designing with use of design principles. For both sub-objectives there are some conclusions.

The first sub-objective consists of a method to determine cluttering on one side and a method to determine panorama locations on the other side. Starting with cluttering, the first thing to mention in the conclusion is the used definition for cluttering. Cluttering is a spatial development or process that leads to a negative experience of random functions, structures and elements which are not in proportion or coherence with the esteemed image of the landscape on a place. With this definition, a gradation to measure cluttering near infrastructure is made, based on the number of annoying elements and the visibility of the landscape characteristics. Based on a film analysis and a questionnaire, this corresponds to the experience of the passengers to some extent. The conclusion comparing railways to motorways is that the experience of cluttering is even worse near railways than near motorways. For this conclusion some main points of this comparison have to be mentioned. Using the components in the definition of cluttering, the main points for cluttering in the motorway surrounding area are:

- Intensive used areas with cluttered functions and elements are all planned around sight locations near motorway entries and exits. The motorway is the most important axis for the development of business areas and industry.
- The experience of large scale cluttered functions is similar on each place and the term non places is applicable because of the lack of historical and spatial binding to the landscape. Remarkable is the fact that functions on sight locations try to attract

the drivers attention using advertisement.

- Main functions near the motorway are, in order of most occurring, business areas, industrial areas, utility areas, small useless green areas and areas under construction.
- Remarkable elements near the motorway, with respect to the railway, are: noise barriers, offices, motels, bridges or tunnels, showrooms etcetera.

The main points for cluttering in the railway surrounding area are:

- Extensive, unimportant and unused waste areas in the urban-rural transition zone that consist of cluttered functions which are less planned but developed in time. This development is independent to railway stations. Because railways developed earlier than motorways, the railway crosses more urban landscape.
- A variety of small scale functions near the railway are experienced as cluttered, as backside of the landscape or as hidden landscape.
- Main functions near the railway are, in order of most occurring, housing areas, industrial areas, business areas and recreational areas.
- Remarkable elements near the railway, with respect to the motorway, are: fences, gardens, flats, factories, sheds etcetera.

The other part of the first sub-objective is about designing a method to determine railway panoramas, which is described in chapter four. This method is based on the method to select motorway panoramas. The main steps for the railway panorama method are as followed. Step 1 is defining the visibility of the landscape from the train, using criteria for the minimal length and depth of a panorama view. Step 2 is the application of the problem of cluttering, using the gradation of cluttering as criteria. Step 3 is the description of the landscape characteristics, boundaries of the view, remarkable elements and connections. Step 4 is connected to the next part of this thesis: use the design principles to upgrade the potential railway panoramas.

The main conclusion for the second sub-objective of this thesis is easier to describe. The goal was to create design principles for upgrading panorama locations and cluttering zones. As visible in chapter five, the main outcome of this part are seven design principles for the railway surrounding area. The main topics of these seven principles are:

- Legibility; dealing with urban-rural contrasts, the contrasts between landscape types, contrasts between landscape units and the visibility of its characteristics.
- Opening up the verges and the land use for these places.
- Keeping the size of elements and planes near the railway as large as possible.
- Showing the front of the landscape instead of the cluttered backside.
- Caring for a sequence of landmarks in the middle-ground or background of views.
- Care for a pleasant rhythm of elements and functions near the railway on different scales.
- Strengthen the coherence within an alignment using an uniform design of railway furniture.

Looking at these seven design principles, the main differences compared with the motorway surrounding area are: the focus on legibility or the contrasts in the landscape on different scales, the principle about fronts, the principle about the size of the landscape and the principle about rhythm.

The final part of this thesis, chapter six, consist of testing of these seven principles by design, using three different designs, each with an own goal. Each goal leads to another strategy and way of applying the principles in a design.

Case 1) Business area Wildeman in Zaltbommel has a high gradation of cluttering in future plans. The principles can be used to prevent new cluttering zones.

Case 2) The brook valley of the Essche Stream near Esch is a potential panorama where some adaptations can lead to a spectacular view. The principles can be used to create or upgrade potential railway panorama views.

Case 3) The landscape near Geldermalsen between the intersection with the Betuweline

and the river Linge has a high gradation of cluttering that is focused on the invisibility of landscape characteristics. The principles can be used to upgrade current cluttering zones.

Role of the landscape architect

There is much debate about the use of principles and the role of landscape architecture. For the principles given in this thesis, based on the three test cases, the main tasks for the landscape architect are:

- When applying the principles in a design, a landscape architect should make an analysis and sketch the future situation for each principle. Because of the huge amount of information in the principles, a landscape architect is needed to know which information is useful and how can to apply this. In this step, the creativity of the landscape architect is an important factor.
- A landscape architect keeps in mind the landscape structures on different scales.
- A landscape architect combines the interest of the visibility from the train, which are the principles, with other interests in the area.
- A landscape architect has the knowledge of landscape characteristics and the experience of public space design to come up with a good design on detail.

Looking at the connection between landscape architecture and spatial planning or social spatial analysis, different parts of this thesis are important for different workfields. In the chapter about cluttering, measuring the experience of cluttering, could be a interesting research task for social spatial analysts. For spatial planning in this chapter, the gradation of cluttering and its use could be an input for further research. Also the connection between policy and the panorama method of motorways and railways, contains much research tasks for spatial planners. For landscape architects, the chapters about the principles and the testing are most interesting because it shows a clear design process from an assignment, of which the use of the principles is one part of it, to an detail design.

Research and discussion points

From the conclusions, there some discussion points and starting points to mention for further research and application of this thesis.

- The first point deals with the determination of cluttering zones. The outcome of the gradation of cluttering, a map of the level of cluttering near the railway, is useful for all kind of different spatial development near the railway. By making this map for the entire railway network of the Netherlands, it becomes clear which alignements or which regions require more attention. Also for the determination of national panoramas it is important to choose sites that are threatened by cluttering, based on the gradation made in chapter three. On short term, the map or a list of cluttering zones can be made of the entire railway surrounding landscape in the Netherlands. The actual change in the landscape, making plans to upgrade the cluttering zones, will be made on long term by landscape architects and spatial planners. The priority are the zones where cluttering is worst, which is the gradation number one: the heavily cluttered landscape where non of the landscape type characteristics and lots of annoying elements are visible. To summarize this point, based on a composite definition, the level of cluttering near all railway alignments can be measured and mapped so that it can be used for further spatial development like the the determination of national panoramas.

- The second point is about the method to determine parama locations, which is designed in chapter four. In four steps and criteria, it is possible to come to a selection of views which may become national railway panoramas, using the right strategy and implementation in policy. For this point, some further research is needed to answer questions like: which political level should be in charge of the determining the panorama locations and which rules for planning on other levels are connected? As a landscape architect, I do not have the knowledge and time to answer these questions. So to summarize this point, now it is possible to determine a number of landscape panoramas on an alignment but the next step is to come to political rules for spatial planning of these areas.

- In these thesis, the principles, adaptations and design ideas are based on the railway

surrounding environment analysis in only two landscape types. Besides the analysed river landscape and sand landscape, the Netherlands consists of the peat landscape, the marine clay landscape, the polder landscape, the loss landscape, the dune landscape, the moraine landscape and the peat moor reclamation landscape (Veldhuis et al. 2009). For these landscape types, an analysis is needed to see whether things have to be adapted, removed or added to the seven principles. So that also in these landscapes types the characteristics comes forward to show the variation of the Dutch landscape.

- As said in the introduction to the design principles, the focus is on the expierence from the train towards the landscape. Depending on the goals of the case on which the principles have to be applied, some comments can be made to the principles about the expierence of the railway from the landscape. This could be a next step or upgrade of the current design principles.

- Another point deals with the the addaptations and design ideas that can be applied to the railway surrounding landscape to upgrade panorama locations and cluttering zones, mentioned in chapter five. The seven tested railway panorama principles can be used to upgrade the railway surrouding landscape to get a better view from the train. They can be used as a guideline for new plans like business are Wildeman in Zaltbommel, to upgrade cluttering zones like Geldermalsen and to upgrade potential panorama locations like the brook valley of the Essche Stream. These principles can be used on short term as a guideline for spatial plans dealing with the railway surrouding landscape so that in railway design and in the design of the railway surrounding area, the view from the train and not only the view toward the train is taken into account.

Each research in the field of landscape architecture leads to new insights and new discussion points. Beside discussion points like a general definition of cluttering for all work fields or the usefulness of the panorama method, there is one last topic to mention concerning debates in landscape architecture. In the last decade, it is common to create design principles that can be used as a guidance for landscape architects when designing a particular area. For example, when designing an area near one of the main rivers in the Netherlands,

reports like the guidance spatial quality for the Waal, Rhine or IJssel comes forward (Linge et al. 2009) (Bosch Slabbers 2007). This is only one example and the railway panoram design principles is another, but there are dozens of reports containing these guides for landscape architecture. The discussion point is: how do landscape architects deal with design principles? I think, there are two opposite type of designers. The question is: what is best? On one hand there are the “right” designers who use the principles as the main tool or source of inspiration for their own design instead of using own creativity. On the other hand, there are the “original” designers who use own creativity and especially not the given design principles to be as original as possible. Or is the best in the middle: where the principles are a source of inspiration to enhance creativity? This is a discussion point wich returns every time when new design principles are reported - I mentioned it two years ago in my internship report - and which is of great influence for the design process of landscape architects.



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DEFINITIONS

Cluttering:	See chapter 3 for a detailed description of this term.	Panorama:	A panorama is a view that is visible from a high location, like a tower or a mountain top. In a flat landscape, like the Netherlands, this view is visible from ground level because of the visible openness of the landscape (Veldhuis et al. 2009).
Coulisse landscape:	Half open landscape has the character of a stage with side-scenes in the form of plantings and buildings (Veldhuis et al. 2009).	Railway alignment:	Defined piece of railway between one place and another (Van Dale, 2005). As explained in chapter 2, the alignment used in this thesis is the railway between Utrecht and Eindhoven.
Experience:	The experience of the landscape, which is the interaction between observer and environment, using sensory impressions and memories (Coeterier 1986) (Lemaire 2002). In this thesis, the focus is on the visual impressions.	Railway furniture:	In Dutch 'meubilering', are all elements on, in or near the railway which do not belong to the constituent elements of the rail itself (Drijver 2005).
Landscape:	A natural, rural or urban area, as perceived by humans, of which the character is determined by natural or human factors and the interaction between those (Veldhuis et al. 2009) (Vroom, 2005).	Ribbon village:	A settlement form that consists of an almost continuous construction of detached buildings along roads (Veldhuis et al. 2009).
Landscape levelling:	A process in which the distinction between urban and rural disappears towards a similar urban landscape without an own character (Hamels et al. 2009).	'Sight' location:	Geographical location which is visible from the motorway and is to a positive location factor for companies (Veldhuis et al. 2009).
Landscape type:	A group of territorial units which internally show a consistent construction, usually historically determined and it contains clear defined characteristics (Vroom, 2005). In this thesis the landscape typology in from Veldhuis (Veldhuis et al. 2009) is used. This typology is based on geomorphology, soil science, water management and cultural history (Barends 1986). Each landscape type consists of one or more landscape units.	Size:	In Dutch: 'korrelgrootte', the measurements of objects. The size of the landscape is set by dispersion and measurements of objects or elements such as groups of plantings or buildings (Vroom 2005).
Motorway:	All roads with an A-number with dual carriageway and no crossings on the same level (Veldhuis et al. 2009).	'Schrikeffect':	Translated to english: fright effect. This is the frightening effect when an large or remarkable element becomes visible unexpectedly (Huls, 1991).
Non-sides:	For this thesis, terms like non-sides, non-places, wastelands, waste areas, the Dutch word 'tussenland' is similar. It are, mostly small, undefined areas that occur because of the landscape transformation of functions near infrastructure that shows no connection to the landscape (Frijters et al. 2004).		

APPENDIX 1: QUESTIONNAIRE RESULTS

Target group: train travellers (age >20) on the alignment Utrecht-Eindhoven.

Method: Paper, 13 multiple choice (percentages) or open questions (italicized words are answers by people)

Response: 57 people, age varied 20 - 60, mostly students.

Date: 01-11-2010 and 03-11-2010.

Train type: High-speed train and slow-speed train.

1) Frequency of travelling by train:

- 20% • A few times a year
- 25% • One or two times a week
- 55% • Each (work)day

2) How often do you travel between Utrecht and Eindhoven (or part of it) by train?

- 15% • This is the first time
- 50% • Regular
- 35% • Always

3) Do you travel mostly by high-speed train/ intercity or slow-speed train?

- 85% • High-speed train
- 15% • Slow-speed train

4) Do you choose to sit upstairs or downstairs? And why?

- 33% • Upstairs Why? Better view, less noisy, quietness.
- 10% • Downstairs Why? Better view, less shaking, quietness.
- 57% • I don't mind, as long as there is a seat left.

5) What are your activities during the journey?

- 8% • Working
- 29% • Reading
- 12% • Talking with other travellers or calling

36% • Looking outside

15% • Other:Sleeping, learning, listening to music

6) When do you look outside?

- 39% • Constantly
- 0% • Never
- 27% • Near cities and villages when the train slows down
- 34% • Near open views (at grasslands or river floodplains for example)

When you have ticked the last option: where are, according to you, the most of these views?

- 19% • Utrecht – Culemborg.
- 48% • Culemborg – 's Hertogenbosch.
- 19% • 's Hertogenbosch – Boxtel.
- 14% • Boxtel – Eindhoven.

7) Do you think the visibility of the landscape is the same when travelling by train or by car (the A2 motorway between Utrecht and Eindhoven)?

- 5% • Yes.
- 53% • No, the landscape is better visible when travelling by train.
- 5% • No, the landscape is better visible when travelling by car.
- 37% • No idea, I have never travelled by car between Utrecht and Eindhoven.

8) How do you know where you are located on the alignment?

- 3% • The conductor will tell me when we arrive at the destination.
- 52% • The buildings and signs near the stations which we pass.
- 42% • Remarkable landscape elements (like rivers, churches or motorways).
- 3% • The type of landscape (pattern of ditches, relief, land use and so on).

9) Looking outside, do you see differences between the landscape near Utrecht and the landscape near Eindhoven? If yes, describe these differences shortly.

58% • No

42% • Yes, ... Near Eindhoven more forest, less landscape variety, more industrial areas, more business areas and the urban area is open. Near Utrecht, the landscape is more boring, there are rivers, more remarkable elements, more ditches and the urban area is more closed.

10) What is the most beautiful part on the alignment Utrecht-Eindhoven?

The answers on this question are pointed on map x.

11) Which parts of the view are ugly because of the landscape, according to you?

8% • Parts with lots of planting close to the railway.

11% • Parts with lots of houses close to the railway.

0% • At open views on housing areas.

0% • At views on grasslands.

25% • Parts with business or industrial areas close to the railway.

9% • At open views on business or industrial areas.

31% • Parts with noise barriers.

0% • At views on open agricultural areas with corn.

4% • At views on areas in construction.

5% • At views on greenhouses.

3% • At views on infrastructure (other railways or motorways).

4% • None.

12) On what part of the alignment are the most of these ugly views?

29% • Utrecht – Culemborg.

3% • Culemborg – 's Hertogenbosch.

17% • 's Hertogenbosch – Boxtel.

51% • Boxtel – Eindhoven.

13) What would you like to see more when looking outside from the train?

- Green 6 times

- Remove of graffiti 5 times

- Cattle (sheep and cows) 5 times

- Open landscapes 4 times

- Remove of plantings close to the railway 3 times

- Sunshine 2 times

- Advertising (funny)/ billboards 2 times

- More variety 2 times

- Covered / hidden ugly buildings 2 times

- Cleaner stations with new designs

- More relief: mountains

- Housing fronts instead of the backsides



Map x: Result of question number 10.

APPENDIX 2: CHARACTERISTICS OF LANDSCAPE TYPES AND UNITS

	Sand Landscape				River Landscape		
	Open heath reclamation	Sand dunes	Half open coulisse / bocage landscape	Brook valleys	Levee	River basin	Flood plains
Relief	High located landscape without relief. Very flat.	Many relief variety on a small scale which result in small steep slopes.	At the transition zone between high sandy ridges and low brook valleys.	Low, compared with surrounding landscape. A slope in the direction of the brook.	Higher than “river basin” and flood plains. Higher towards the dike.	No relief, very flat.	Relief of the dike on both sides, relief of the river itself, relief of gullies and creeks in between.
Geomorphologic elements and patterns	Located on the high sandy ridges and planes.	Because of wind erosion on the high sandy ridges, infertile sand dunes arise above the “podzol” grounds.	Traditionally best location for urban and agricultural activities on the sand grounds because of the favourable ground water level.	In the lower sand grounds, between sand ridges, the brook valleys consists of the same sandy material.	River sediment: sand and loam near rivers and also on levees of ancient rivers are visible.	River sediment: heavy clay planes in-between (old) levees.	Sediment of the river in creeks and gullies.
Land use	Because of the reclamation of heath and forest using fertilizer, all functions are possible in on the sand ground: urban activities, young forest, intensive and extensive agriculture.	Historically, because of forests reclamation and later heath reclamation, the natural developed sand dunes and planted forests are protected areas.	All kind of small scale agricultural activities. Old villages and new extensions together with business areas. The most common land use is grassland, forest and the combination of both.	Most of the valleys are ecologically protected and the landscape consists of grassland and (wood production) forest.	Varied, intensively used for fruit agriculture, tree nurseries and greenhouses.	All kind of urban and infrastructure functions, mostly grassland or groups of trees.	Nature (dynamic wetlands) and agriculture (meadowland).
Type of “verkaveling”	Large-scale linear block pattern (rectangular). Near villages, there are some irregular ancient agricultural fields.	No “verkaveling”. Forrest is divided in blocks.	Small-scale irregular “verkaveling”.	Non linear, irregular “verkaveling”, following the brook.	Irregular “verkaveling”, following river pattern.	Regular block “verkaveling” or sometimes strip “verkaveling”.	Irregular “verkaveling”, following river pattern.
Pattern of ditches	Linear and regular	No ditches	Irregular pattern	Non linear and irregular	Irregular	Regular, with an high water level.	Irregular
Urban characteristics	Most of the villages and farms are young and built in the last century. They fit into the linear pattern.	Traditionally no urban activities, only some new business, housing or recreation areas.	Old (ribbon) villages with old farms, together with new urban extensions.	No ancient occupation in the brook valley. There are some new farms, urban extensions or business areas located in valleys.	Ancient ribbon villages (or new extensions) near the dike and ancient (sometimes fortified) cities.	New villages, farms and business areas. Some of the villages are based on ancient ribbon villages.	Bridges, brick factories.
Historical elements (points, lines and planes)	Points: churches, farms, groups of trees. Lines: the entire linear pattern: roads, channels, ditches, lanes. Planes: blocks of agricultural fields.	Points: solitary trees, lakes (fens) Lines: no traditional elements, only new ones like channels and rail- and motorways. Planes: pinewood forest and sand dunes.	Points: Old farms, churches, solitary trees. Lines: roads, ditches, old lanes and wooded banks. Planes: small scale agricultural fields and forest.	Points: solitary trees, and new farms Lines: the brook itself and the green edges of the valley Planes: open grasslands.	Points: churches, mills Lines: dike, the road on the dike, ribbon villages Planes: agricultural variety	Points: churches and farms Lines: straight roads and ditches Planes: Large open grasslands with some groups of trees.	Points: old brick factories, ferry house and boat Lines: dike and river Planes: lakes and grasslands.
Openness	Open	Closed forest and half open sand dunes.	Half open	Traditionally open	Closed	Very open	Open

APPENDIX 3: ANNOYING ELEMENTS

	Sand Landscape				River Landscape			Flood plains
	Urban	Open heath reclamation	Sand dunes	Half open coulisse / bocage landscape	Brook valleys	Levee	River basin	
Area under Construction	0	0	0	0	0	0	0	0
Green leftovers		0	0		0	0	0	0
Tree nurseries	0	0	0		0		0	0
Greenhouses	0	0	0	0	0		0	0
Small farms		0	0	0	0		0	0
Horse riding school	0	0	0	0	0	0	0	0
Silos	0		0	0	0	0		0
Large barns / machine sheds			0	0	0	0		0
Camping area	0	0	0	0	0	0	0	0
Sports ground		0	0		0	0	0	0
Golf course	0	0	0	0	0	0	0	0
Allotments	0	0	0	0	0	0	0	0
Cross area	0	0	0	0	0	0	0	0
Recreation lakes	0	0	0	0	0	0	0	
Offices		0	0	0	0	0	0	0
Parking lots		0	0	0	0	0	0	0
Junkyards	0	0	0	0	0	0	0	0
Construction companies	0	0	0	0	0	0	0	0
Storage area	0	0	0	0	0	0	0	0
Transport area	0	0	0	0	0	0	0	0
Showrooms	0	0	0	0	0	0	0	0
Billboards		0	0	0	0	0	0	0
Factory	0	0	0	0	0	0	0	0
Roads			0		0			0
Motorways	0	0	0	0	0	0	0	0
Railways	0	0	0	0	0	0	0	0
Water purification plant	0	0	0	0	0	0	0	0
Bridges / Tunnels		0	0	0	0	0	0	
Landfill	0	0	0	0	0	0	0	0
Electricity pylons	0	0	0	0	0	0	0	0
Noise barrier (graffiti)	0	0	0	0	0	0	0	0
Villas and other remarkable houses		0	0		0		0	0
Flats		0	0	0	0	0	0	0
Houseboats		0	0	0	0	0	0	0
Backsides: gardens and fences	0	0	0		0		0	0

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