

LA Master Thesis

The Line in the Landscape.

Exploring the social and spatial opportunities of implementing innovative high speed railroad technology in the formation of transport flowscapes in the Netherlands.

Giordana Credendino

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Colophon

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Chapter I: Introduction

I.1 Fascination

My passion for architecture and its deeper meaning has always stood on the principles of merging art and technology to solve or express societal issues, in the environment we inhabit.

In my journey through the disciplines of Architecture, Urbanism and Landscape Architecture I have been fascinated by the classical notions of *virtú* and *technê* (Kite, S., 1999).

These notions of knowledge and craft have guided my curiosity to explore the limits of science and art, of experimenting and experiencing, and technology as a means to explore creativity.

One of the greatest architectural examples that inspired me in my journey is the creative technology invented by Filippo Brunelleschi (1377-1446, Florence, IT) for the construction of the beautiful dome of the Cathedral of Santa Maria del Fiore, in Florence (Figure 1).

Brunelleschi's machines truly revolutionized the Italian quattrocento culture of the engineer-architect, and inspired many more of us to investigate the role of technology within our discipline and within our society (Figueirido et al., 2021).

As mediators in the field of landscape architecture we must investigate the challenges and opportunities that "hinge upon how to represent different relationships involving nature, culture and technology." (Swaffield, 2002). Subsequently, I have learned to see the landscape as a human process that exhibits our social heritage, and technology as the tool with which we achieve meaningful goals.



Figure 1. Brunelleschi's dome (Illustration by Ferdinando Baptista, Edit by author)
The meeting point between art and technology, where the machine becomes an innovative tool that allowed Brunelleschi to achieve a unique and iconic dome structure, inspiring new generations of engineer-architects.

I.2 Problem statement

The brief that inspired this research is related to a physical gap in the railroad connection between the Randstad metropolitan region and the north of the Netherlands. The need for a new connection has been made public over the last decade and many plans have been presented to resolve this issue, but new landscape challenges emerged with every iteration, only highlighting the relevance of designing such a connection further. This thesis addresses the exploration of a new high speed train railroad infrastructure that will promote an increased green mobility solution, less airplane travels within Europe, but also more research into innovative solutions.

I.2.1 Connection

The Netherlands has a rich history of railway construction that makes it possible for a leading number of daily commuters to live and work in different environments on a national level (Schwanen et al., 2004). This enriching lifestyle is powered by extensive networks that form enviably engineered connected flowscapes, such as the Randstad metropolitan region (Figure 2). However, as the country aims at addressing mobility demand increases, new spatial, environmental and social challenges emerge that need to be addressed in the field of landscape design (Barten et al., 2020).

By creating a social landscape map of the emerging daily commuting demand nationwide, one can visualize the problem in Figure 2. The 10 biggest cities in the Netherlands by inhabitants have been mapped as an area equal to the spatial reach by public transport within 60 minutes (considered to be the maximal daily commute), and colorized based on an averaged daily travel demand. The railroad network has been applied as the top layer on the map, to better visualize this unique gap in the structure. By comparing on both a qualitative and quantitative level the attributes resulting from this research with existing patterns on the territory, one can conclude that the city of Zwolle fits the model of central node observed in the commuter city of Utrecht. Although the similarities are striking, the redevelopment of Zwolle as commuting hub is only being considered partially in newly trending developments.

Over the last decades, a lot of effort in research and design has been put into filling this northern railway connection gap, but the public's scrutiny has deemed the landscape itinerary of Friesland, Groningen and the Drenthe regions too vulnerable to build upon (Lelylijn, 2022). In June 2022, the Dutch government announced yet another possible solution for this connectivity issue, submitting the new Lelyline connection directly to the European Commission as a potential link in the Trans-European Transport Network (TEN-T) initiative (TEN-T, 2013), (Lelylijn, 2022) (Figure 3).

This Lelyline has received abundant funding by the EU and will connect Amsterdam to Groningen, but the same controversies regarding the implementation of outdated railway technologies, within vulnerable cultural landscapes arose (Van Der Maas, 2022).

How can we ignore the opportunity of depressurizing Utrecht, enlarging Zwolle and adapting new methods that might revolutionize our railway system? Why apply the same old technologies that are known to cause spatial issues?



Figure 3. Temporary planning of the Lelyline
The controversial itinerary through the vulnerable landscape of Friesland.

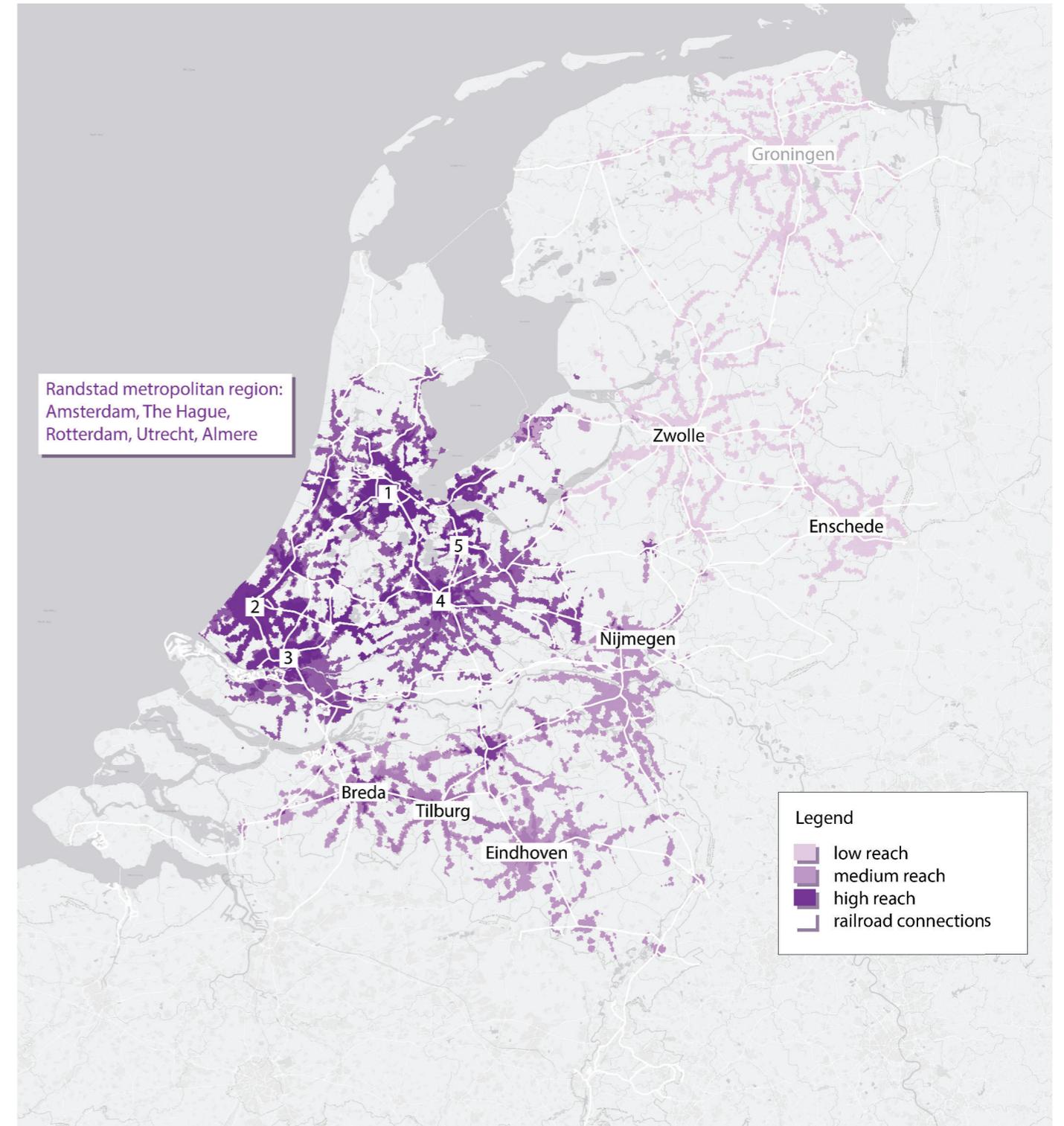


Figure 2. Reach within 1 hour of traveling by rail
The gap in efficiency and accessibility of the system proves to be great in the north, although it shows many viable opportunities to take advantage of the ideal location of Zwolle as second train hub, next to Utrecht.

I.2.2 Barriers

It is imperative that modern society begins striving for a more accessible and open infrastructure, as our current urban tissues densify and become increasingly dictated by structures designated to connect A to B, while truly dividing us through cuts in the landscape, creating residual pieces of land characterized by obstacles in our everyday pedestrian activities (Jaeger et al., 2007).

Heavy rail infrastructure is in fact generally associated with barriers and cuts within, and outside the built environment. They create physical separations in the landscape that result in habitat fragmentation, as well as physical and mental distancing between people and functional places (Figure 4). Railroads are considered dangerous infrastructure, requiring gates, crossing points, automated bars and dikes to protect us from it. In a spatial situation, they dictate where we are allowed to go, how long it will take us to get there, and which elements we are able to see (Figure 5). Subsequently, the land is split, fragmented and marginalized by these developments (Barrientos & Borda-De-Água, 2017) (Figure 6).

The station area at Zwolle is one of the many urban examples that we find to be splitting the city and redirecting traffic in ways that cause cognitive confusion and very strong functional separation within the city (Van Der Maas, 2022). Our future development goals should aim at addressing present issues, as well as resolving past disruptions.

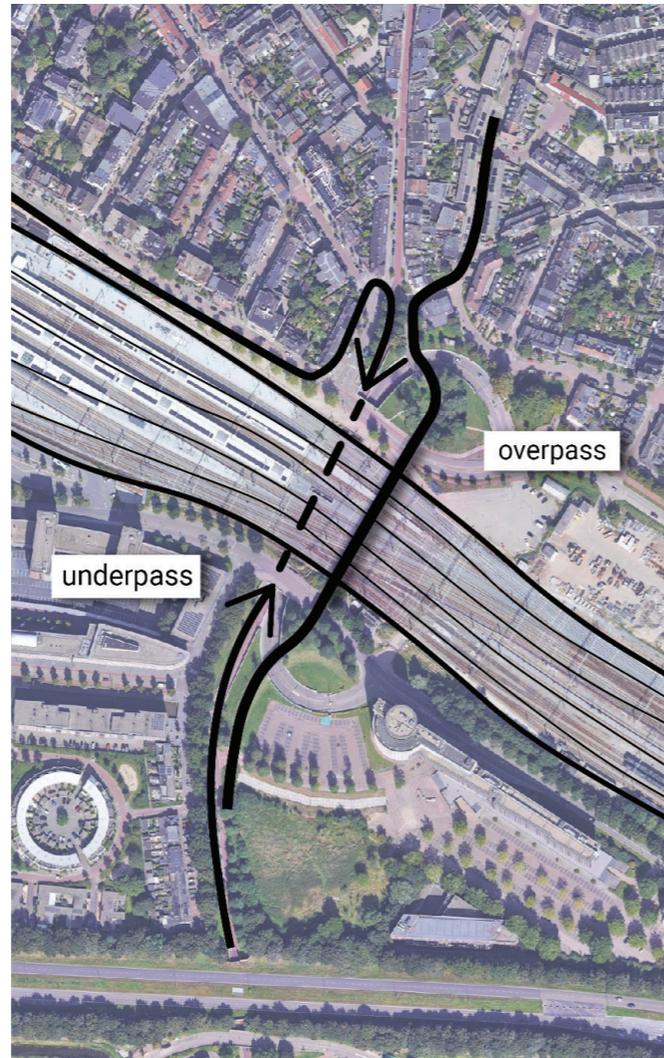


Figure 4. Case study Zwolle spoorzoneplan
Demonstrating the inaccessibility of the area, where train traffic is prioritized over slow mobility which is placed either on an overpass or underpass.



Figure 5. Case study Zwolle spoorzone impression (Bai Fazhong + Author)
Pedestrians are forced to turn left at the railroad dike, where all the spatial elements introduced in the area redirect the attention and accessibility away from the railway.

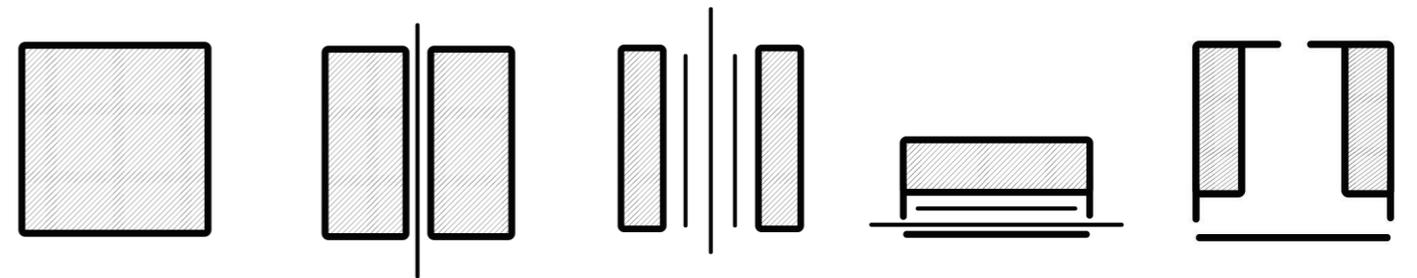


Figure 6. Zwolle railroad barrier:
The landscape system starts from a bound square, is then cut by railroad itself, then dissipated by the many barriers barriers, then disrupted by tunnels and underpasses, and finally results in a fragmented landscape that does not function as a system anymore.

I.2.3 Social relevance

In recent years our governmental institutions have focused special attention on creating visions for the future that include many fields of social interest. As a base for these efforts stand a number of Sustainable Development Goals (SDGs) set by the European Union which include a “green” system of public networks that is sustainable, inclusive, and accessible (TEN-T, 2013), (UN, 2015).

Researchers and experts in the field of high speed infrastructure and public transport networks have spent decades discussing the potential of large scale developments in the application of sustainable connecting systems, yet the European network has slowed down its growth within the last 15 years (Figure 7). Numbers show that the construction of high speed rail has improved drastically, as shorter lines are able to achieve faster speeds with very positive investor and client satisfaction (Figure 8). Yet the Dutch infrastructure does not yet challenge the goals set, as the topic of inclusivity does not emerge in the actual construction of the infrastructure, as we see the costs of complicated curvilinear implementations through vulnerable landscapes are leading to very expensive and inaccessible facilities (Figure 9) (Koppenjan and Leijten, 2007).

In the exploration of technological application and landscape transformation by means of flows, one must address the biggest concern: who are we doing this for? In the topic of invasive emerging technologies, public interest has played an important role in establishing the contours of satisfaction and acceptability.

In the cases of energy production, agricultural practices, transportation, and information systems, individuals and activist groups have made their opinions heard with movements such as NIMBY-ism (Not In My Back Yard). This last describes the unwillingness to participate in transformational installments of invasive technology within close by areas to our living environment, leaving many large scale projects unresolved (Schively, 2007). But how can we achieve different results if we keep resorting to the same practices?

There is no “one fits all” solution to any societal and environmental issue, however the acceptance of invasive landscape technology has become quite a complicated and rare consensus to reach. Is society not willing to embrace change?

“The desired future for rail requires a bold vision and a strong will to implement change on the part of governments, the rail industry and those training the rail engineers of the future.” (Arup, 2019)

Therefore what this research aims at discovering is the potential ways in which bold and innovative technologies can be introduced into society, inspiring a more inclusive and sustainable railway landscape design (Arup, 2020).



Figure 9. HS network in Belgium and the Netherlands
The gap in the high speed railroad system is evident and inefficient, the structure itself is unable to provide the services that we wish to achieve in terms of sustainable travels.

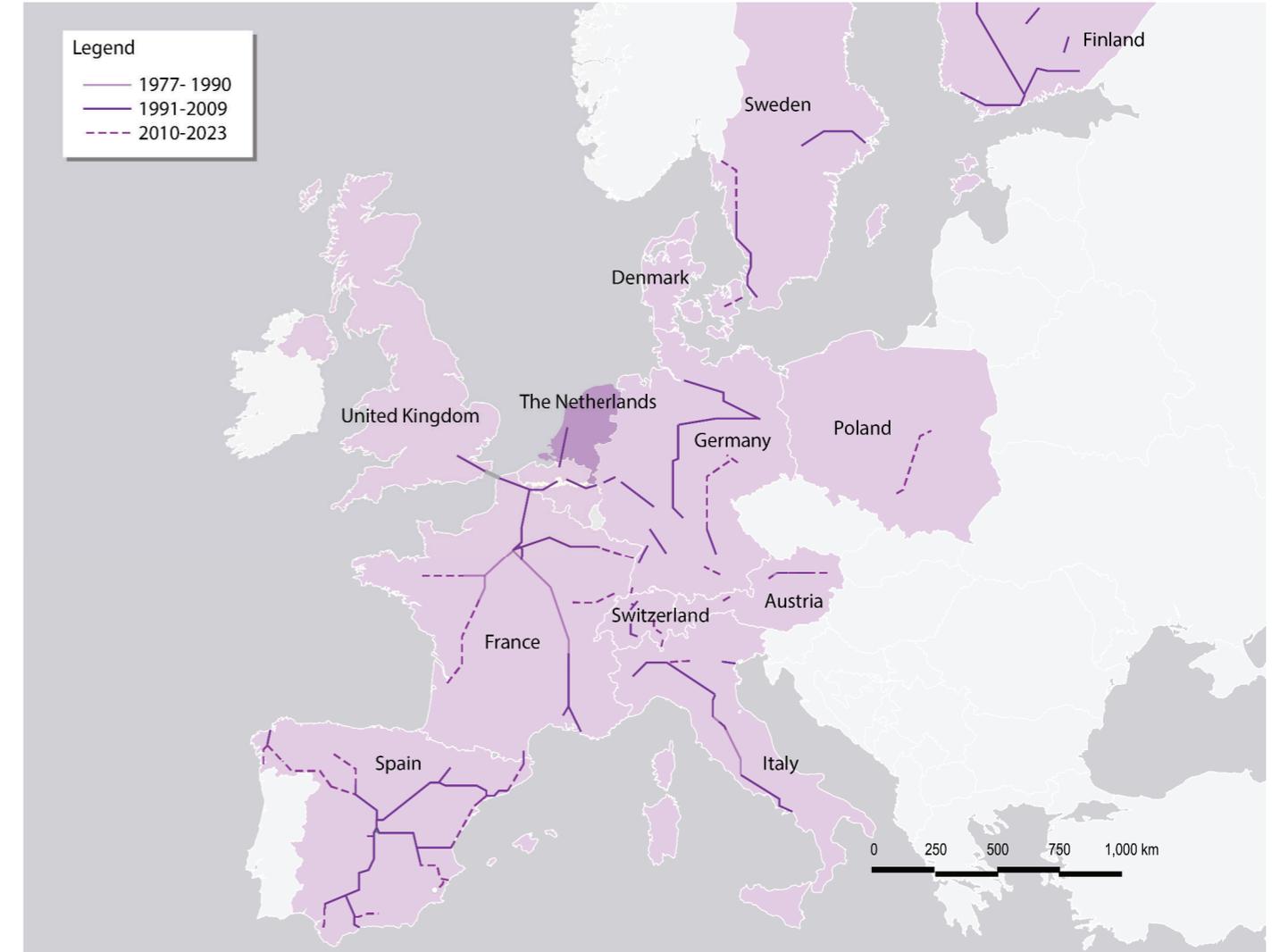


Figure 7. HS network in Europe
Similarly to the Belgian and Dutch system, the European network is incomplete, the leading countries in terms of system are France and Spain, where the high speed industry is much more advanced.



Figure 8. speed of train increase and potential
France proves to be the leading country in railroad extension as well as speed achievement, proving that extremely high speeds can be reached with already existing technology and knowledge.

I.2.4 Future relevance

This master thesis explores the possibility of implementing a more interactive railroad structure between the north and east of the country, taking advantage of the potential of Zwolle becoming a central node for sustainable high speed transport within the Netherlands. Catering to both the demand increase and the strategic commuting locations of Amsterdam, Groningen, and Enschede, Zwolle will connect the north with the heart of the country better, as well as facilitating a new international connection with Germany and Scandinavia (Figure 10).

This research and project proposal introduces innovative developmental concepts and technologies to resolve the past and present issues of infrastructural barriers, expensive and time-consuming developments, unsustainable domestication of cultural land and the European goal of CO2 neutral travels within the union (TEN-T, 2013), (UN, 2015).

The professional objective of this report is to re-think the current design process behind building railroads, resulting in the technical implementation of a 10 m high and wide viaduct in a densely planned landscape. The technology used for the construction of the railroad will elevate the structure on pillars, creating no continuous physical barriers on the ground level. The spatial challenge of this brief is to integrate such an invasive technology through kilometers of dense cultural landscapes.

By exploring this topic from a landscape architecture lens, this thesis reevaluates our systems and preconceptions about what the role of a landscape architect should be within these complex infrastructural projects. In the design chain, civil engineers conceive a network from A to B, envisioning a smooth implementation that aims at not causing political and environmental tension. The efforts of landscape architects are only required in the final steps of mitigating the implementation of the system

with the underlying land (Arup and AECOM, 2016). This results in complex curves and less aesthetically invasive solutions (like tunnels and bridges). The here presented research hypothesizes and tests the applicability of a new viaduct structure, consisting of straight self-assembling segments that might potentially revolutionize the way we build railways and travel within Europe. This machine does not only facilitate the construction phase of the project, but also the design liberty that comes with such versatile and iconic structures, in terms of landscape continuity, public functions and vitelline opportunities (Figures 11,12,13).

The numerous “what ifs” and assumptions create a visionary collection of research and design that will hopefully inspire our idea of landscape innovation as a meeting point between art and science, experimenting and experiencing.



Figure 11. Shinkansen (photo by Blanscape/Dreamstime) Symbol of elegance and landscape integration in the field of Japanese high speed trains.



Figure 12. Viaduct d'Avignon (photo retrieved by google/maps.com) Classic viaduct high speed train that became an icon of the French landscape.



Figure 10. Potential connection from Enschede to Berlin, connecting to the high speed line in Hannover Proving that implementing such a network in the Netherlands would benefit sustainable traveling within Europe as a whole, opening the doors to an extensive high speed network.



Figure 13. The Underline, Miami (image by theunderline.org) Modern definition of the many activities and functions that the viaduct typology allows.

I.2.5 Technology

Creating and understanding are at the base of this research into the world of technological possibilities. In order to create a more sustainable and connected future we must understand what limitations these technologies might have.

Starting from the building process, until the actual operation of the train itself, the infrastructure that will be designed requires spatial awareness that follow strict rules that cannot be ignored, and that will form a number of parameters for the design itself.

The construction process begins in a prefabricated environment, requiring accessible industry and material acquisition. Once the members are ready, the land requires minimal acquisition and minimal preparation (Figure 14). The machine that assembles the elements works by autonomously moving along the prefabricated tracks, not requiring further infrastructure, beyond the starting point of assembly. Once all the prefabricated elements are assembled, the machine is dismissed at the train station. This process requires a maximum of repetition in the members and a maximum of straight members (Zhihu, 2022).

The functioning of the high speed train also requires a precise form of infrastructure that allows for very minimal curves. In other words, the radius of said curves directly affects the speed of the train (Figure 15), (Fundación de los Ferrocarriles Españoles, 2022). Each radius can be classified functionally and visualized as city curves lines (Figure 16), city detours (Figure 17), and landscape lines (Figure 17). More on these requirements will be discussed in the initial design stages of the project, solely translated into spatial values, without focusing on complex calculations.

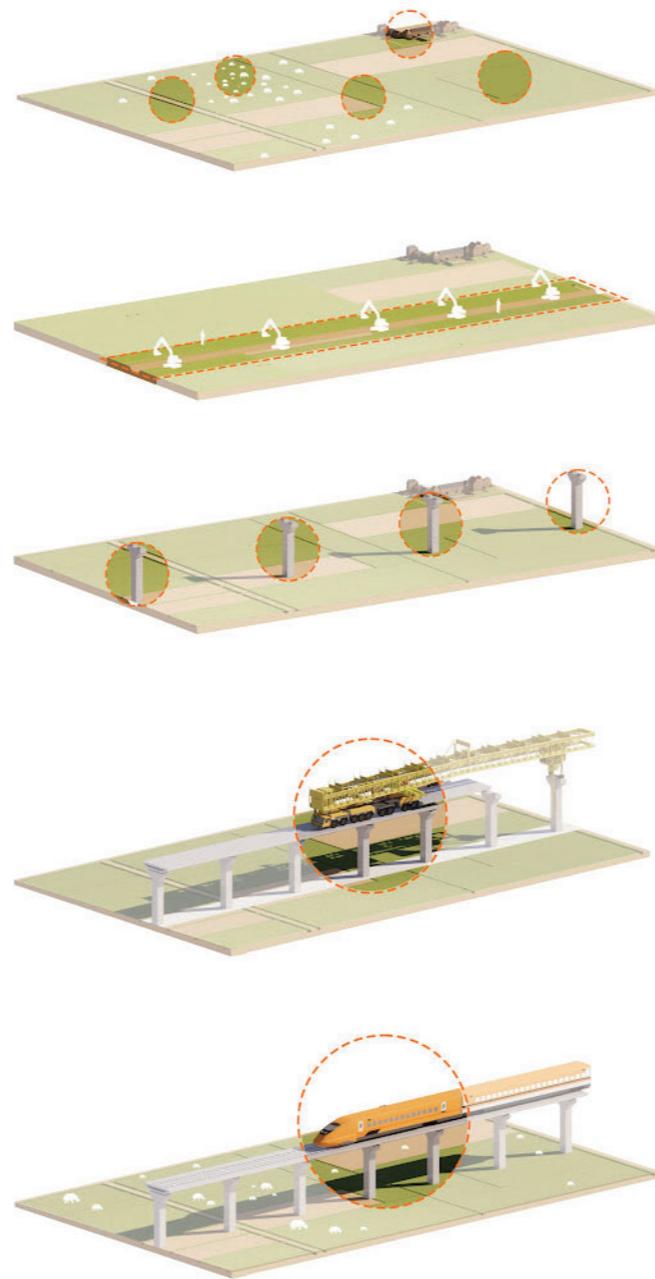


Figure 14. On site assembly process:
 Accessible landscape with industry;
 Minimal land acquisition and digging;
 Support members are secured by hand;
 Machine autonomously builds modular precast railway members.
 Train can function without the infrastructure creating barriers.

Cur	Japan			France			Germany			
	Line Type	V_{max}	R_{min}	Line Type	V_{max}	R_{min}	Line Type	V_{max}/V_H (km/h)		R_{min}
		(km/h)	(m)		(km/h)	(m)		Passenger train	Freight train	
	Tokaido Shinkansen (present situation)	220	2500	Southeast line	270*	4000 (3200)	Wurzburg–Hanover Mannheim–Stuttgart	250	80	7000 (5100)
	Sanyo Shinkansen (east of Okayama)	250	4000	TGV Atlantique	300	4000 (3400)	Berlin–Hanover	250	80	4400

Figure 15. Relation between speed of the train and curve radius for different train sizes and uses. The radius of the curvature of the railroad is the biggest influence on the speed that the train can reach.



Figure 16. Curves used inside the city with a radius size of around 40 meters. These types of curves described by the inner city radius only allow for very slow speeds, these are therefore off limits for this project.



Figure 17. Curves used to leave the city and to circle around urban areas with a radius size of around 400 to 4000 meters. These curves are called city detour and landscape line typologies and they describe curves that allow for acceleration on medium and high speeds, these typologies are ideal for the high speed railway.

I.3 Research Question

In this thesis, I explore the possible landscape benefits of a new invasive railroad technology within the Dutch landscape, to achieve a more connected future. The railroad connection between Zwolle and Enschede has been chosen as a location for this brief, studying the opportunity to create a future international high speed connection between Enschede and Berlin.

The main goal of this research is to use the viaduct technology to explore as much of the territory as possible, in order to describe a spatial application for this high speed train technology. Therefore the reading and writing of the landscape will be dictated and guided by the structure itself and its impact on the landscape.

I.3.1 Main Question

I argue by tackling the social design of the new infrastructural landscape, one can create a more inclusive way of integrating invasive technologies as to form a resilient and future proof system that can change and adapt with time. Thus, the overarching research question of this thesis is:

What are the social and spatial opportunities of implementing an overpass railroad technology within the Dutch cultural landscape?

I.3.2 Supporting Questions

The supporting sub questions to this research deepen the knowledge on the interrelations between landscape, technology and society.

The answer to “What are the challenges with the current system?” will provide a base line for possible opportunities to be compared and tested.

The answer to “What are the potential challenges of the new system?” will provide an insight into a technical and social brief to tackle the implementation.

The answer to “How to tackle these challenges through design solutions?” will lead to a toolbox of potential applications of the technology that will need to be tested on the landscape.

The answer to “What are the boundaries of the project?” will lead to an overall reflection upon the impact area of the development, including further knowledge on the opportunities regarding this type of technology.

The answer to “What are the spatial and social values of the landscape?” will provide insight into the social and spatial aspects to highlight in order to provide opportunities for the cultural landscape.

The answer to “How to highlight these through design principles?” will provide an overall perspective and material for reflection upon the actual integration of this technology within the landscape, completing the roadmap towards answering the main research question.

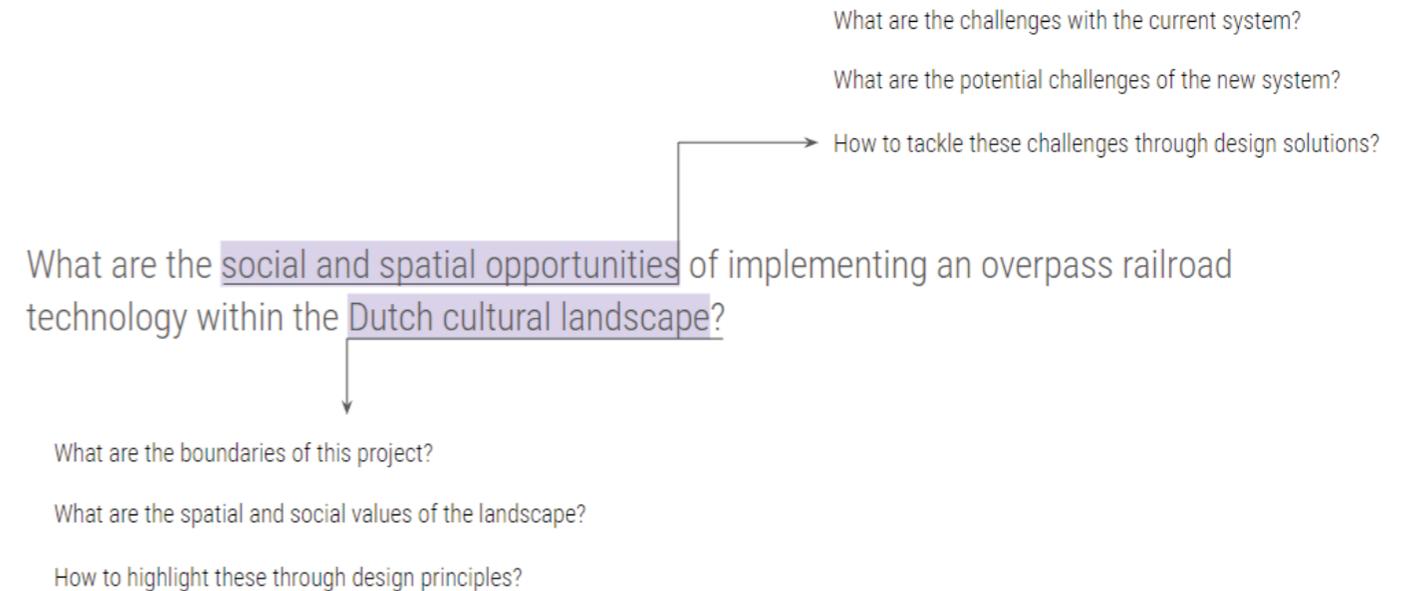


Figure 18. Relation between main question and sub-questions
Each sub question aims at answering a relation between the landscape, technology and society, focusing on spatial attributes.

Chapter II: Methodological Framework

This spatial research aims at investigating the design opportunities to form a more connected system of railroad landscape from a social perspective. Thus the research will take into account two main research fields, Landscape Architecture and Sociology. All theories derived will then be translated into spatial design methods to truly answer the research questions, and synthesize the findings in site specific design solutions.

II.1 Framework

The exploration that will be conducted in order to answer the research question and ultimately test the application of the overpass railroad technology needs to reflect the aforementioned fields of research. In the landscape architecture lens, the object of research is defined as a system. In this specific thesis, three main aspects need to be considered as imperative for the understanding and creation of social and spatial values and opportunities. One framework will inform us on the spatial systems that create flowscapes (complex networks), one framework will inform us on the social attributes of acceptance of landscape technologies and the last framework will provide a spatial reference for the small scale appreciation of this technology. The methods described below are experimental and require a research design that will allow for a smooth and sequential appropriation of these frameworks.

II.1.1 Flowscapes Framework

According to Nijhuis S. and Jauslin D. (2015), "flowscapes" are regarded as an advanced landscape design framework, which not only aims at resolving immediate problems and adapting to the environment, but also reacting to dynamic processes, creating conditions for future natural and human development. The flowscape framework therefore transforms single purpose infrastructure (a to b connections) into operative landscape structures which consist of processes and interactions. In this Master thesis the flowscape framework will be applied to the design of a high speed network with focus on sustainable social processes (Nijhuis, Jauslin and Hoeven, 2015).

II.1.1.1 Research Methodology

This research sees design as a tool to conceptualize and test the applicability of innovative infrastructure as a multidisciplinary, semi-qualified approach that focuses on the spatial quality of said structure. Speculation will be welcomed in order to test multiple theories and explore imaginative visions (Figure 19). As the final result of this thesis will be a site specific design proposal on the basis



Figure 19. Speculative Procedures (Busquets et al, 2007)
The non linear and complex application of conceptual and educated guessing over factors that are relevant and factual.

of generalizable mitigation theories and approaches between technology and landscape, the research will include various exploratory design methods.

Three types of design research are used in this master thesis to approach, investigate and test the applicability of this framework. Research for design is used to inform or validate the design by acquiring targeted information as an input for design. Research through design is used as a tool to explore, identify, and map possibilities to inform on alternative concepts and ideas. Finally, research on design aids with finding specific design concepts, principles, precedents, or types as a foundation for future design (Nijhuis and de Vries, 2019).

II.1.2 Technology, Landscape and Society

Technology has played an incredibly important role in the creation of our landscape as we know it today. Polder landscapes, coastal landscapes, energy landscapes, and urban landscapes would not exist without machines, engineers and innovation. As our society grows we use more resources and expand our use of technology in the landscape as an inevitable response. With public interest

growing in the protection and nourishment of our natural environment, many technologies have been deemed socially unacceptable and rejected by the population through phenomena such as the not in my back yard (NIMBY) mentality.

But these technologies need to be tested and implemented if we want to fulfill the public demand for energy, transportation, food, water supply, etc. In order to do so, research-through-design, following the flowscape design framework needs to be guided by social theories that can be generalized and tested.

II.1.2.1 Unified Theory of Acceptance of Use of Technology (UTAUT)

Landscape technology (and all other technologies) need to go through stages of designing, planning, testing, implementing and marketing before they can actually be applied to solve societal issues. The UTAUT informs on what factors influence the acceptance of use of technology, allowing researchers and designers to focus on certain conditions.

This theory suggests that the actual use of technology

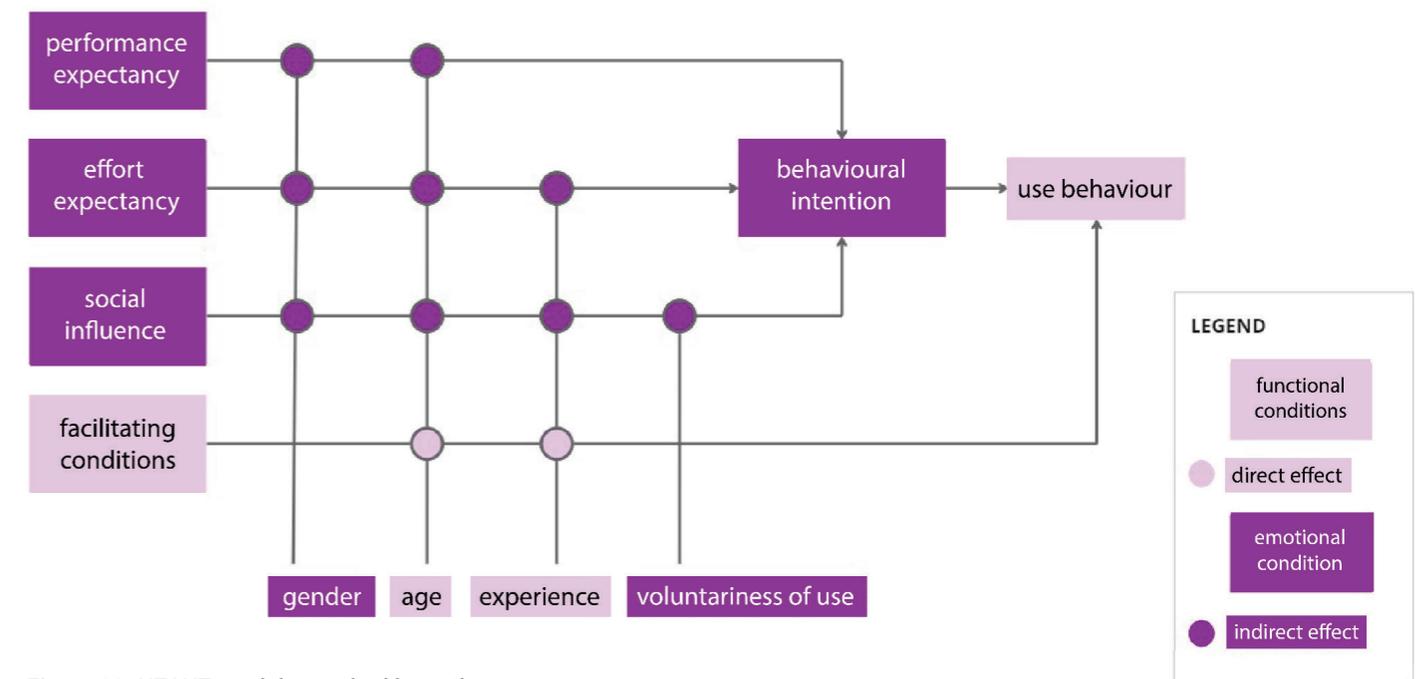


Figure 20. UTAUT model reworked by author
Describes the extent to which emotional conditions reflect the behavioural intention of the use of technology, which makes for the biggest portion of factors that influence the use behaviour.

(use behavior) is mostly determined by behavioral intention. The likelihood of accepting a technology is dependent on the direct effect of four key constructs, namely performance expectancy, effort expectancy, social influence, and facilitating conditions. The effect of each construct is moderated by age, gender, experience and voluntariness of use.

The retelling of the UTAUT model (Figure 20) highlights the dominance of emotional conditions effecting indirectly the use behavior of participants towards new technology.

II.1.2.2 Three Dimensions of Meaning

As a society we share culture and aspirations and we are capable of articulating meaning from our environments, by reading the influence of technology on our landscape. Robert Thayer explores the human emotional response to the landscape in his beautiful article Three Dimensions of Technology in the American Landscape (1994). He describes the human attitudes of Technophobia, Technophilia and Topophilia (Figure 23).

Unfortunately, technology is seen as a double edged sword, as it is a positive demarcation of modernity, yet in clear opposition with nature. When we perceive an environment, we identify the elements that compose it, we scan for elements that do not belong where they are (perceptual dimension) and we try to assign them a function (functional dimension) and we reflect upon them (symbolic dimension) (Figure 21). This is what happens with technology in the landscape, and in every case, Thayer explains that every individual expresses attributes of Technophobia, Technophilia and Topophilia (Figure 22) (Thayer, 1992).

My purpose in experimenting with this framework is to suggest that each contributing dimension can be utilized as tools in the design process of technological landscapes.

II.1.2.2.1 Framework

The three dimensions of meaning elaborated below, form a framework for the readability of the landscape design by guiding research through design that aims at informing on alternative concepts and ideas within Perception, Function and Symbolism

The Perceptual Dimension (Figure 21) allows us to categorize technological landscapes according to how perceivable or conspicuous they are. Invisible technologies make no perceivable changes to the land. The implicit ones are those that make changes to the "natural" landscape and then recede. Explicit landscape technologies are those that predominate our perception and form the background for activities. The iconic ones are those that are highly conspicuous and stand out from their background as focal points (Swaffield, 2002), (Thayer, 1992).

The Functional Dimension (Figure 21) helps us gather the meaning of technological landscapes based on their primary utilitarian roles, which can differ per society. Transformative landscapes convert raw materials to secondary products. Energetic landscapes generate and/or distribute energy. The transportive ones allow for movement of goods and/or people. Agricultural landscapes produce food, and finally informative landscapes are responsible for the processing and transmission of information (Swaffield, 2002), (Thayer, 1992).

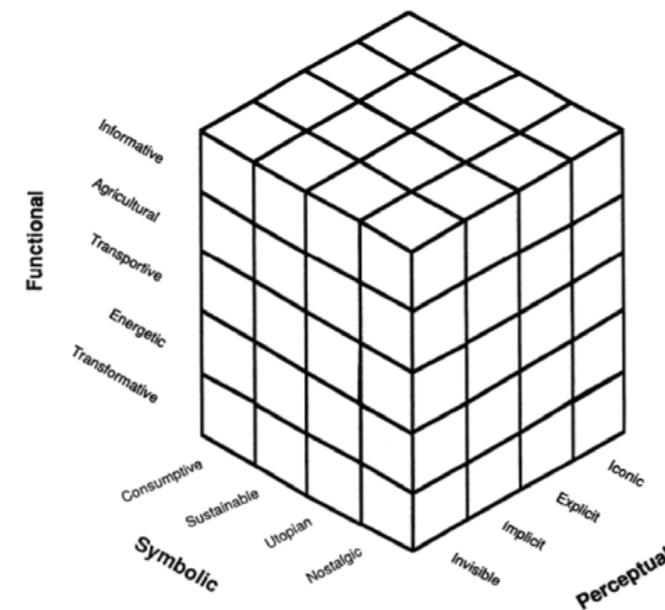


Figure 21. three dimensions of meaning with their respective emotional relation to the landscape (Thayer, 1992). These terms are used to form an opinion and to understand the meaning and relation between these technologies and our landscape.

The Symbolic Dimension (Figure 21) relates to the most emotional side of humans in terms of value of the past, present, and future, and in terms of their sustainable or consumptive role in regards to resources and ecosystems. Consumptive technological landscapes "consume" disposable resources, while sustainable technologies allow for longevity, by utilizing renewable resources (Swaffield, 2002), (Thayer, 1992).

In the words of Simon Swaffield after the work of Robert Thayer: "Through repeated experience with many landscapes, participants mentally construct a cognitive framework of subjective meanings based on perceptual,

functional and symbolic dimensions." (Figure 21 and 22) "Participants respond to a specific landscape as if it were an 'objective' stimulus, placing it in a relative 'field' of various proportions of topophilia, technophilia, and technophobia." (Figure 22 and 23) (Swaffield, 2002).

This detailed framework will form the basis for a less complex application of the principles of perception, function and symbolism, which will lead the exploration of the landscape on the scale of experience. Therefore the method used will reflect the landscape experience over the personal experience, relating the two through this framework description.

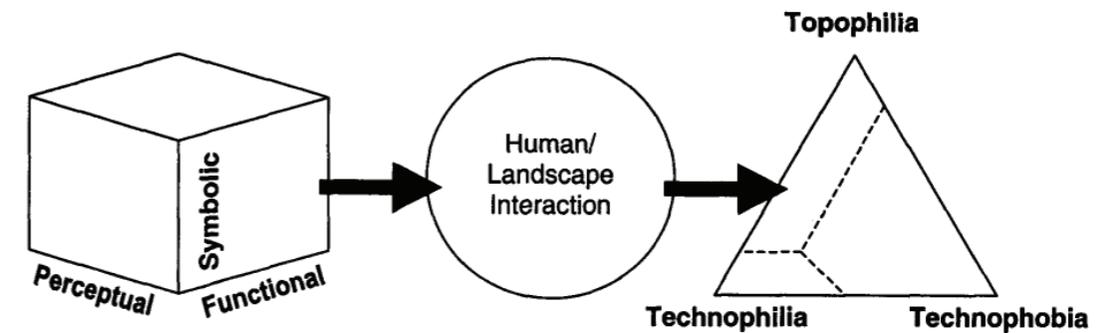


Figure 22. Formulation of Topophilia, Technophobia, and Technophilia through the experience of technology within the 3 dimensions of meaning. The perceptual, functional and symbolic dimensions are the emotional factors that influence the behavioural intention towards the use and acceptance of technology where technophilia, topophilia and technophobia are the terms used to describe these emotions.

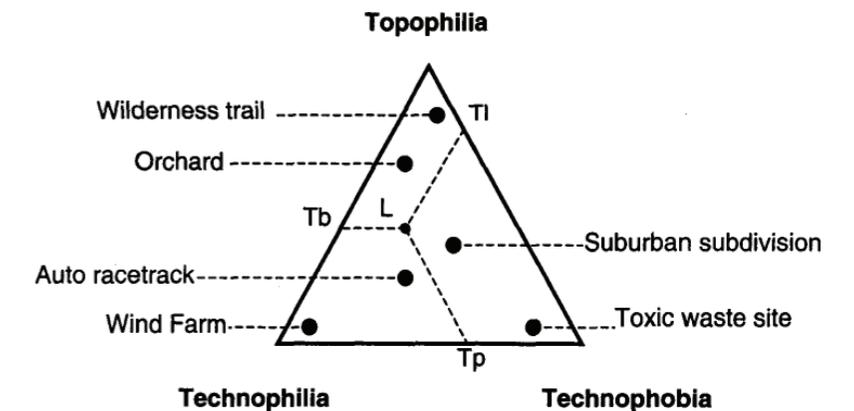


Figure 23. Topophilia, Technophilia, Technophobia: three attitudes toward technology and landscape. Examples of the landscape technologies that create the emotional attitudes of technophilia, topophilia and technophobia.

II.3 Research Design

The way in which this research and landscape exploration are organized is based on the overall frameworks of flowscapes, which dictates the attitude of the railroad as a complex network that changes through social and environmental processes, and the three dimensions of meaning, which describe the integration of the railroad within the landscape as seen by society.

These two lenses are necessary to obtain an answer to the sub-questions that describe the relations between landscape, technology and society that are investigated in the main research question.

The challenge based brief of this project requires a combination of theoretical and practical experiments which are based on exploration and experience.

Literature reviews will define the challenges and opportunities regarding current and future railroad technologies. Existing guidelines define the technical and social brief regarding railroad design and the technical implementation of railroad technologies. The method of research through design will allow for vast experimentation with different alternative options that will inform on the approaches to be taken. Research for design will allow for an assessment of the options and for a formation of conclusions. Finally, research on design will allow for a comparison and generalization of the findings into design principles, which will lead to an overall assessment of the implementation opportunities.

The scheme here presented aims at visualizing the relation between the process and the research goals (Figure 24).

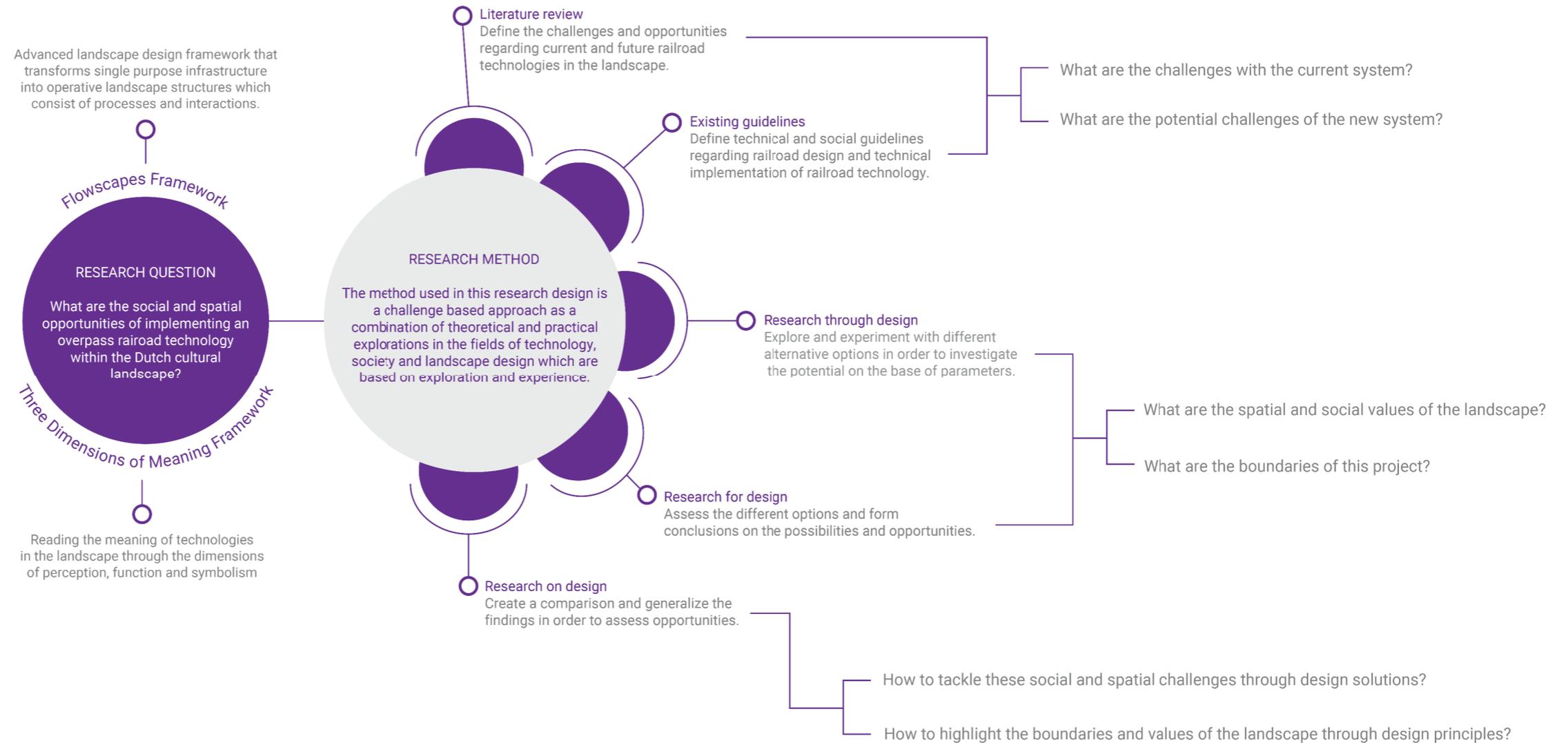


Figure 24. Research Design on answering the main research question
Visual representation of the research process as an organizational tool to answer the research questions.

Chapter III: Line in the Landscape

In this chapter the implementation of the high speed railroad journey from Zwolle to Enschede is discussed.

The reader will find an initial Alignment of the railroad keeping into account technical, social and spatial parameters; a research on the perceptual, functional and symbolic dimensioning of the viaduct; an initial implementation of the railroad technology in the landscape of Overijssel.

Furthermore, a location will be chosen for the detailed design.

III.1 Boundaries: Overijssel by train

In this initial research on the location and project boundaries, the existing railroad itinerary between Zwolle and Enschede is analyzed, conceptualized and used as a design exploration. The analysis here presented allows for a layered knowledge that takes into account the territory as a regional system, the flow of people solely along the heavy railway infrastructure and the natural systems as landscape contours. The topic of movement and flows will be further analyzed as part of the design exploration in following chapters.

The two cities of interest are located in the province of Overijssel, roughly 60 kilometers away from each other, and respectively contouring the territorial borders of the west and the east of the province (Figure 25). The current railroad infrastructure between Zwolle and Enschede is limited, one direct connection is present with a journey length of 50 minutes with 4 intermediate stops in order from west to east in Raalte, Nijverdal, Almelo, and Hengelo or alternatively a journey length of 1 hour and 4 minutes with 9 intermediate stops in order from west to east in Heino, Raalte, Nijverdal, Wierden, Almelo, Almelo de Riet, Borne, Hengelo, and Enschede Kennispark (Reisplanner | Plan Je Reis | NS, 2023). Although the structure is not too

extended, many landscape cuts are already present in the region, especially obvious in the Sallandse Heuvelrug nature area and nature reserve crossing (Figure 25).

The railroad landscape system currently in place is part of an intricate mosaic of textures and fabrics. In a span of 60 kilometers, the visitor is catapulted back in history, through the extensive built and natural heritage of this green province. High and low moraines frame the view over heathlands, grasslands, forests and rivers, and the panoramic views over the pastures turn into magical games of shapes and shadows when meeting the dune topography, morphed by the many interlard sand drifts (Figure 26).

The landscape system will therefore be considered as the underlying mosaic of large scale sites in support of both the current and the envisioned train lines.

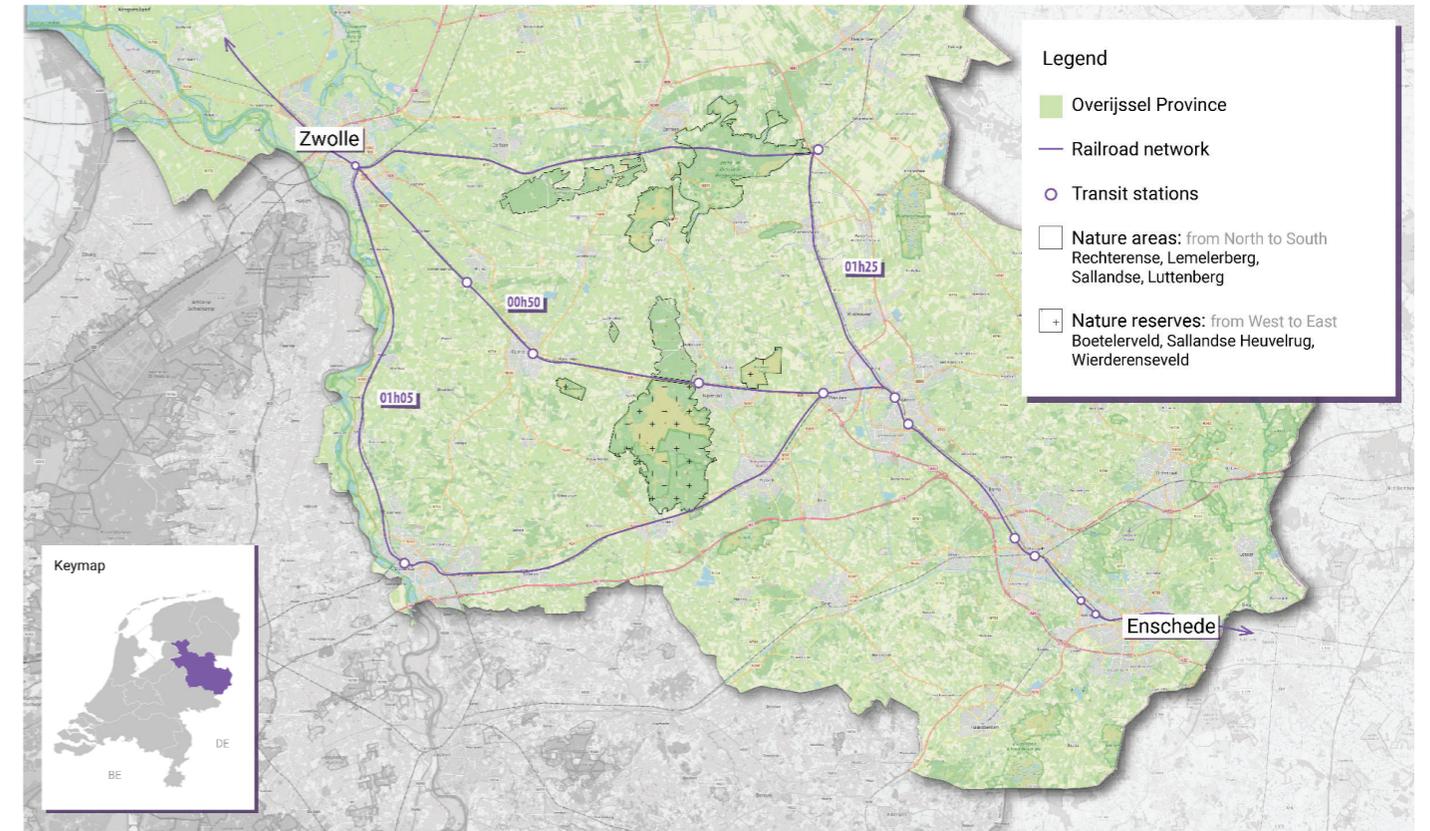


Figure 25. Boundaries of Overijssel by train
Representation of the current railroad system, demonstrating its time inefficiency and evident effect of the railroad cut through the Sallandse Heuvelrug National Park and recreational area.



Figure 26. Initial landscape experience by train
Demonstrating the dynamic and varied landscape experience that a simple train ride through the region of Overijssel can offer.

III.2 Alignment

III.2.1 Parameters

In order to approach the phase of alignment of this new infrastructure, a list of parameters was set, following the afore mentioned initial research on case studies and existing guiding principles of both the brief and the technology, as well as landscape requirements that accommodate society (Figure 27).

The parameter list includes primary and secondary parameters, ones that depend on each other and ones that are independent. This reading of the many requirements allows for a more direct translation from qualitative parameters to quantitative scores. During the phase of the alignment of the railroad, these parameters are in fact transformed into a matrix, using a Likert-type scaling method to rate the options on a bipolar manner. An example of this is presented to explain the relation between the matrix and the parameter diagram (Figure 28).

This whole research and project is based on quite a long list of technical requirements and parameters, which are critically applied in all scales as a crucial design step.

	A	= Letter corresponding to omnibus alignment on map
Time	16.62	= calculated using "D (250kmh)" times 250 plus "D (120kmh)" times 120
Total Distance	66	= calculated using "D (250kmh)" plus "D (120kmh)"
D (250kmh)	63	= measured on map in kilometers
D (120kmh)	3	= measured on map in kilometers
New Nooks	3	= number of curves on map
Max pumb	0	= height in meters of topographic peak
Section Type	1	= "1" when line profile does not present peak, "2" when line profile presents peak
Cities (towns)	3	= number of cities or town crossed by the line
Villages	3	= number of villages or vinex neighborhoods crossed by the line
Municipalities	4	= number of municipalities crossed by the line
Industrial Areas	2	= number of industrial areas crossed by the line

Figure 28. Explanation of values found on matrix as showed by the example of line A
All the values assessed from the matrix come from the development of the parameters and a conversion into Likert-like scales.

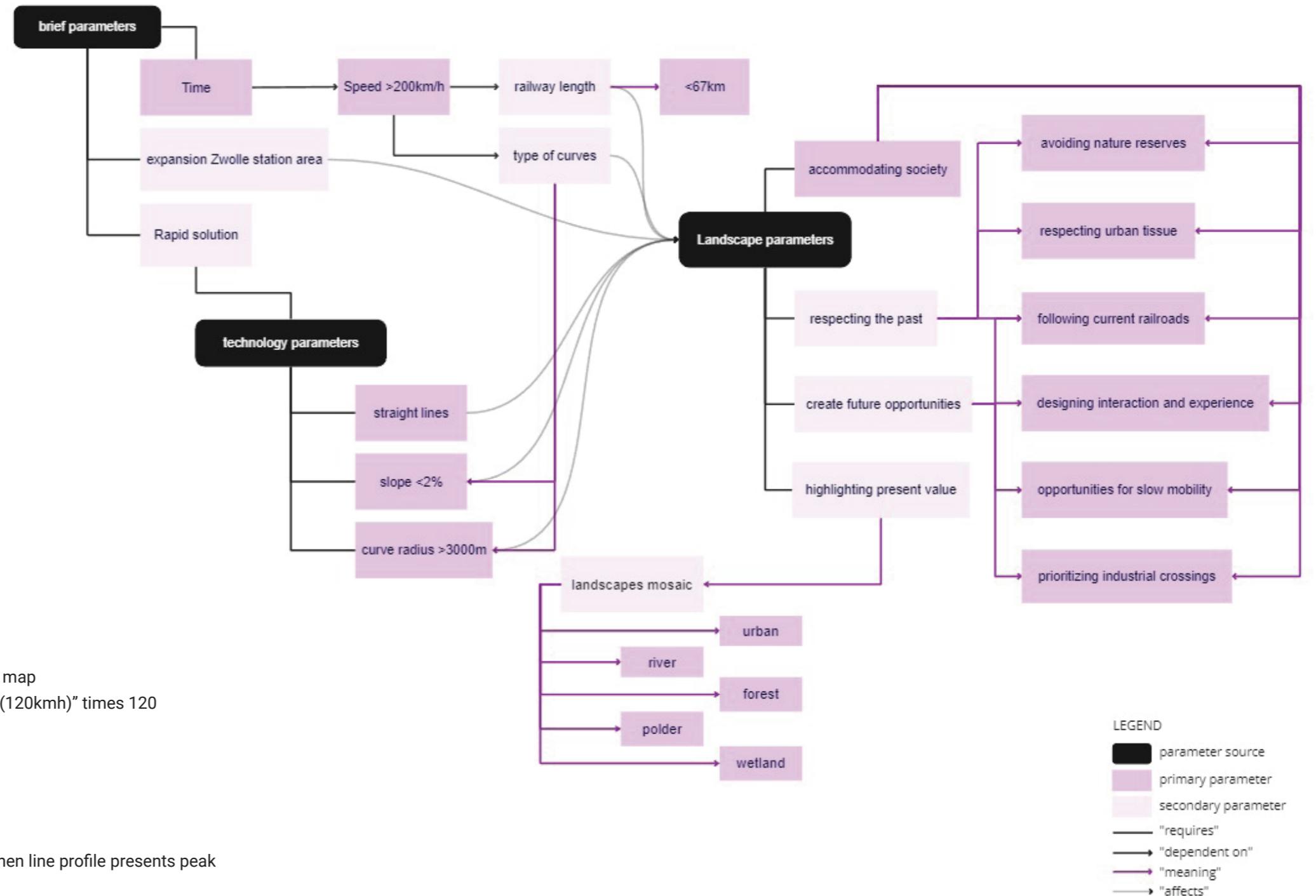


Figure 27. Creation and dependency of parameters
Diagram resulting in an extended list of parameters, out of which the primary attributes are made evident and will lead the initial stages of the implementation.

III.2.2 Lines

With the parameters as guiding concepts, 15 essentially different lines were drawn onto a 1:30000 scale map. In order to simplify this process and allow for endless flexibility when designing with these, the lines were stuck onto a physical map using simple rope (Figure 29).

These 15 alignments include many ways of crossing the landscape, some using existing railroad cuts, some creating totally new entrance points to the cities of Zwolle and Enschede.

Using the previously mentioned parameters and translating them into Likert-like scales to be able to collect, organize and compare all 15 alignments, the assessment matrix has been developed (Figure 30).

The assessment of each line consist of research-on-design where the initial scales of the matrix are filled in, for each line individually. The landscape is then analyzed through the perspective of each line.

	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
Time	16.62	20.02	21.06	17.5	26.54	18.68	23.4	24.72	19.56	21.54	18.72	17.48	18.5	18.46	17.44
Total Distance	66	65	65	61	64	67	65	64	62	67	65	62	63	65	64
D (250kmh)	63	48	44	50	21	57	35	28	44	46	53	52	50	54	56
D (120kmh)	3	17	21	11	43	10	30	36	18	21	12	10	13	11	8
New Nooks	3	2	3	2	2	3	2	2	3	3	3	4	3	2	3
Max pumb	0	0	30	30	0	50	60	0	55	55	55	30	40	0	25
Section Type	1	1	2	2	1	2	2	1	2	2	2	2	2	1	2
Cities (towns)	3	6	7	4	5	4	5	6	6	4	2	5	4	5	3
Villages	3	2	3	1	3	4	2	2	3	4	3	2	3	3	4
Municipalities	4	7	7	5	6	7	6	6	7	5	4	6	7	7	7
Industrial Areas	2	7	7	4	4	2	4	5	5	3	1	3	4	2	3

Figure 30. All spatial parameters quantified into an assessment matrix
It is possible to make an initial visual assessment of the alignments however, no priorities or approaches are defined, meaning the current state of the matrix does not inform us of the actual relation between landscape and technology yet.

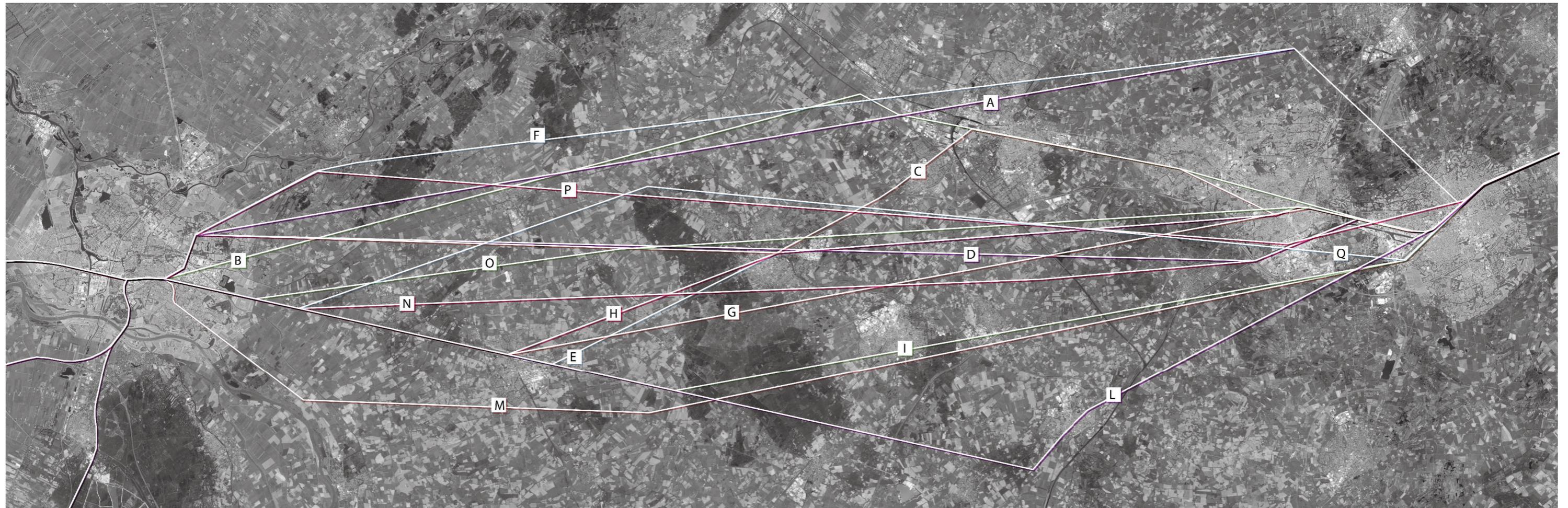


Figure 29. 14 initial alignments drawn using rope on a 1:30000 scale
15 essentially different lines that focus on respecting the parameters on a superficial level at the provincial scale.

III.2.3 Categorization

As each line is assessed based on the parameters, different relation between the structure, society and the landscape are described. A new way of reading the landscape starts to emerge and a necessity for an intercalary analysis of the territory emerges.

This is done by zooming in and out into the design of the lines, collecting the scores and comparing them in order to categorize these initial alignments in terms of the approaches used to integrate the technology into the landscape.

Three groups of lines emerged from this assessment, 5 lines followed a gentle approach towards the integration with the landscape, 5 lines followed a bold approach and 5 lines followed a tangent approach. The gentle lines scored highly on the landscape parameters, meaning that they follow existing railroad cuts, they offer opportunities for landscape redevelopment and they all prioritize the existing tissues. The bold lines scored highly on technical requirements including a short journey time and a small amount of curves. The lines that follow the tangent approach have mixed characteristics that fit both the gentle and the bold alignments, however, these last 5 lines present a special approach that includes a vast and varied exploration of many landscapes and environments within Overijssel.

	B	C	D	E	H
Time	20.02	21.06	17.5	26.54	24.72
Total Distance	65	65	61	64	64
D (250kmh)	48	44	50	21	28
D (120kmh)	17	21	11	43	36
New Nooks	2	3	2	2	2
Max pumb	0	30	30	0	0
Section Type	1	2	2	1	1
Cities (towns)	6	7	4	5	6
Villages	2	3	1	3	2
Municipalities	7	7	5	6	6
Industrial Areas	7	7	4	4	5

Figure 31. All lines assessed as "Gentle"
The relationship between the lines and the landscape is described as respectful of the tissue and based on the existing itineraries of the railroad.

III.2.3.1 Gentle approach

The first category of approach discovered during this investigation gives special attention to the existing social centers of the working class within a number of existing developments (Figure 33). In this research, the industries and production sectors present along the lines B, C, E and H are described in order to understand the potential role of these passing working communities within the new high speed network development (Figure 31 and 32).

The approach is described as "Gentle" as it is characterized by a non radical strategy that makes it possible for the design to not have to deal with critical landscapes, untouched by developments. Furthermore these four lines focus on the existent railroad cuts, either up-cycling them to reach higher speeds or simply re-aligning them to create a more direct connection.



Figure 33. Initial social investigation into character, industry and people
The gentle approach creates opportunities for the many industries of the region to participate in the construction and maintenance of the new infrastructure.



Figure 32. All "Gentle" lines on the map
Resembling the existing structures from Figure 25, page 35.

Line H (Figure 36), for instance uses 36 km of current railroads, on which it also crosses the Sallandse Heuvelrug park, therefore it doesn't disturb more protected nature. Furthermore, it runs parallel to Delden, without interfering and equally across the industrial area of Hengelo. These are all low nuisance areas for redevelopment.

This track is quite slow compared to the others because of its extended use of the current infrastructure, which can only ride at a maximal average speed of 160 kmh, however there is a great opportunity here to up-cycle the railway in this area to accommodate 300 kmh travels. This is only possible because the 1880s structure was built in a very straight line, allowing for enough time to accelerate to such speed (Figure 34).

By choosing to take this approach further, one can focus on developing a network in broader terms highlighting the relation between the landscape and the people. In this analysis, the adjacent settlements to the line have been assigned with production, logistic, or collateral roles within the network. zwolle functions as a storage, Heino will provide views and will benefit from the redevelopment of the N35 highway to Raalte, which is an important food manufacturer. The Sallandse Heuvelrug will function as a buffer area with beautiful views, Nijverdal's metal production will compliment the railway development, as will Hengelo and Enschede, as prime manufacturers of plastics (Figure 35).

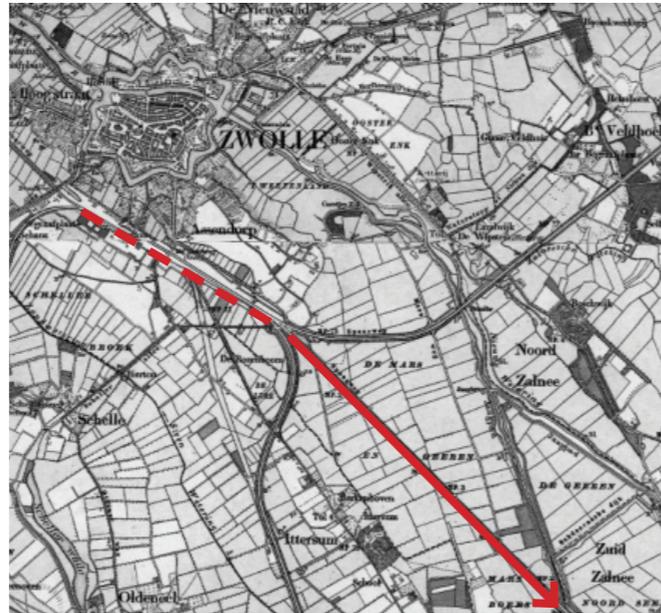


Figure 34. Straight line railroad in 1889
Some of the current infrastructure could be retrofitted to reach high speeds.

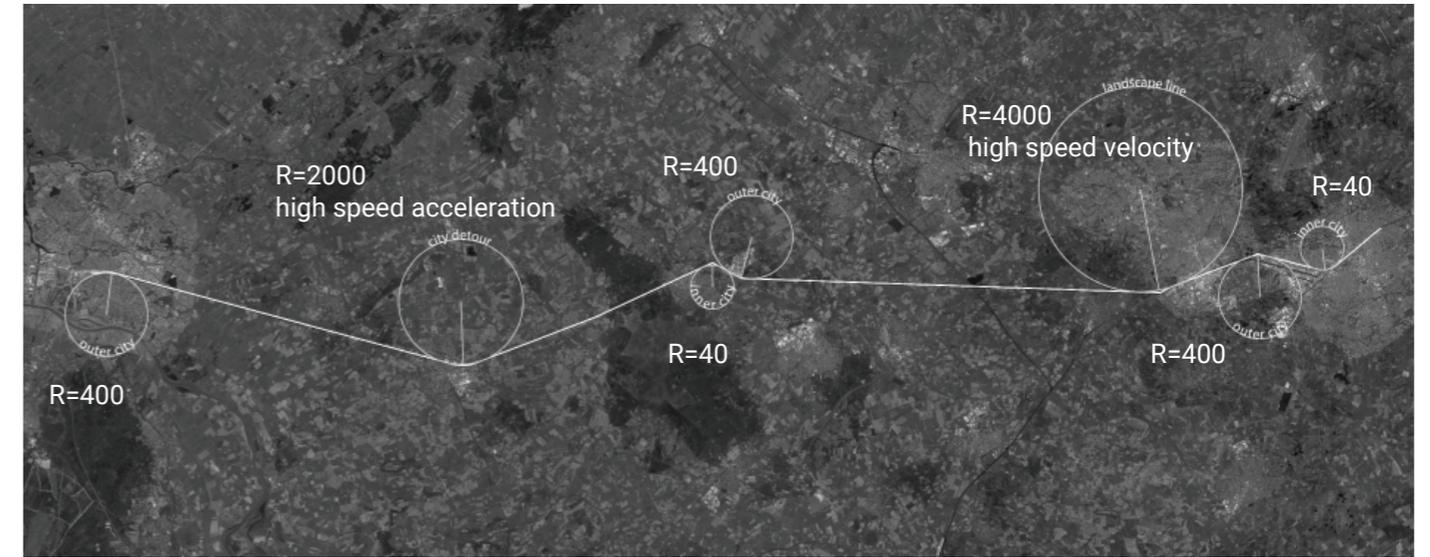


Figure 36. Line H represented as outer city, city detour, inner city and landscape line radius characteristics
The structure of this line does not allow for high speeds, since the inner city and outer city typologies of curves are present within the middle of the itinerary.

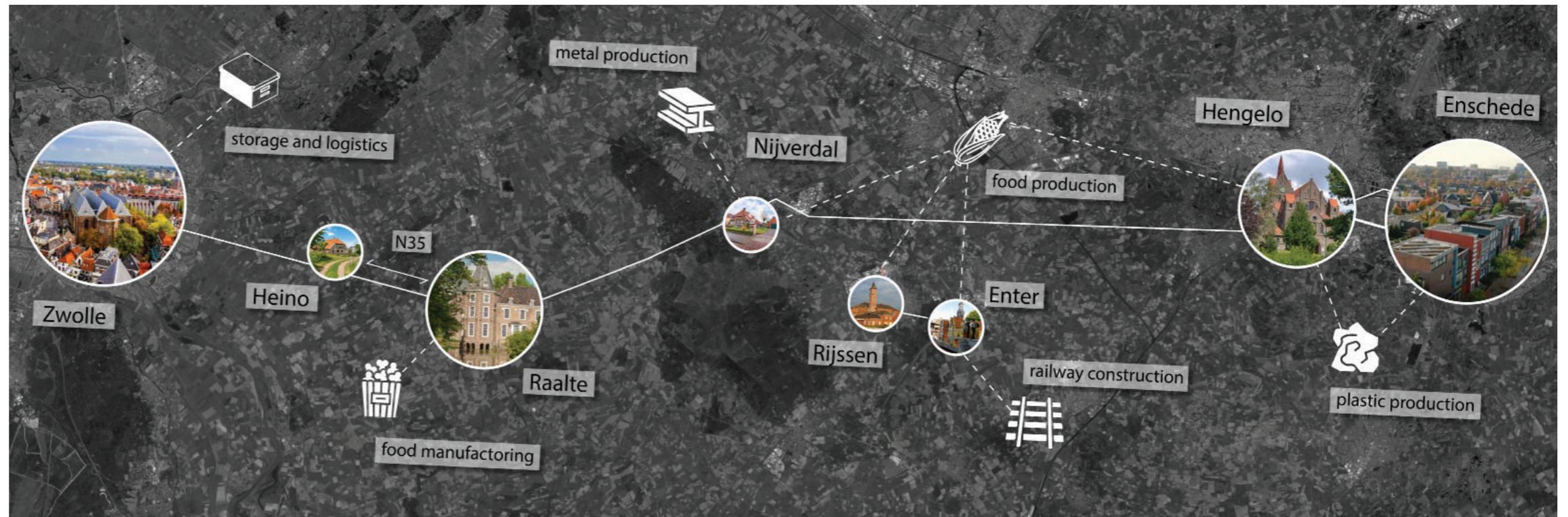


Figure 35. Potential industry integration vision
Potential of the industries as described in Figure 33.

III.2.3.2 Bold approach

The lines described by the “Bold” approach explore some taboo choices, like for example the opportunity to cut the journey duration by almost half its original non-stop time (Figure 38). This is done in line G, N, and O by crossing through the Sallandse Heuvelrug National Park, and in lines A and F by creating a new urban railroad cut to enter the destination station through the north of Enschede. These lines generally scored very well in all the technical and brief requirements, but poorly on the landscape and social parameters (Figure 37).

The Sallandse Heuvelrug is a National Park that forms part of the ridge between Hellendoorn and Holten in Overijssel (Figure 39). The area was formed as a lateral moraine, which originated about 150,000 years ago in the penultimate ice age, when river deposits were pushed to this area, leaving us with this beautiful, un-Dutch like landscape with peaks of over 75 meter NAP (Normaal Amsterdams Peil, average Amsterdam level). This area must not only be protected for its natural value but also for its extreme recreational and cultural value, since not many of these moraines remain in the country.

An element that resulted to the disadvantage of this approach is that most iterations cross the 1800 inhabitants village of Bornerbroek, right through the middle. Although this approach seems relevant in terms of the technical brief of the research, more iterations and new nooks are necessary to integrate these lines fully within the landscape, meaning that their overall “boldness” might decrease drastically.

The exploration of this approach focused on the research of line G, N, and O, as these cross the 150.000 years old moraine in a straight line between tops of around 30 to 40 meters above sea level. Analyzing the feasibility of this idea allows for an exploration of the opportunities related to integrating this typology within topographically challenging areas.



Figure 39. Sallandse Heuvelrug National Park (image from <https://www.sallandseheuvelrug.nl/>) Beautiful and unique landscape, characterized by diverse topography and vegetation.

	A	F	G	N	O
Time	16.62	18.68	23.4	17.48	18.5
Total Distance	66	67	65	62	63
D (250kmh)	63	57	35	52	50
D (120kmh)	3	10	30	10	13
New Nooks	3	3	2	4	3
Max pumb	0	50	60	30	40
Section Type	1	2	2	2	2
Cities (towns)	3	4	5	5	4
Villages	3	4	2	2	3
Municipalities	4	7	6	6	7
Industrial Areas	2	2	4	3	4

Figure 37. All lines assessed as “Bold”
The relationship between the lines and the landscape is described as innovative and invasive.

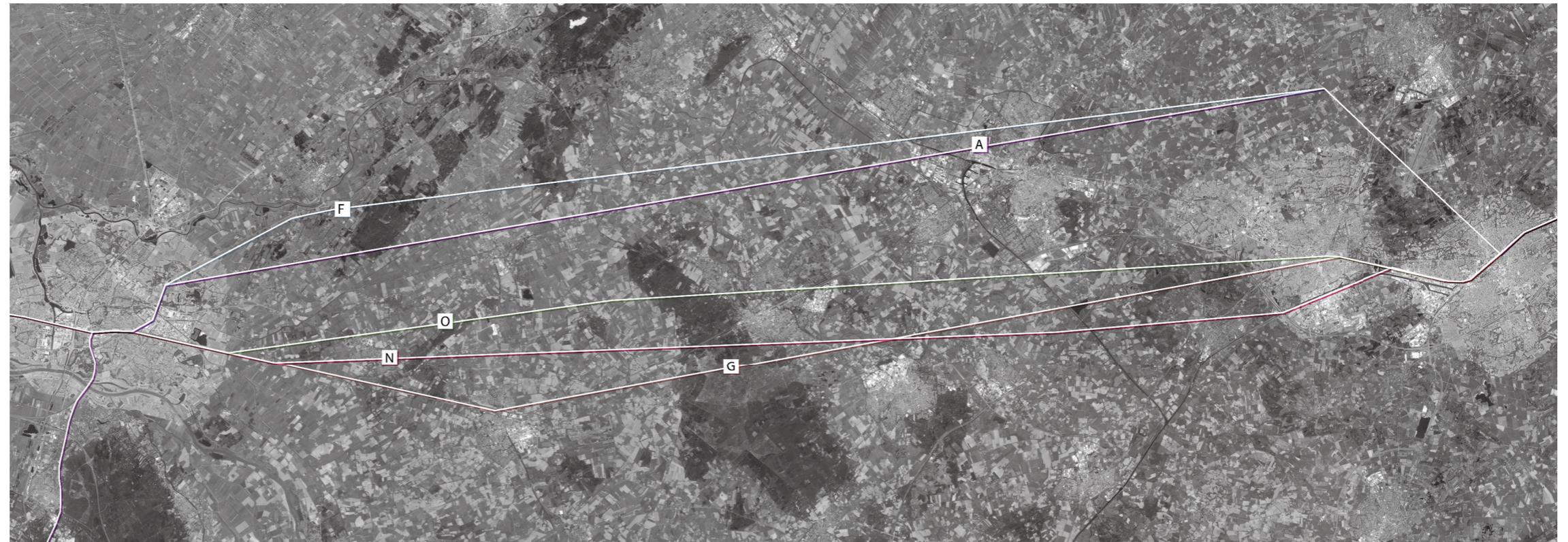


Figure 38. All “Bold” lines on the map
These lines are unique and do not resemble slow sled trains in the region.

In order for the current railroad to be built through the nature area, a 15 to 20 meters deep trench has been dug out (Figure 42). This is not an ideal landscape solution, as it focuses on transforming the landscape, rather than integrating within it. Other opportunities include creating curves in the line to follow the natural topography, or digging a tunnel, which once again goes against the landscape and social parameters, as well as geohazards (Figure 41 and 42).

Some options were tested, in the name of scientific curiosity, firstly by iterating on different entry points of the line (Figure 43) diving into the moraine and creating a journey in one of the natural valleys of the park, with quite some difficulties (Figure 40). Even after manipulating the scale of the contours in scale 1:20 (w:h) it is in fact impossible to fully cross the park within the valleys, with a viaduct height of 8 to 15 meters. The height of the viaduct resulted to be a crucial requirement to follow, since the slope of the construction shall not exceed 2% (Figure 44).

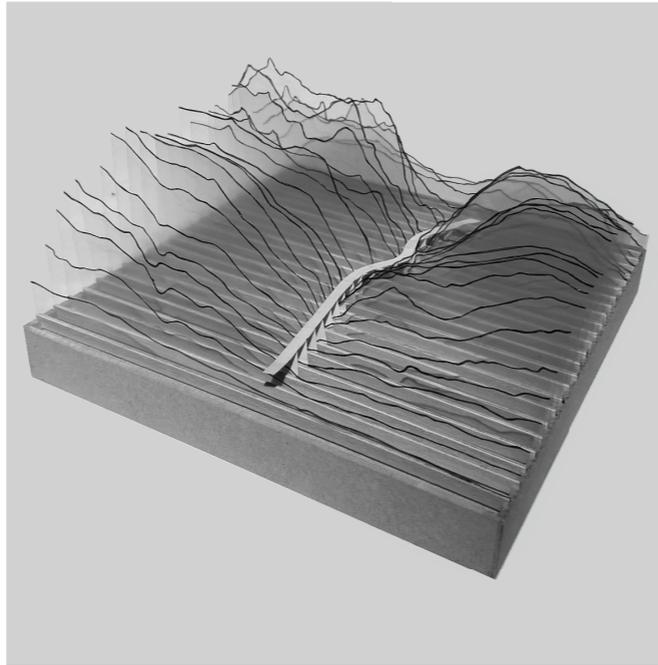


Figure 40. Topography of the highest peak exaggerated on a 1:20 scale in height
The train cannot cross the natural valleys of the park without digging a trench.



Figure 41. Tichang-Wanzhou High-speed Railroad, Enshi, Hubei Province, PRC (source: <http://en.people.cn>)
This image is taken as a negative example, the tunnel dug in the topography is not acceptable in the Sallandse nature reserve, the highway viaduct through the valley has got too many tight radius curves for the high speed train.

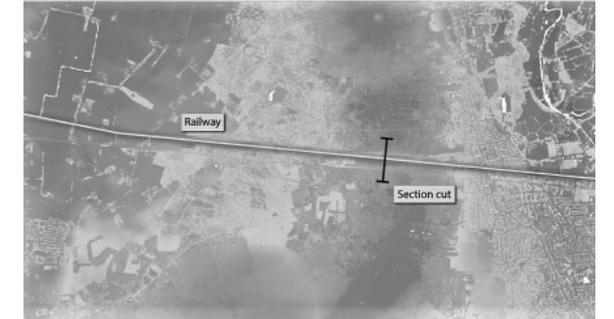
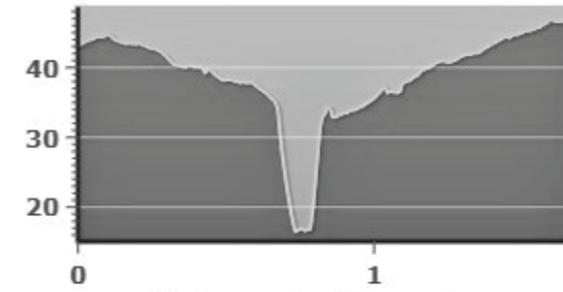
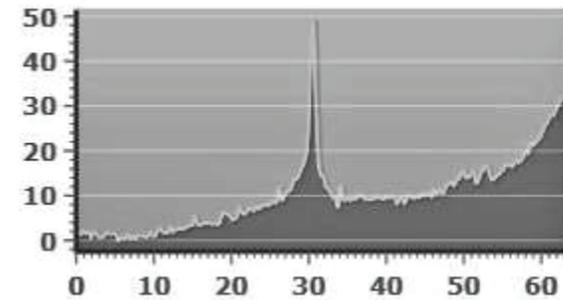
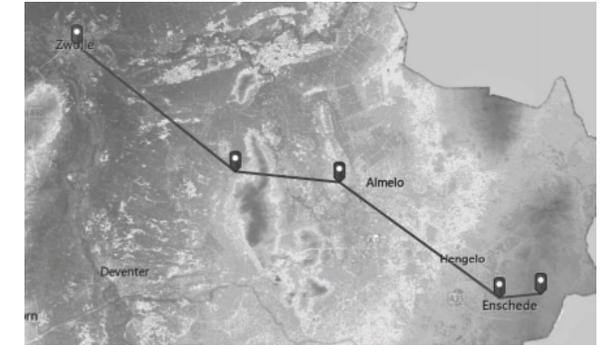
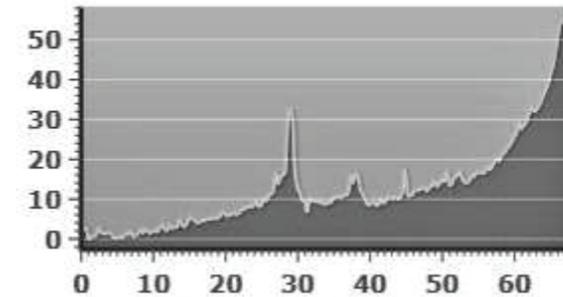


Figure 42. Section of the current trench
This would not be deemed acceptable within the natural reserve, furthermore the process of digging trenches goes against the parameter creation of Figure 27, page 37.



x = distance in kilometers
y = altitude in meters

Figure 43. Sections exploring the highest and lowest peaks crossed by the bold alignments
The impressive peaks of the park are unavoidable in the bold lines, yet they are unapproachable for ethical reasons.

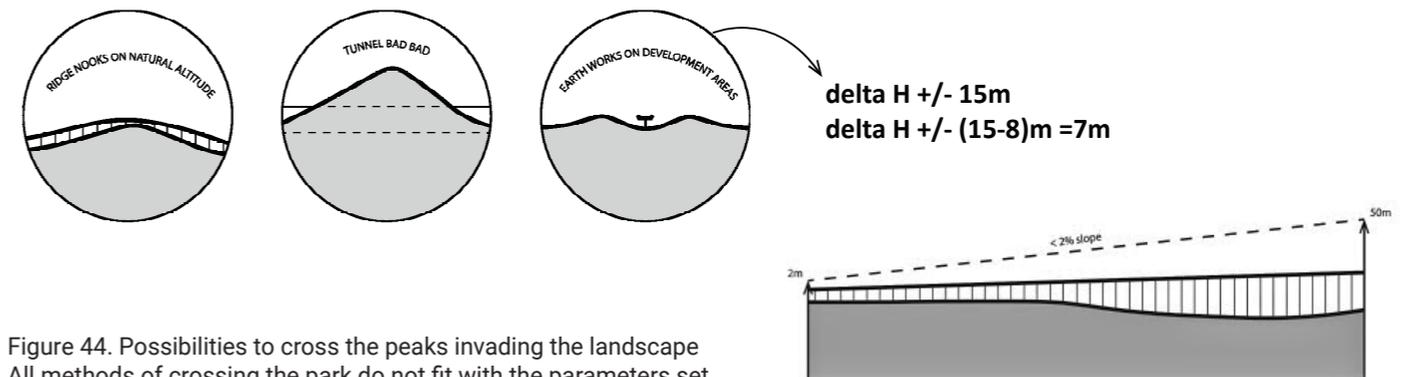


Figure 44. Possibilities to cross the peaks invading the landscape
All methods of crossing the park do not fit with the parameters set.

III.2.3.3 Tangent approach

Lastly, the tangent approach created a new category of alignments that runs parallel to settlements as well as to natural landscapes (Figure 46).

In comparing this approach with the previously mentioned ones, these alignments present characteristics from both the bold and the gentle approach, but they all focus on exploring areas of the current network that are either lacking a connection or are poorly positioned along it. This approach aims at investigating the many landscape typologies present in the region, scoring very well on technical, social and landscape parameters (Figure 45).

Looking at the geology of the province, we notice that the alignments kiss many landscapes, maintaining a more homogenous profile and avoiding many urbanized areas. The quality of the different soil types and the particle size of the different deposits on site can give us an idea of the structural rhythm that our three dimensional structure will have, in terms of spatiality.

In this landscape we find mostly nutrient poor sandy soils with flat topography, slowly transitioning into a higher hinterland, near the border with Germany (Figure 47).

The tangent approach describes a mixed and curious implementation of the railroad within the landscape that provides a dynamic overview and exploration of this green province. This approach will dictate the attitude of this thesis to explore and experience the diversity and flexibility of the brief.

	I	L	M	P	Q
Time	19.56	21.54	18.72	18.46	17.44
Total Distance	62	67	65	65	64
D (250kmh)	44	46	53	54	56
D (120kmh)	18	21	12	11	8
New Nooks	3	3	3	2	3
Max pumb	55	55	55	0	25
Section Type	2	2	2	1	2
Cities (towns)	6	4	2	5	3
Villages	3	4	3	3	4
Municipalities	7	5	4	7	7
Industrial Areas	5	3	1	2	3

Figure 45. All lines assessed as "Tangent"
The relationship between the lines and the landscape is described as exploratory and respectful yet innovative.

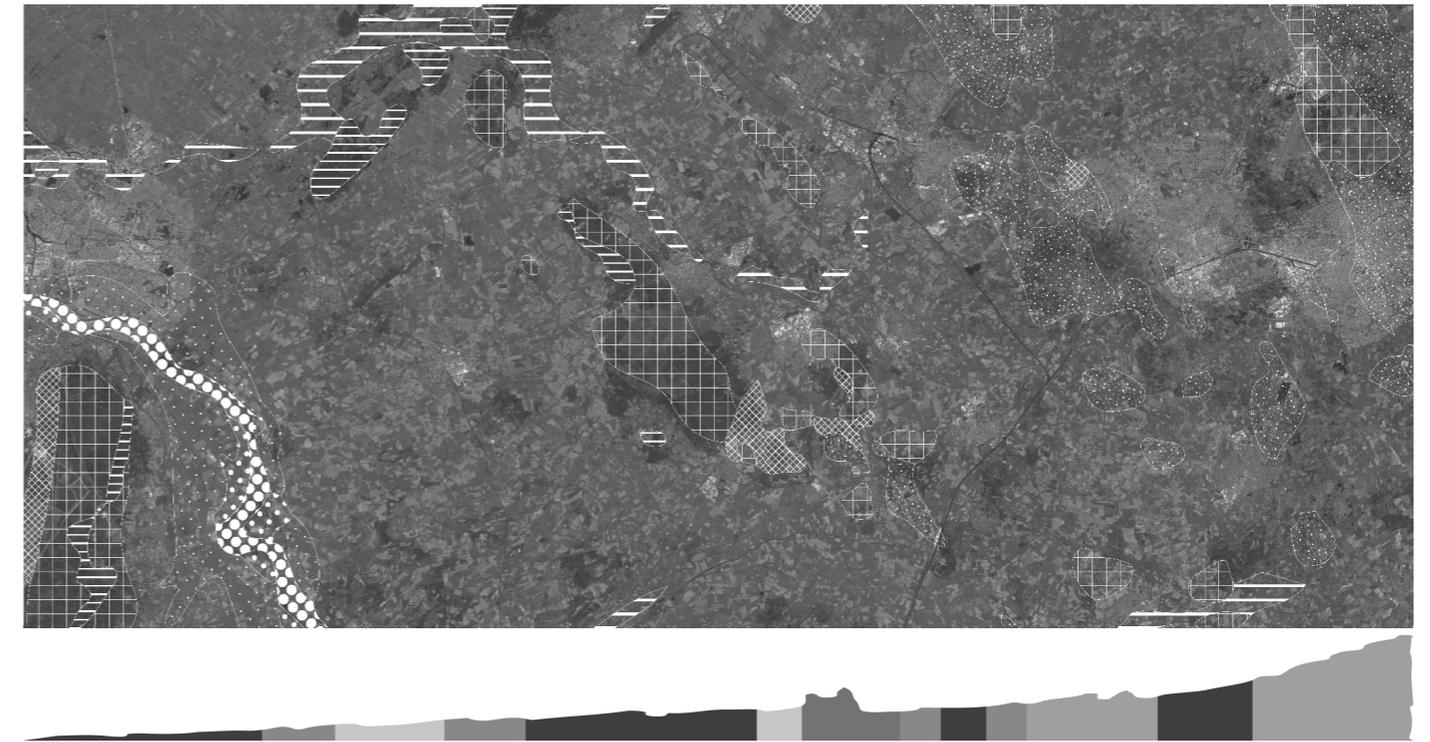


Figure 47. Soil formation through deposits in the area
The unique soil structures create the base for the beautiful and varied landscape of Overijssel.

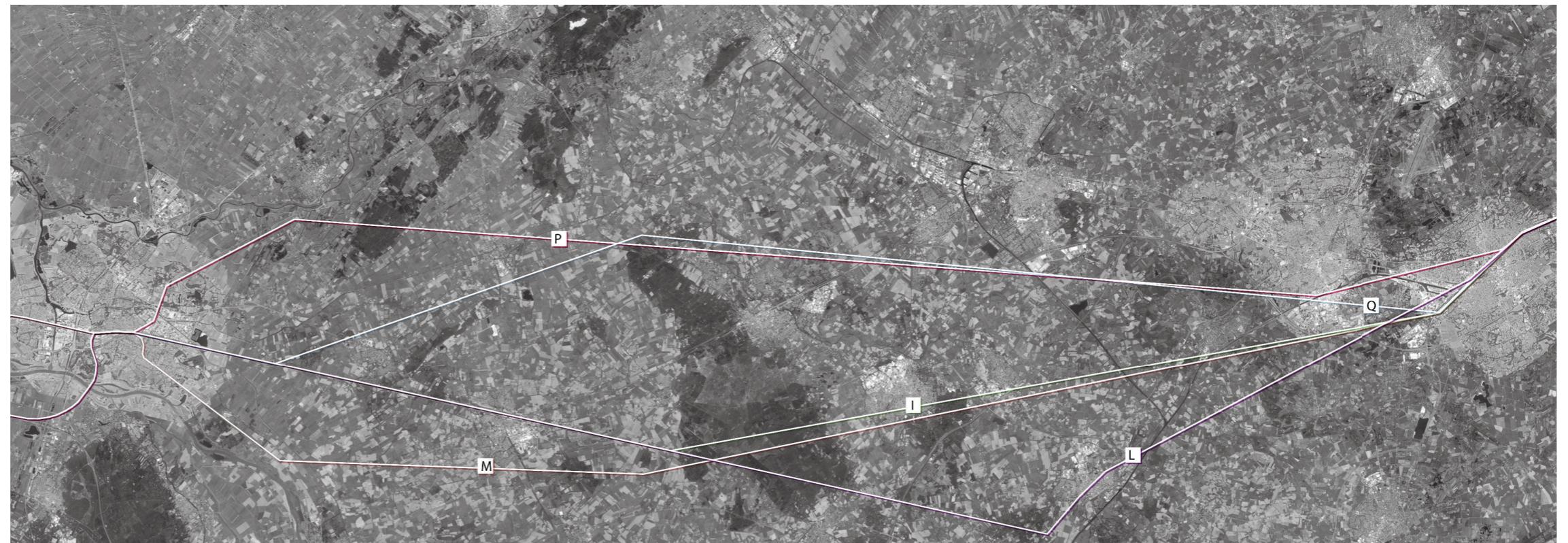


Figure 46. All "Tangent" lines on the map
These lines are tangent to most nature areas, urban settlements and topographic peaks.

III.2.4 The line in the landscape

As previously mentioned, the tangent approach dictates a curious explorative attitude that allows for a comprehensive landscape reading. This reading results in a mosaic vision for the province.

III.2.4.1 Landscape mosaic

The viaduct will be modular and repetitive but the rhythm and supports needed on different soil types will vary, creating an even more site specific alignment. The structural rhythm will not be elaborated on in this specific research, but three initial typologies of rhythm are developed that allow for maximal modularity and efficiency (Figure 48)

The mosaic reading (Figure 50) of the landscape in the provincial scale is for this research quite a sensitive topic since the line is interacting with many landscapes and complicated human processes (Figure 49) which cannot be researched fully within the scope of this dissertation. The opportunities in taking this approach are endless, the abundance of variety makes this journey a super dynamic one, in line with the high speed train typology. The line P

has been chosen to further explore this technology on a smaller scale (Figure 50).

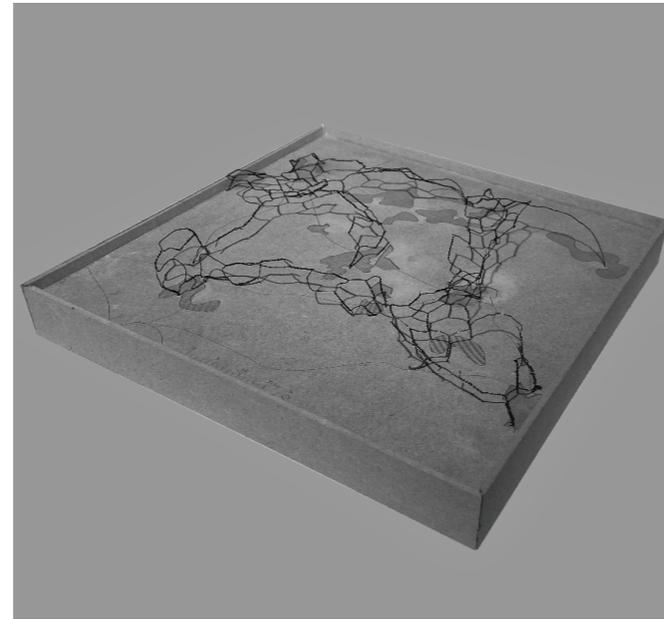


Figure 49. Opportunities for a social network creation
The model describes the strength and connections between people and places.

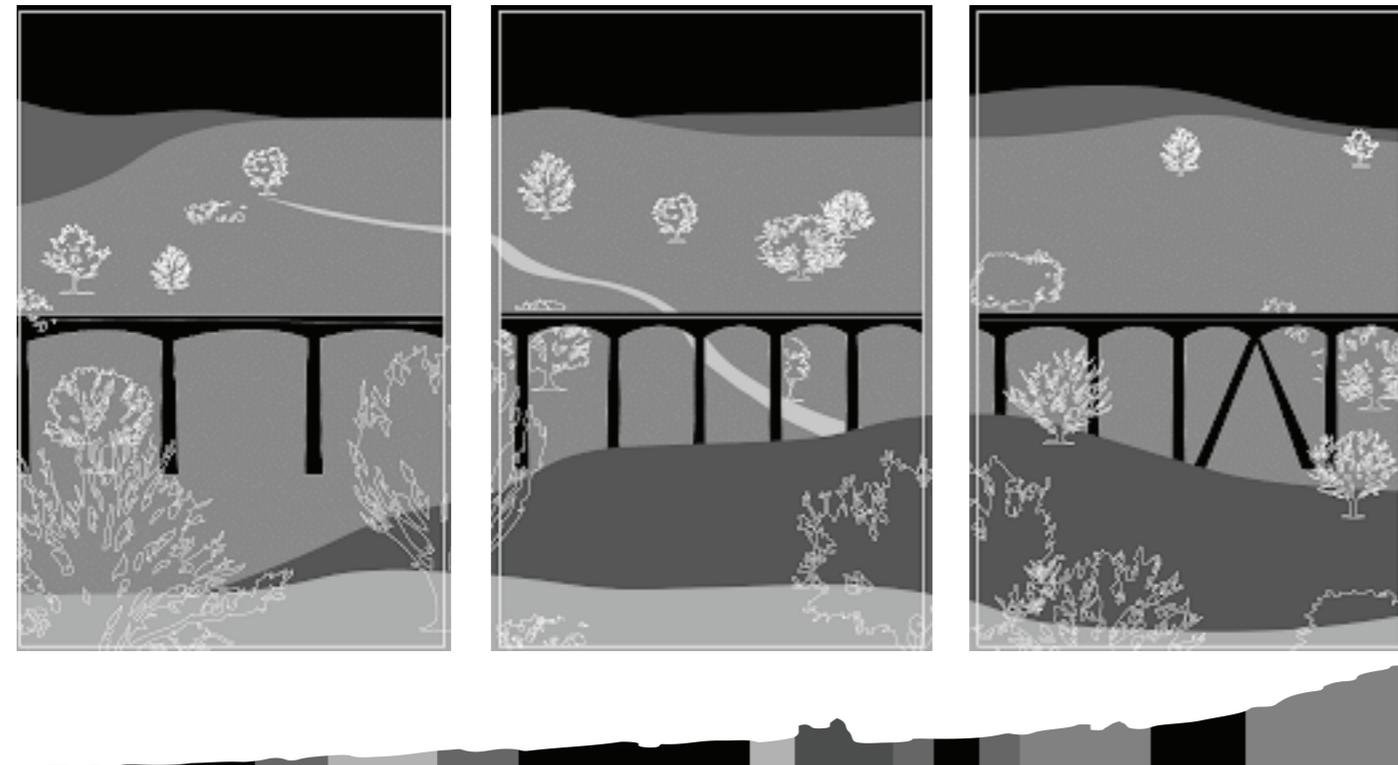


Figure 48. Three structural rhythms based on soil stability
To adapt the structure to the soil, a minimum of three rhythms will need to be designed to fit with more or less stable soil types.

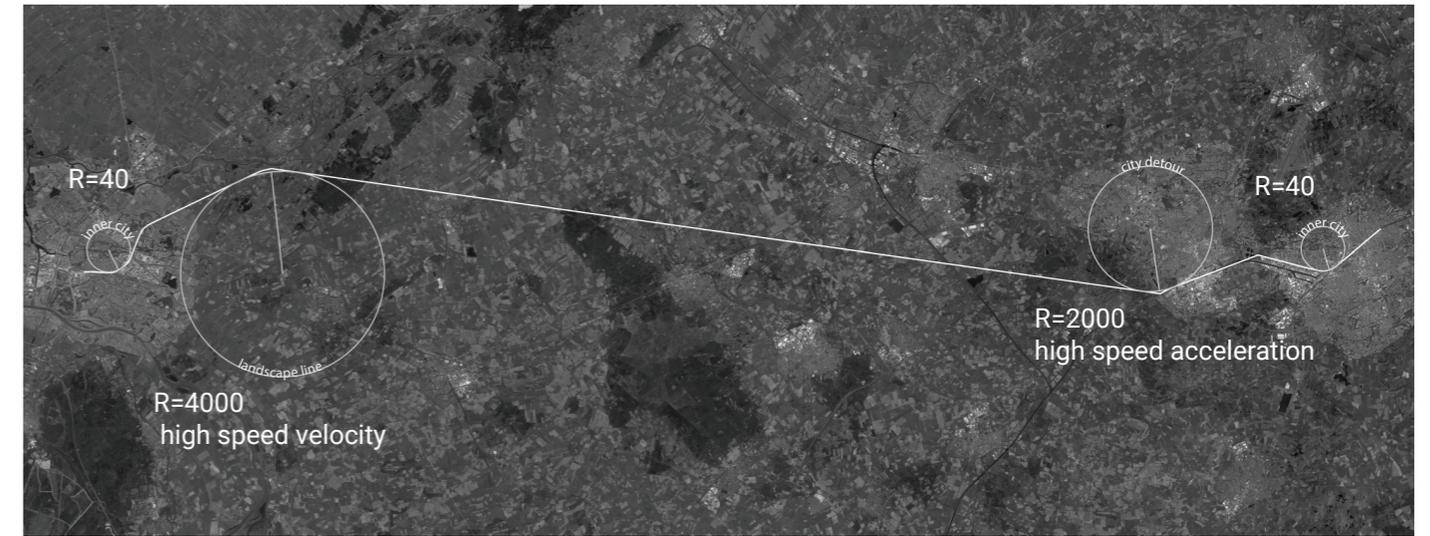


Figure 50. Line P represented as inner city, landscape line and city detour radius characteristics
The efficiency and high speed of this line are remarkable, as well as its capacity to explore many landscape types and its respect for the built up tissues.

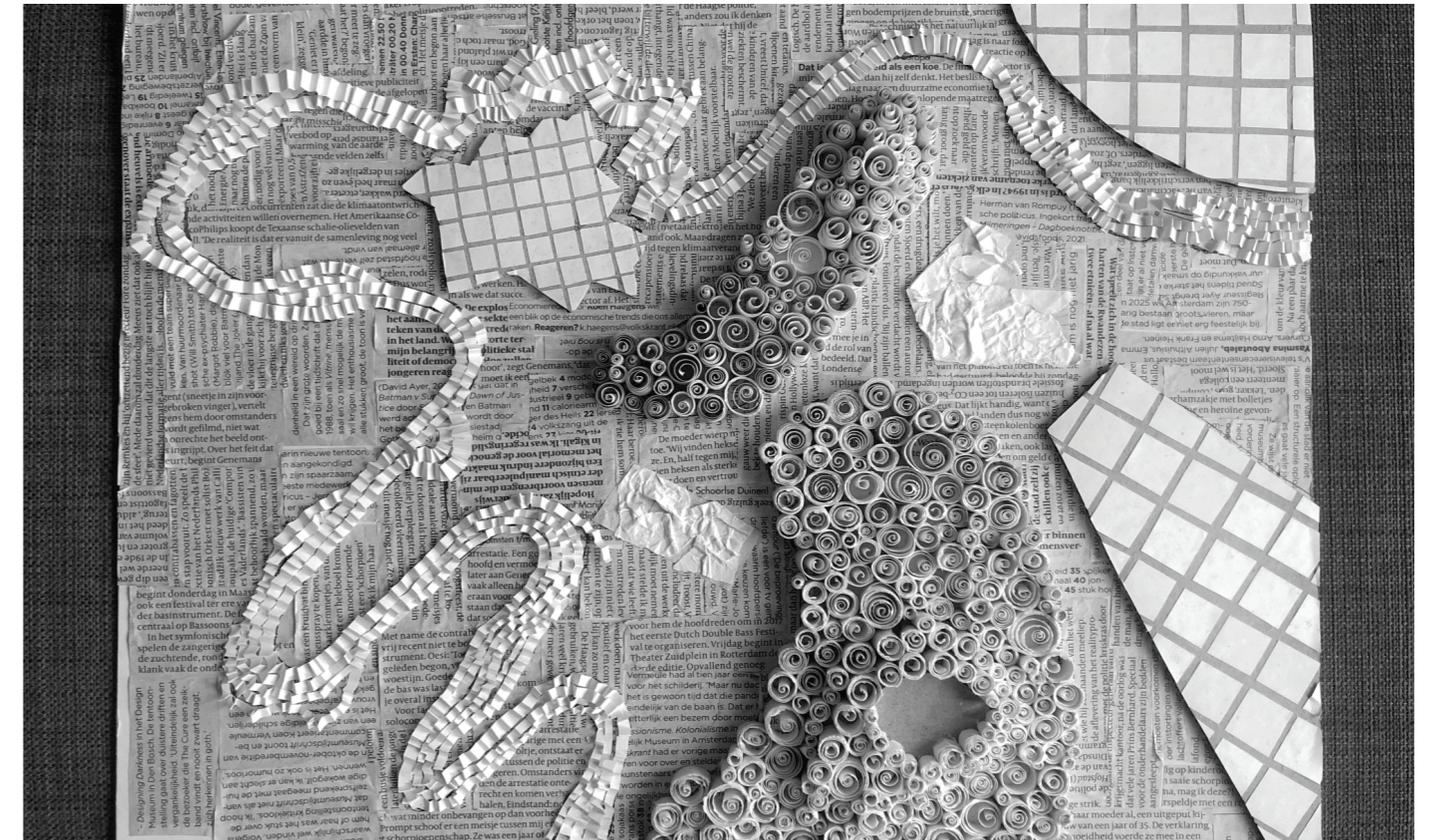


Figure 51. Interpretation of the landscape mosaic of Overijssel through textures and shapes
The tangent approach results in a vast and dynamic reading of the landscape that describes the different areas as mosaics.

III.2.4.2 Challenge vision

The next phase of the research is based on the brief of challenges and opportunities that can be found on the alignment scale. Looking at this like as a physical entity, the diagnosis and brief related to this implementation include very real challenges, like the interference with about 120 buildings along the itinerary. Because of the fabric and density of the Netherlands, this is an inevitable challenge that can be tweaked and iterated further in detail, but overall will never be resolved. This is why in this research there will be no avoiding this issue.

The tangent line P described at inner city, landscape line, city detour and inner city curve speeds is further diagnosed with all the potential social interactions, seen at this scale as a potential conflict. The possible visual relations between the viaduct and the landscape are also made clear, as well as some design attention areas that might require a more technical testing and implementation (Figure 52).

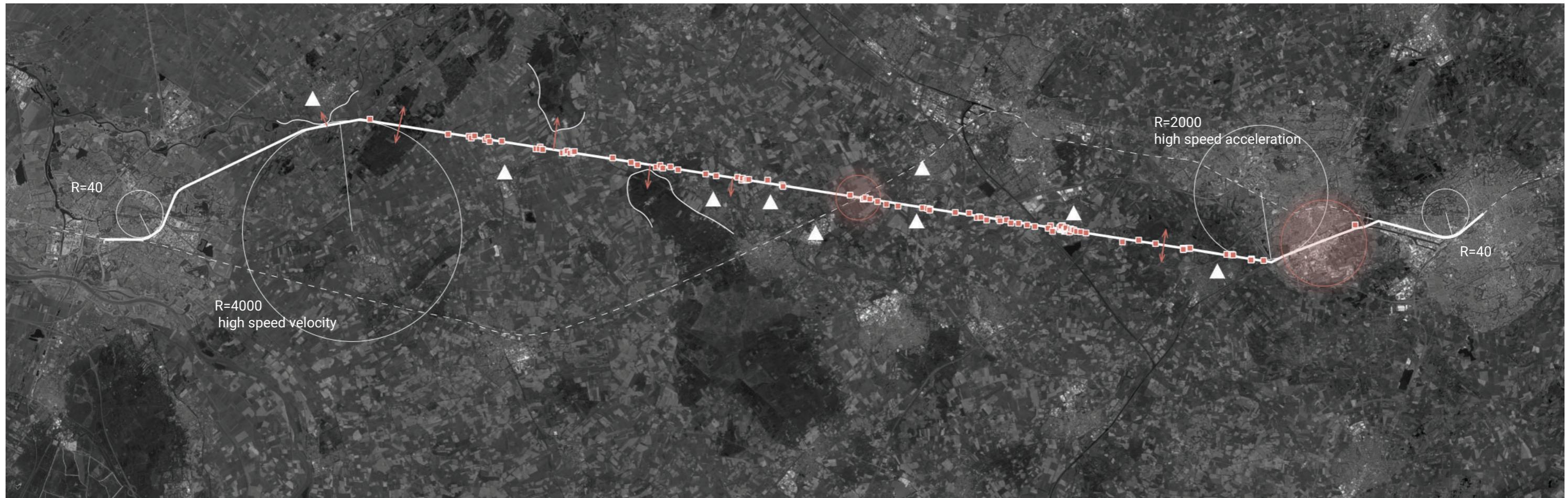
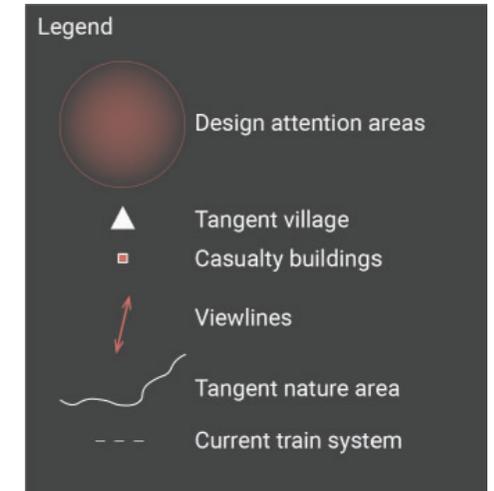


Figure 52. Map describing the technical implementation of line P, focusing on the challenges of the integration. The many farmhouses, natural areas and crossings that might cause challenges during the implementation.

III.2.4.3 Opportunity vision

In the social framework of this thesis, one of the key elements is the exploration of the benefits and damages that this type of development can have on the human and non human communities of Overijssel. A vision map for connecting opportunities is drafted with the help of supporting research in the field of urban development, urban growth, rural protection theories and strategies (Figure 53).

The vision on the large scale is to create the opportunity for regenerative projects, station area development and provincial scale landscape planning.

The planning of this vision started on a very simple scale, identifying structures that define land use, land value, urban developments (such as infrastructure, green and water) and the agglomerations of living areas that influence or are dependent from each other.

From this initial analysis and landscape reading the vision map was drafted, including terms that adhere to the concepts of urban sprawl, corridors, green hearts, urban boundaries etc (Haartsen et al., 2003), (Johnson, 2001), (Roggema, 2016), (TEDxTysonsSalon, 2017).



Figure 53. Map describing the landscape system implementation of line P, focusing on the connection opportunities

III.3 Mosaic Implementation

The approach of the tangent alignment led to a territorial investigation of the landscape as a mosaic system, in which all the landscapes present form a patchwork of compositions that ultimately form a unique provincial system.

With this reading in mind, the line in the landscape has been placed in its mosaic vision in which all the landscape mosaics are independent, to then culminate as a whole (Figure 54).

These landscapes are the station area landscape, the polder landscape and the forest landscape. These were chosen as the most descriptive landscapes on the province in terms of repetition, extremely different spatial quality and impact on the development.

This reading does not exclude a more unitarian approach, but it focuses on understanding the individual dimensions of perception, function and symbolism of these places, before merging them into a unitarian vision.

The location at Dalfsen in fact describes perfectly the mosaic of landscapes that the province has to offer and will be used for a principle application that aims at generalizing the results of this study.

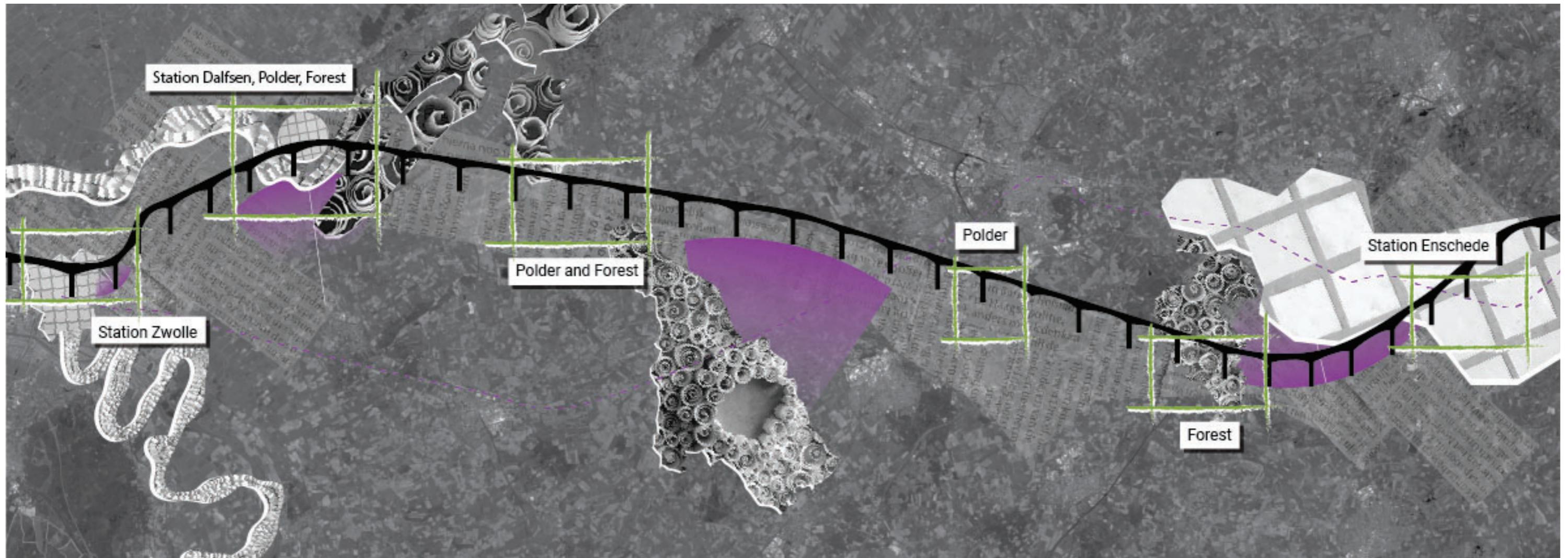


Figure 54. Map describing the mosaic implementation of line P, focusing on the individual landscape characters

III.3.1 Station Areas

As described by Bertolini & Split in *Cities on Rails* (1998), station area redevelopment shall be put in the spotlight, given their role as spaces of flows, where specialized and integrated clusters of activities are interconnected. These areas function as great social hubs, hosting mobility and recreation.

III.3.1.1 Zwolle

The city of Zwolle is characterized by a strong medieval walls structure surrounding its center and rich heritage. The central station district is characterized by a mosaic of patterns and experiences, a labyrinth of barriers and dynamic flows. This station is a passing area, not a destination. It ornares the travel and commuting activity within its structure but it does not provide connection between the surrounding tissues, in fact it creates barriers, rejecting flows of movements

The spatial dynamics of the urban space in zwolle has been analysed, resulting in a perception and flows cognitive map. The spoorzone here described holds the potential to develop further and host a number of visitors and program (Figure 57).

One of the goals of this analysis is to envision the opportunity to transform this area into a dynamic place that does not only offer facilities for travelers, but also connected and accessible areas or the inhabitants and visitors of the city.

The new high speed platform structure will be integrated within the current station, to allow for multimodal transport as well as a clear and highlighted station district. With the structure will come the facilities on a double deck, with simple access and more public space to park bikes, between the viaduct pillars (Figure 55 and 56).

The station area boundaries are often dictated by the impact of the barriers in the urban landscape (Figure 58). In the case of Zwolle, the railroad dictates a change in structure and flows, the boundary of the separation appears at the connection between the medieval walled city center in the north and the english garden in the south.

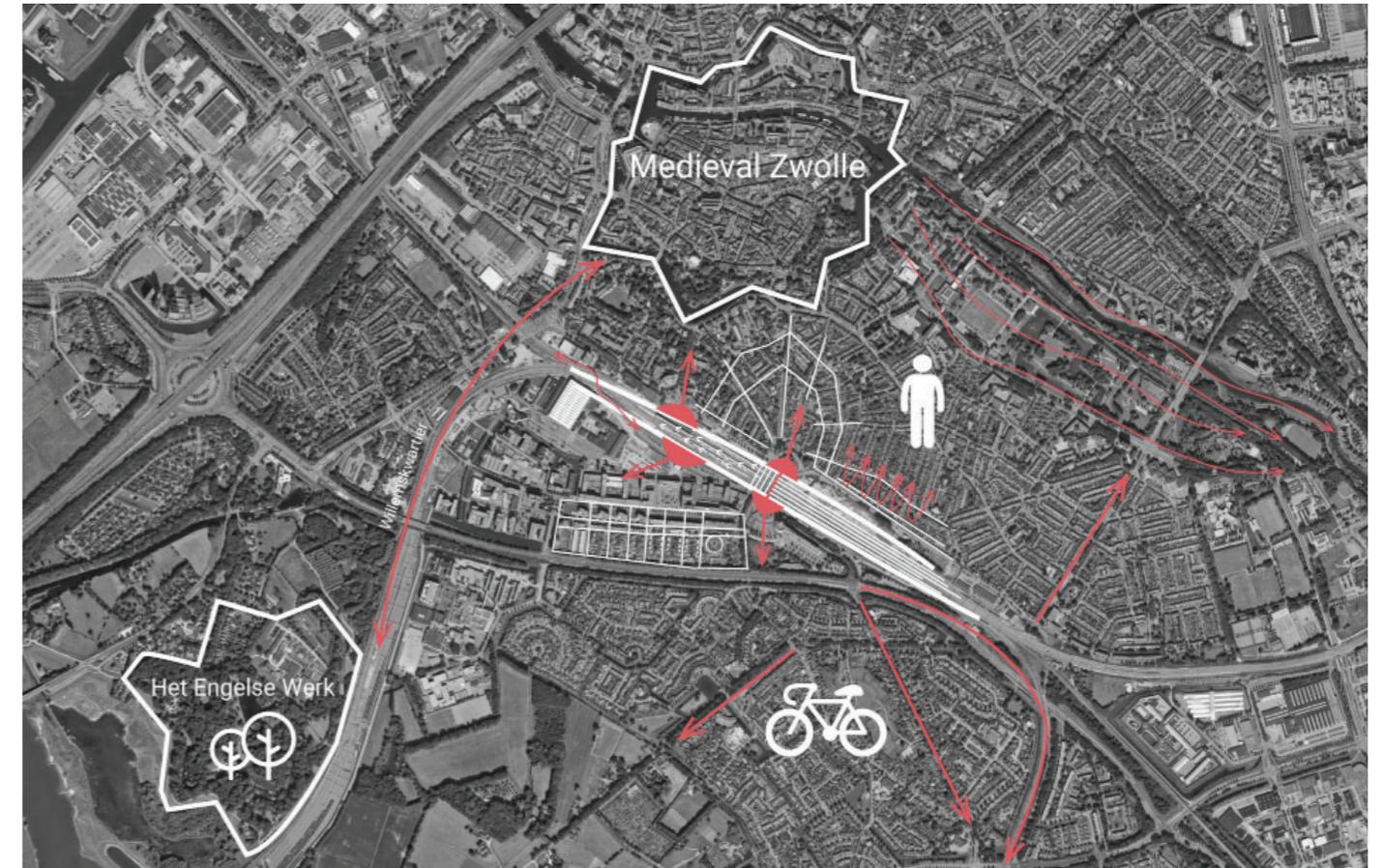


Figure 57. Cognitive map analysis of Zwolle's station district
Describing the disconnection between the flows of people, the urban fabric and the railroad barrier.



Figure 55. New high speed platform
Proving that the station areas can host overpass structures.



Figure 56. Generated with Mid-journey Ai
The possibilities are endless.

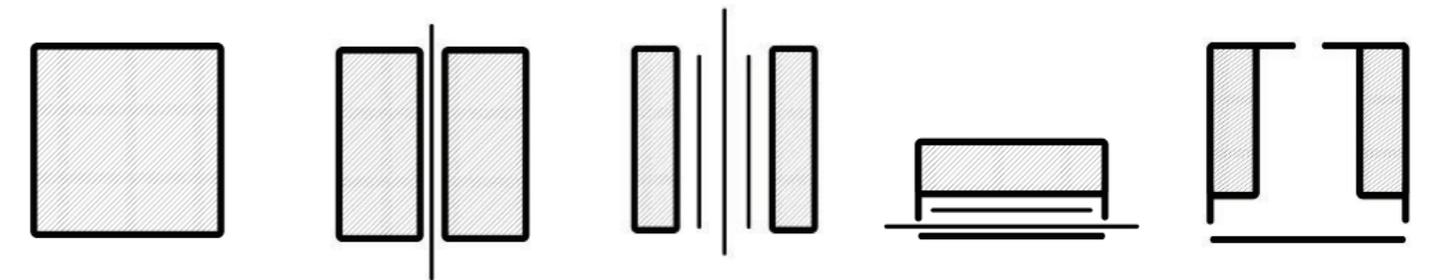


Figure 58. Landscape as a fragmented system due to the infrastructure
Process as mentioned on page 13.

III.3.1.2 Enschede

Enschede is a rural city of the Netherlands, located at the border with Germany whose popularity has been growing with the success of the knowledge park (Kennispark Enschede) and institutions like the TU/ Twente. This growth needs to be addressed through increased accessibility and redevelopment.

In the cognitive analysis of the station districts of Enschede, the two main stations have been selected for analysis. In the central station reading, the most obvious elements are the dominant car flows, the structured spatial experience and excessive residual space, that make this station disconnected and less of a district (figure 61). The more continuous flows present at the kennispark station and its distinct park morphology give it personality and potential to grow (Figure 62).

For this type of redevelopment, the central stations are often chosen to build an extension, as these areas tend to be easier to reach and more in need of upcycling. Even smaller stations like Enschede's can benefit from a modernization, maintaining classic viaduct building traditions (Figure 59). For this vision making step, technologies like the increasingly popular artificial intelligence tool Midjourney AI visualizer, can help generate images based on written prompts and photographic reference (Figure 60).



Figure 59. Enschede's new HS platform
Station area is suitable to host an overpass platform.

III.3.1.3 Principles

As a result of these cognitive analysis a strategy has been developed that describes the principles needed to spatially integrate the technology within the station district landscape (Figure 63).

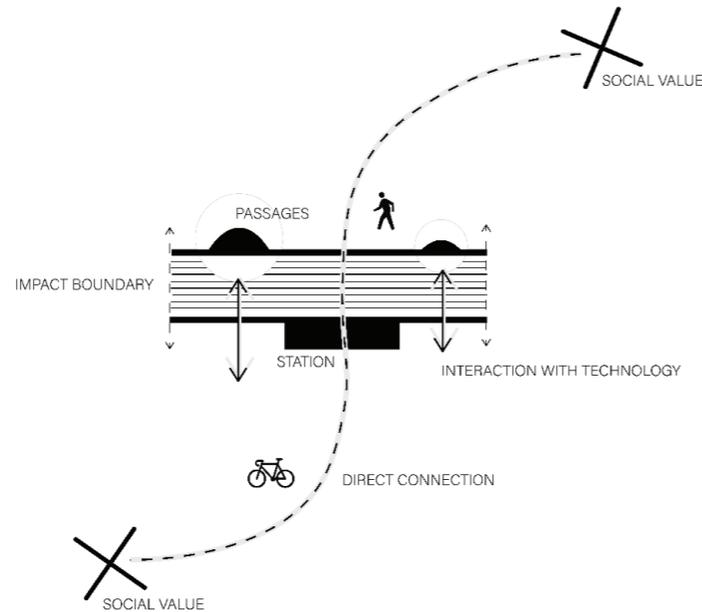


Figure 63. Station district landscape principles
The station area principle can guide the redevelopment of railway sites by defining boundaries, values and creating opportunity for slow mobility.



Figure 60. Generated with Mid-journey Ai
Endless opportunities to redevelop this area.

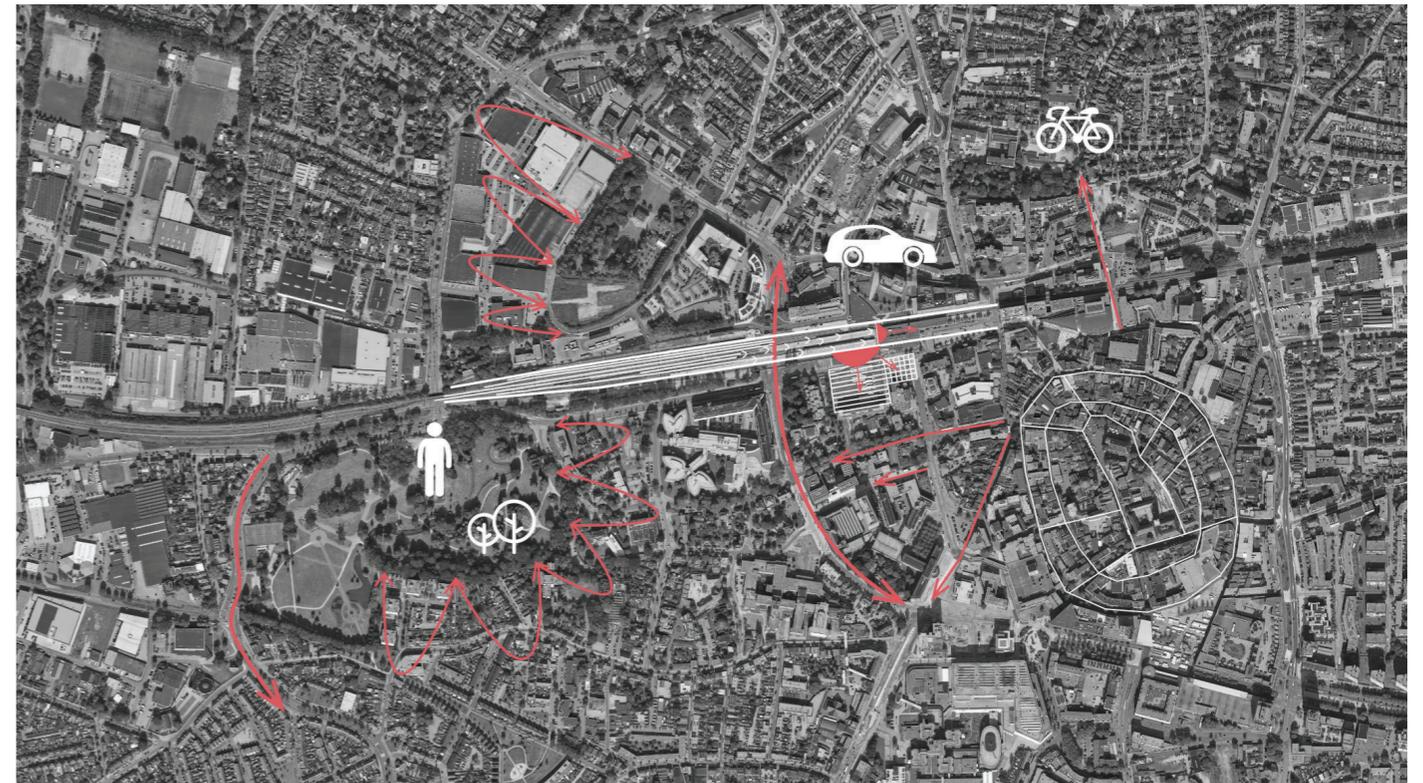


Figure 61. Cognitive map analysis of Enschede's central station district
Describing the station area as a complex fragmented system that is car dominated and characterized by barriers in the pedestrian infrastructure.

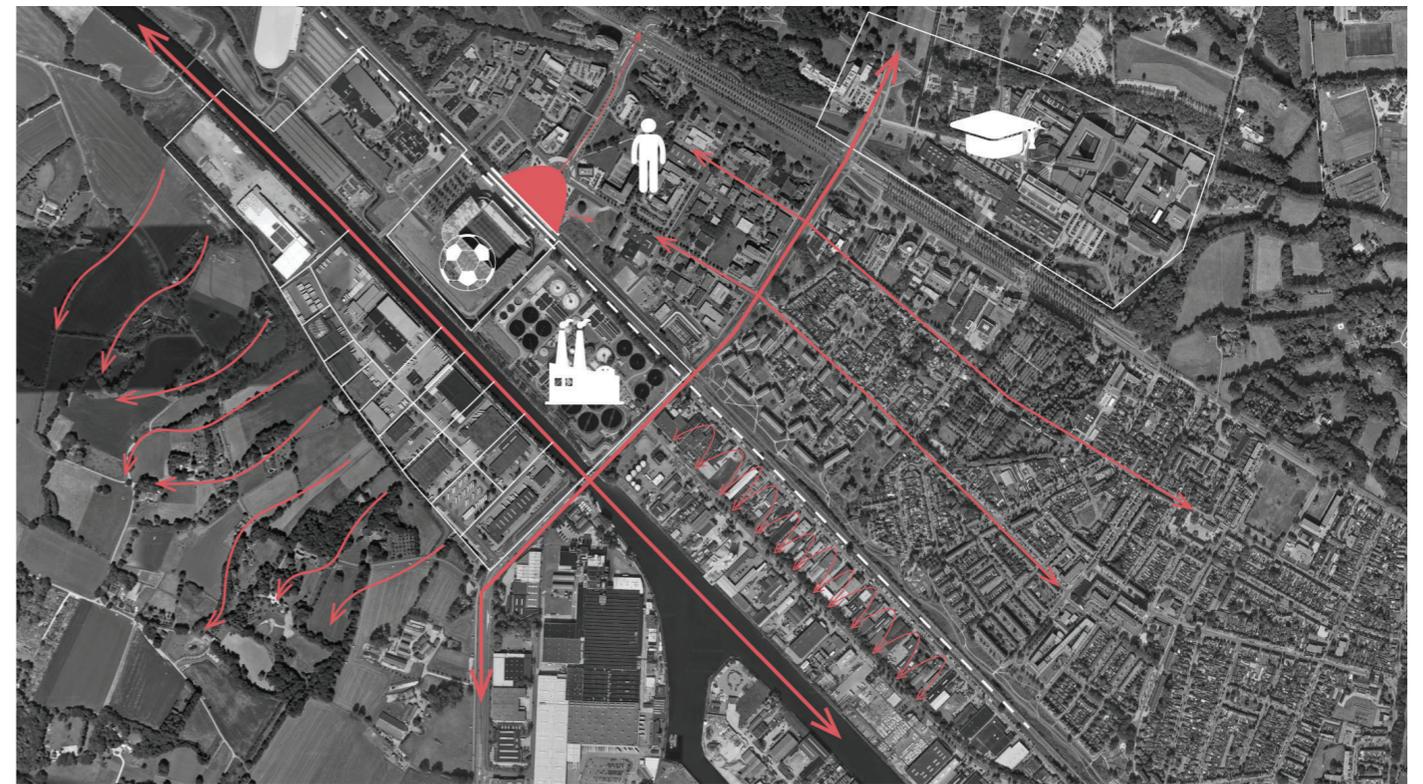


Figure 62 Cognitive map analysis of Enschede's kennispark station district
Describing this area as a linear and fragmented zone, where traffic is dictated by the large industrial fabric.

III.3.2 Polder landscape

The polder landscape is characterized by open views over the horizon (Figure 64). Its clear and structured tissue is typical of productive landscapes, in which the soil is meticulously crafted to accommodate pragmatic activities such as farming and agriculture, which led the Netherlands to become a top producer and exporter of goods worldwide.

Its orderly value does not only indicate the way the soil itself is used, but also how people interact with the landscape.

In this very open setting, the horizontal and vertical elements present play together and the juxtaposition of trees, shrubs, canals and textures allows for a logical and intuitive reading of the land.



Figure 64. Open and readable Dutch polder landscape (photo by author)

III.3.2.1 Boundaries

It is simple to read the polder structures as organized. From a first person perspective, the avenues, skylines, recreational clumps etcetera become informative elements that represent this type of landscape (Figure 65). In order to explore and define the boundaries of the character of this landscape, a first person perspective analysis on the views and perception in the polder has been conducted. By using the QGIS plugin "viewshed analysis" the visibility, from different points in the landscape can be computed and visualized on a map.

Starting from the average point of view of a standing adult, at 1.6 m from the ground, the legibility of the structure is quite remarkable, the area shown in Figure 66 describes the breadth of the viewshed in this land. Similarly, a map for the visibility from the point of view of a passenger sitting inside the high speed train on the overpass, at 13 m from the ground is constructed (Figure 67).

In order to create this map, various categories of metadata were collected such as the biota, spatial boundaries, climatology meteorology information, atmosphere, elevation, environment, farming, geoscientific information, imagery base maps earth cover, inland waters, location, planning cadastre society, structure, and transportation. This list of multifocal topics highlights the interrelation between the different layers of the landscape and are extremely useful to start describing which factors influence and/or are influenced by this technology.

Furthermore, this analysis reiterates the relation between what we see and how visible we are, which is direct and proportional, meaning the viaduct will be extremely visible in the open polder landscape, especially when no other elements are present to counteract the "verticality" of the line.

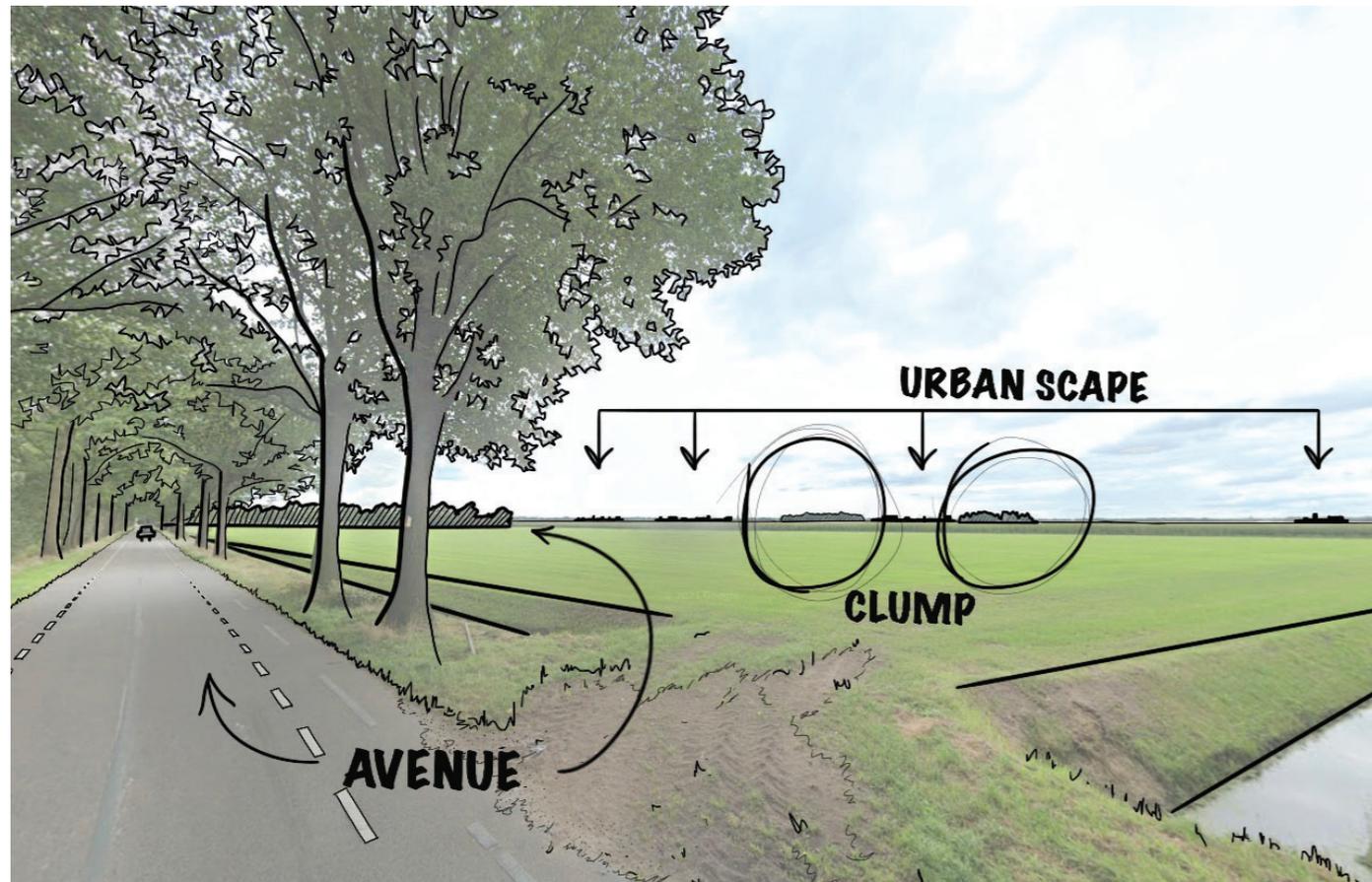


Figure 65. Visual readability of the polder system where ground structures inform on the landscape functions

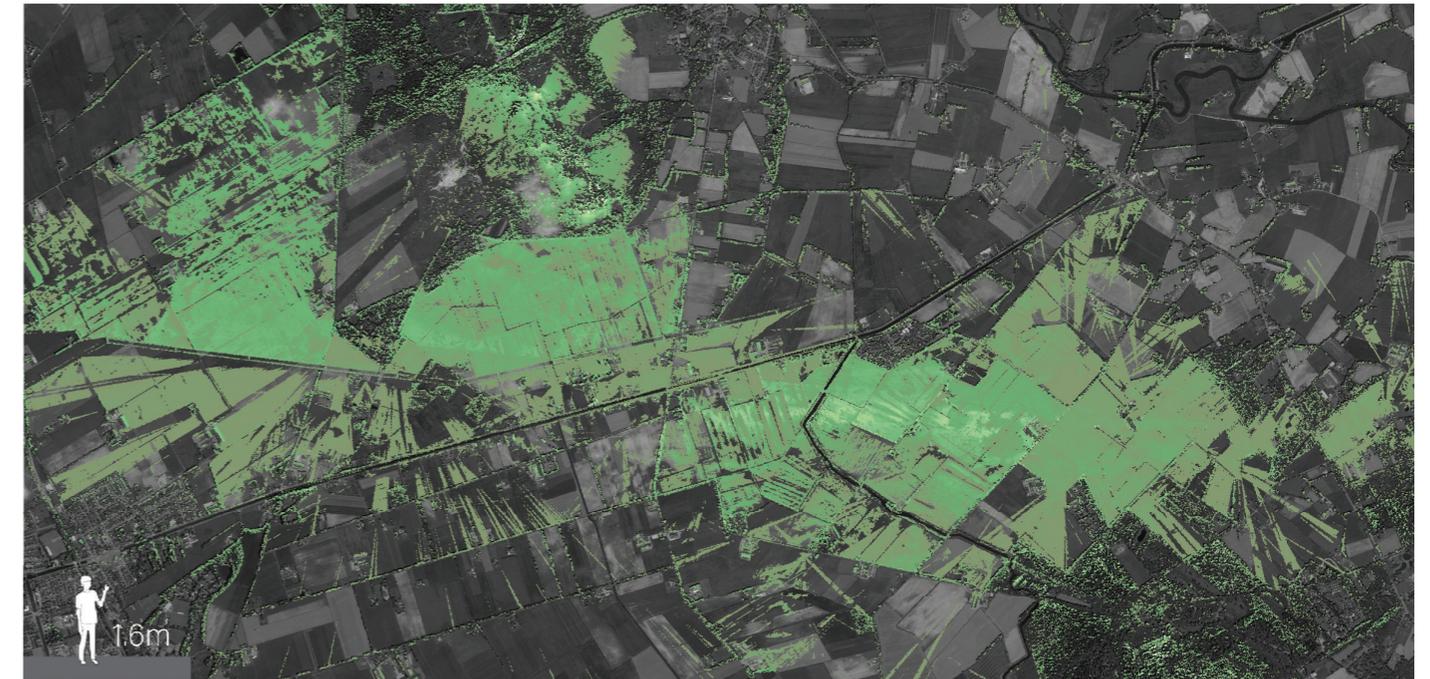


Figure 66. Vast readability of structure as seen from ground level

polder_visibility	
19,2941	19,2941
1,6078	25,7255
5,6275	29,7451
10,4510	34,5686
14,4706	39,3921

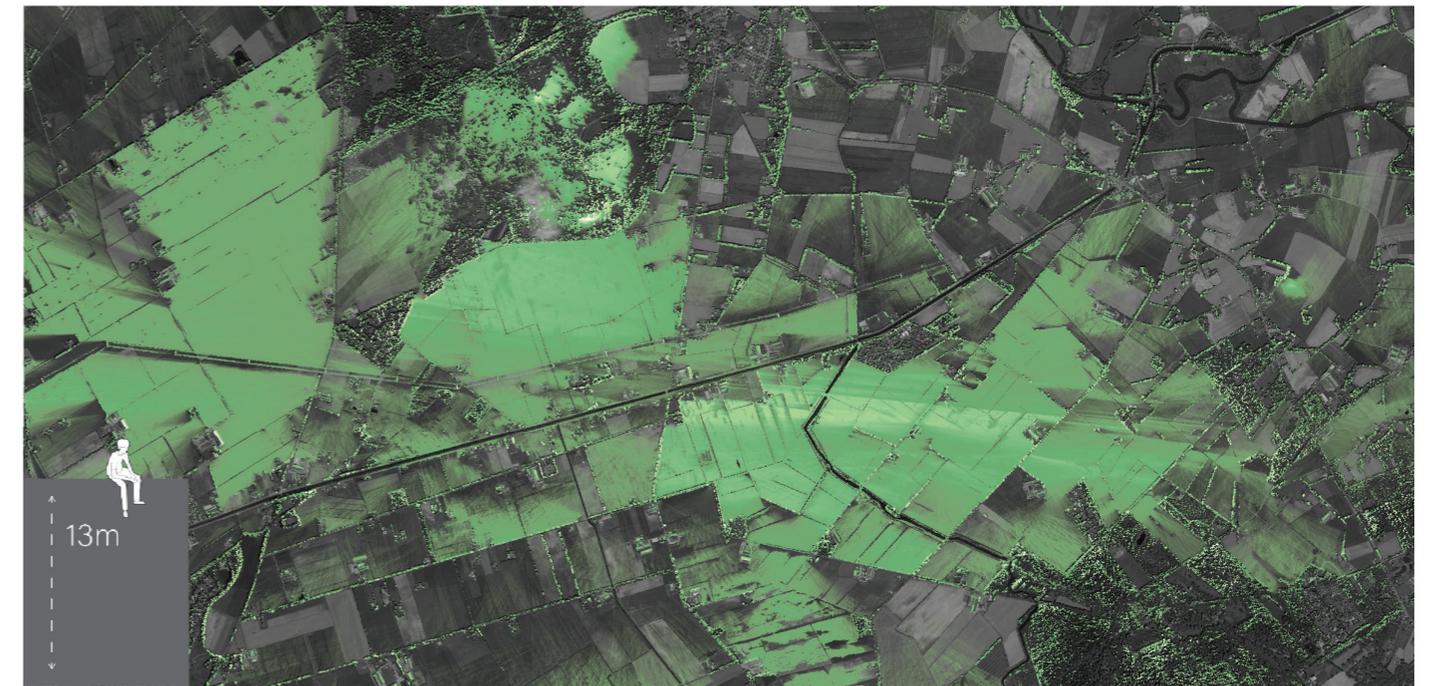


Figure 67. Vaster readability of structure as seen from viaduct level

III.3.3.2 Principles

As previously mentioned, the impact boundaries of the polder landscapes along the line P are dictated by what we can see (Figure 68).

In the open field a clump of trees directs us towards a recreational area, a row of trees points towards a ground structure, like a road or a canal, breaking the continuity of the landscape both on ground level and on horizon level, simply using vertical signaling elements (Figure 69).

This intrinsic readability creates an opportunity to integrate the many farmhouses affected by this development into the valuable polder signaling system (Figure 71). 70 out of the 121 buildings mentioned in the challenge vision (pages 52 and 53) will not be suited for living once the implementation is complete, this is because they fall within 50 meters of the railroad, area between which the noise pollution is not accepted for living conditions in the Netherlands.

The goal of this landscape implementation is for the viaduct to become part of the polder structure, being perceived mostly as a line. With green vertical elements this line can become an important indicator for function in the proximity of these retrofitted farmhouses (Figure 70 and 74)).

Placing a public function in these farmhouses will allow for interaction with the structure, which is a very important step in the acceptance of technology (Figure 72). Not only the line will become part of the system, it will become a reference point in terms of landscape reading (Figure 73 and 75).

from the train perspective, the landscape value will remain untouched, as elements near the viaduct will appear invisible at speeds between 250km/h and 350km/h, which are made possible to obtain by the straightness of the alignment.



Figure 68. Visibility is dictated by vertical elements in the landscape, which inform on functional structures

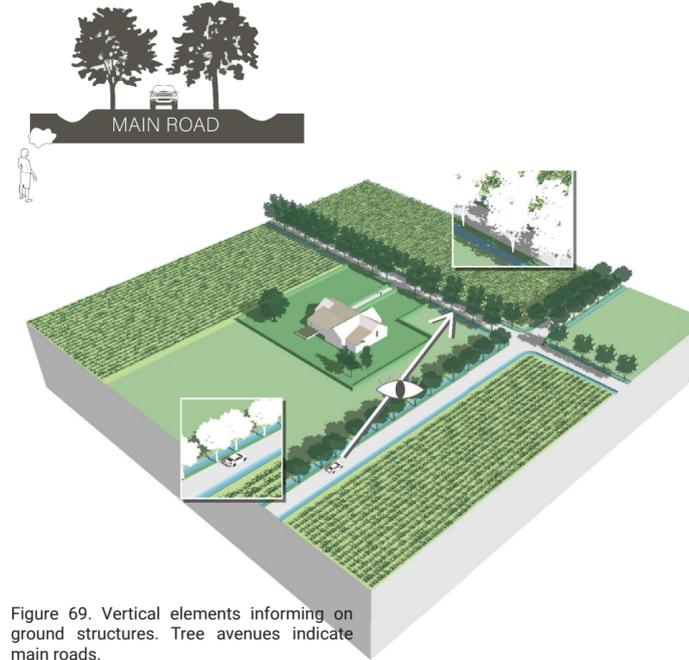


Figure 69. Vertical elements informing on ground structures. Tree avenues indicate main roads.

Line in the polder.

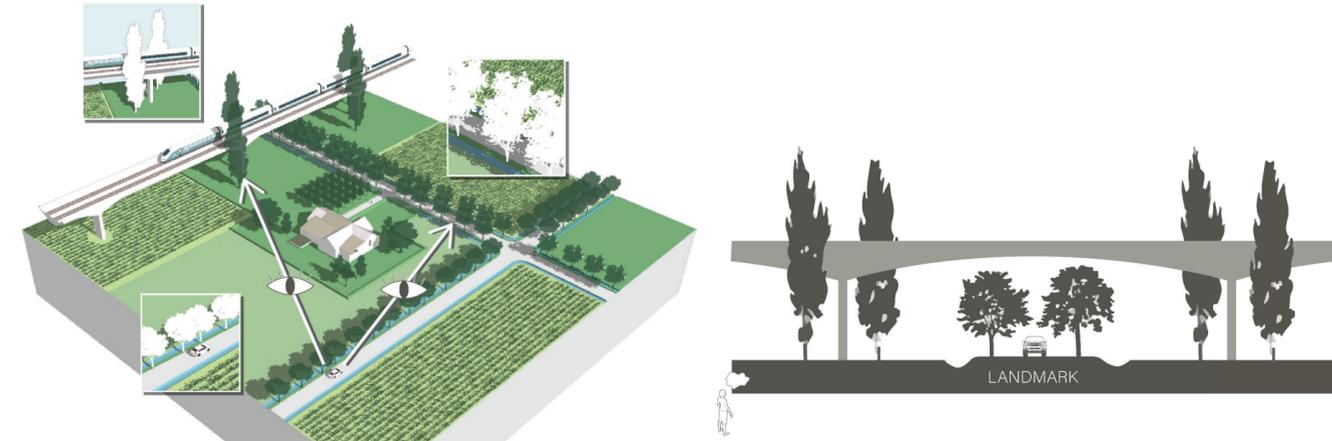


Figure 70. New landmark introduced by the viaduct implementation, informing about the proximity with a public garden or hospitality



Figure 72. New public orchard inviting the visitor to interact with the viaduct structure.



Figure 73. The new landmark system as experienced while driving on a main road, informing of the proximity to a public function.

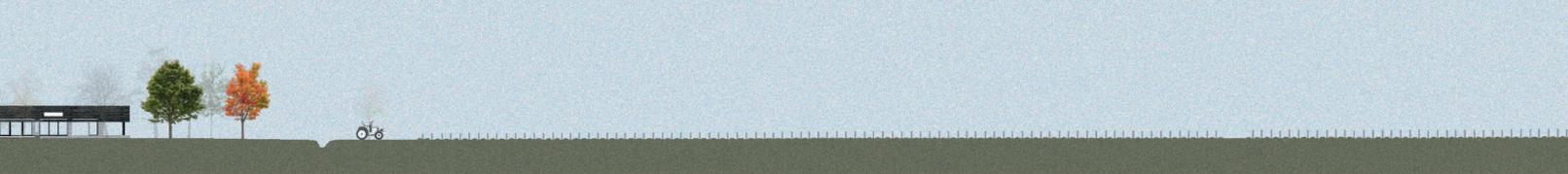


Figure 71. Typical farmhouse located closer than 50 meters away from the new railroad viaduct.



Figure 74. Design for a typical farmhouse turned into hospitality with public orchard and free interaction with the viaduct.



Figure 75. Experience of the line in the landscape landmark from the agricultural land.

III 3.2.3 Framing

The perceptual dimension of the viaduct as spatial element is not only limited to its column span and horizontal "line" body, the framing of the views provided by the portal structure creates another attribute to integrate with the landscape. Experimenting with the views and framing of the site character allows for a further exploration of the values and attributes that need to be highlighted. The framing is different, and therefore variant in each landscape typology, also dictated by the character itself.

In the polder landscape, the design principles for the implementation really focus on playing with the horizontality of the landscape in which the sky becomes the protagonist.

On the one hand, when the viaduct is placed on 13 meters tall pillars, the passengers of the train will be at 18 meters above ground, and when the viaduct is placed on 8 meters tall pillars, the passengers are placed at 13 meters above ground level. For the passengers themselves this will not prove to be a great change. This is due to the fact that most of the characteristic landscape elements demonstrate horizontal attributes which are in line and accentuate the open character of the site.

On the other hand, when the viaduct is elevated on 13 meters tall pillars the perception from an outside point of view, like seen in Figure 76, is that of a colossal structure, which does not directly influence the landscape, it in fact detaches itself from the context quite easily. While when elevated on 8 meters tall pillars the perception of the structure changes, the viaduct becomes more integrated in the long views and horizontal core elements. The columns are assigned as vertical attributes of the landscape, and the frame highlights this spatial character, like seen in Figure 77.

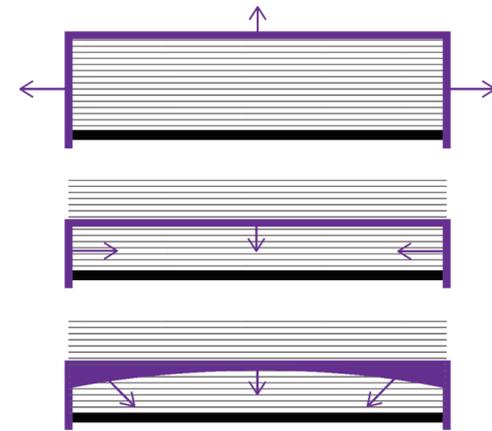


Figure 79. Diagram explaining the visual effect of the juxtaposition of the horizontal landscape with the vertical elements of the viaduct

Finally, the height of the frame is not the only influencing parameter in terms of spatial design, as the shape of the frame appears to have a strong impact of the views as well. In Figure 78 this factor can be seen, as a soft arch is added to the top frame of the structure in order to create a classical and integrated view over the landscape.

The diagram represented in Figure 79 describe the effect of the frame on the human perception. The tall frame in the horizontal context guides the eye away from the landscape, since the structure is not perceived as a frame to the horizon. The shorter frame allows for a clearer perception of the structure as a contour to the horizon. The soft arch reiterates the framing, drawing the eye to the elements of the horizon.

Once again the landmarks are introduced into the design in Figure 80. The juxtaposition between vertical and horizontal play are fundamental elements of the integration of the structure, as seen in the aforementioned principle.



Figure 76. Visual representation of the 13 meter tall pillars losing the focus on the landscape.



Figure 77. Visual representation of the 8 meter tall pillars highlighting the focus on the landscape.



Figure 78. Visual representation of the arched frame of the landscape, directing the views to the skyline.

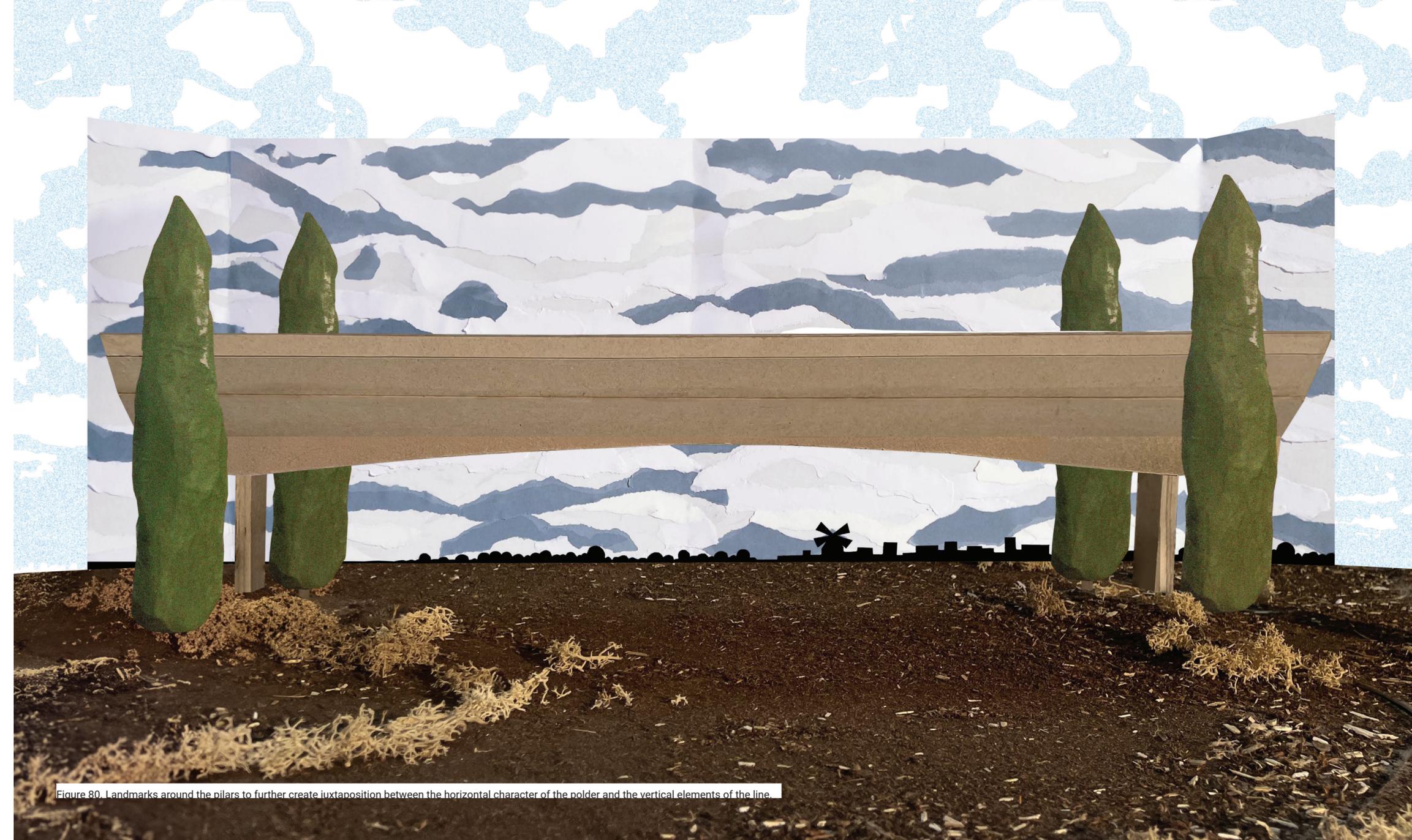


Figure 80. Landmarks around the pillars to further create juxtaposition between the horizontal character of the polder and the vertical elements of the line.

III.3.3 Forest landscape

The forest landscapes in this region are characterized by a calm and quiet atmosphere, their bucolic and immersive spatial experiences transport the visitor through an ethereal journey.

The province of Overijssel is host to many mature forests, some deciduous and some coniferous, like this one shown in Figure 81.

The beauty of this place, located at the Rechterense Veld recreational area, is encapsulated in the discovery of the heritage of the site. This forest was in fact used during medieval times as hunting grounds, following its controlled burning to provide open grounds within this habitat, to facilitate hunting for food.



Figure 81. Quiet and dense Dutch coniferous forest landscape (photo by author)

III.3.3.1 Boundaries

As briefly mentioned before, this specific location is represented by two contrasting landscape characters. The dense mature forest, alternating between coniferous and deciduous species, hides the story of the heritage of the land Figure 82.

Used as hunting grounds in the middle ages, the native forest, formed on sand drifts was burned down and heath grew from these nutrients. this cycle has been kept alive in the centuries by cutting / grazing the bushes and allowign for open plains to mark the landscape (Figure 83).

During the beginning of the last century, this area was still a wet heathland which has then mostly been planted to reselble today's structure. As the forest grows denser, maintenance requires more open spaces to be created

to encourage biodiversity and natural value. Since all the specimens in this forest are around the same age, this will remain a man-dependent park that focuses on the maintenance and discovery of local natural heritage (Figure 84).

Since the exploration of the park invites the visitor to discover the densiy of the forest by introducing contrast with the openness and the color, the viaduct will do the same, appealing to both visible and invisible senses. The spatial contrast in fact is one of the main characters of the site and the viaduct will play an important role as "scaler" in an environemnt where the struture is the only constant element.



Figure 82. The dynamic and dense Rechterense forest with its vertical elements and soft ground cover and canopies.

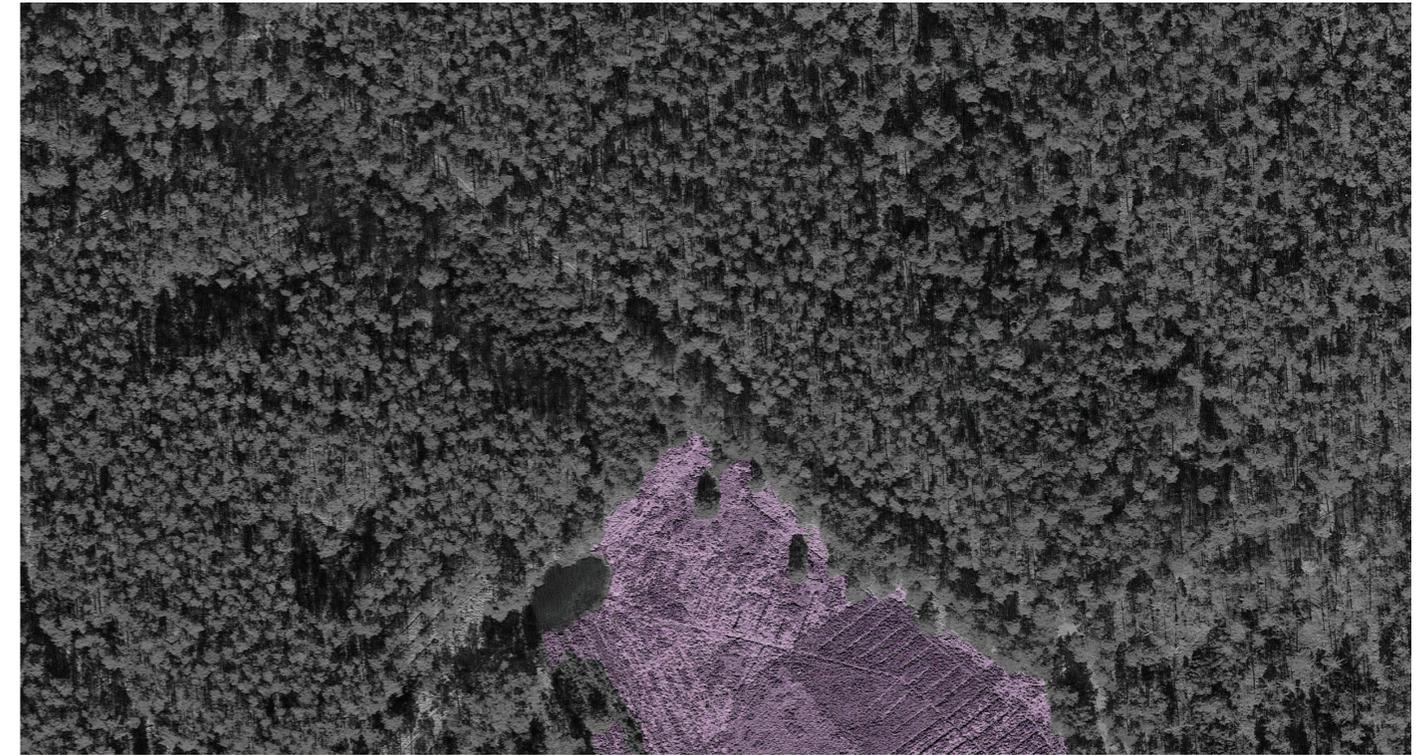


Figure 83. Juxtaposition of dense forest and the open field on plan (<https://www.google.nl/maps>, edited by author)



Figure 84. Blooming heather landscape at the Sallandse sand drift (image from <https://www.sallandseheugelrug.nl/>)

After the implementation of this technology, a new layer of perception will be introduced to the calm and quiet character of the site (Figure 86). The peacefulness of the forest is in fact highlighted even more by the sound of the high speed train. This new perception will become a new influence on the place and so the project boundaries clarify their presence. A blurred area between 100 and 150 meters on each side of the railroad will be affected (Figure 85).

These high velocity trains, especially when railed on a viaduct, do not produce unbearable sounds, but in a silent setting these will propagate nonetheless. This needs to be taken into account, especially when introduced into wilderness, the next pages will elaborate on this topic.

When the viaduct is present in the enclosed environment it is invisible but perceivable by its sound (Figure 87). When the viaduct intersects the open field, the discovery of the structure combines with the discovery of many special plant species, such as the heath, and many bird species like buzzards and orioles. The discovery of the biodiverse open field becomes a beautiful moment for interaction with the technology, framing the view with beautiful arched spans (Figures 87 and 89).

Thus, the overpass becomes part of the forest system like a discrete guest (Figure 90), appearing and disappearing as the landscape and its flora changes. The line in the landscape appears in the open field and disappears into the forest (Figures 88 and 91).

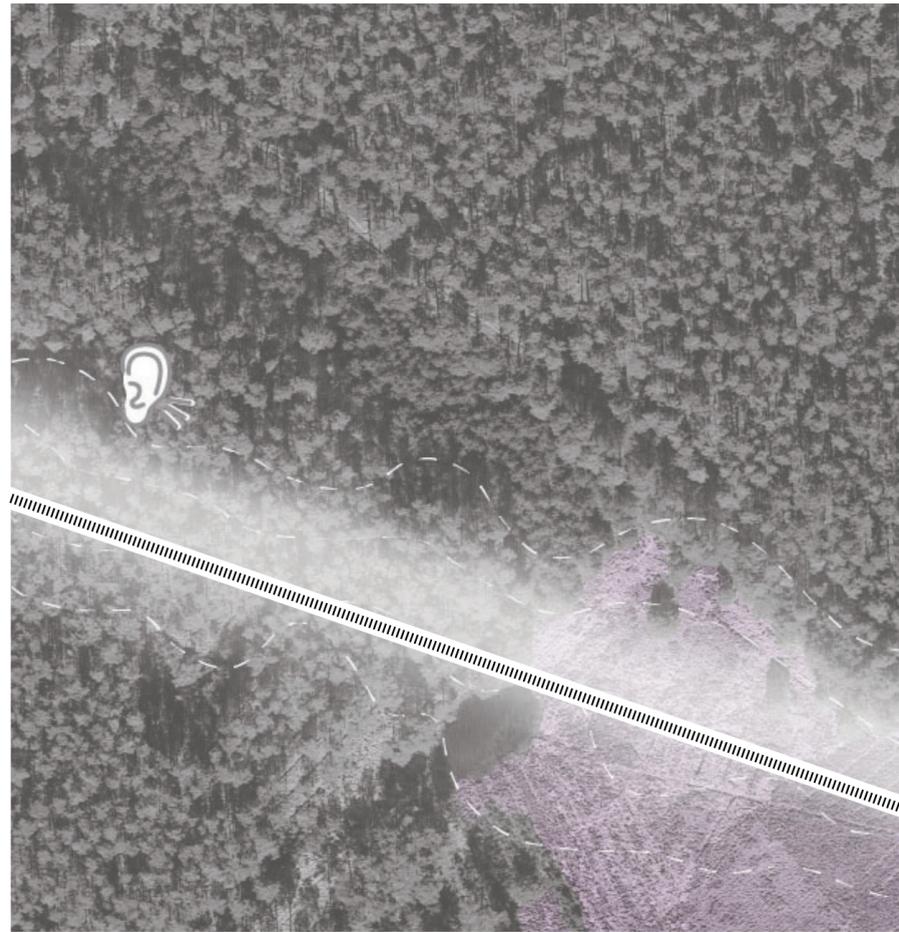


Figure 85. Intrinsic character of the site where the noise pollution of the railroad creates a new perception of the forest.

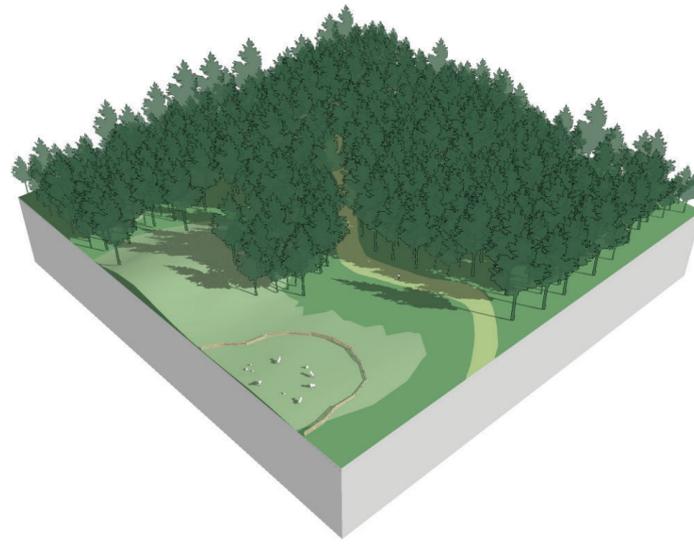


Figure 86. Entrance to the dense coniferous forest landscape of the Rechterense Veld

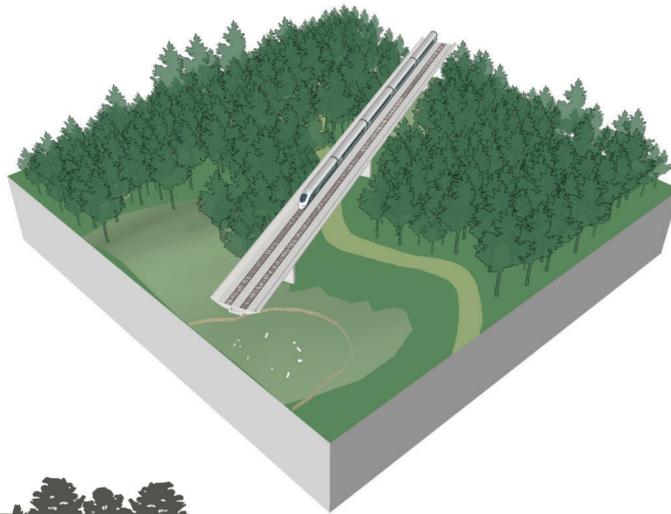


Figure 87. Viaduct implemented in the landscape reacting to the double character of open and dense landscape.



Figure 88. The line in the landscape appearing and disappearing in the forest.



Figure 89. Perception of the viaduct in the open field, where the size of the structure highlights the maturity of the forest.

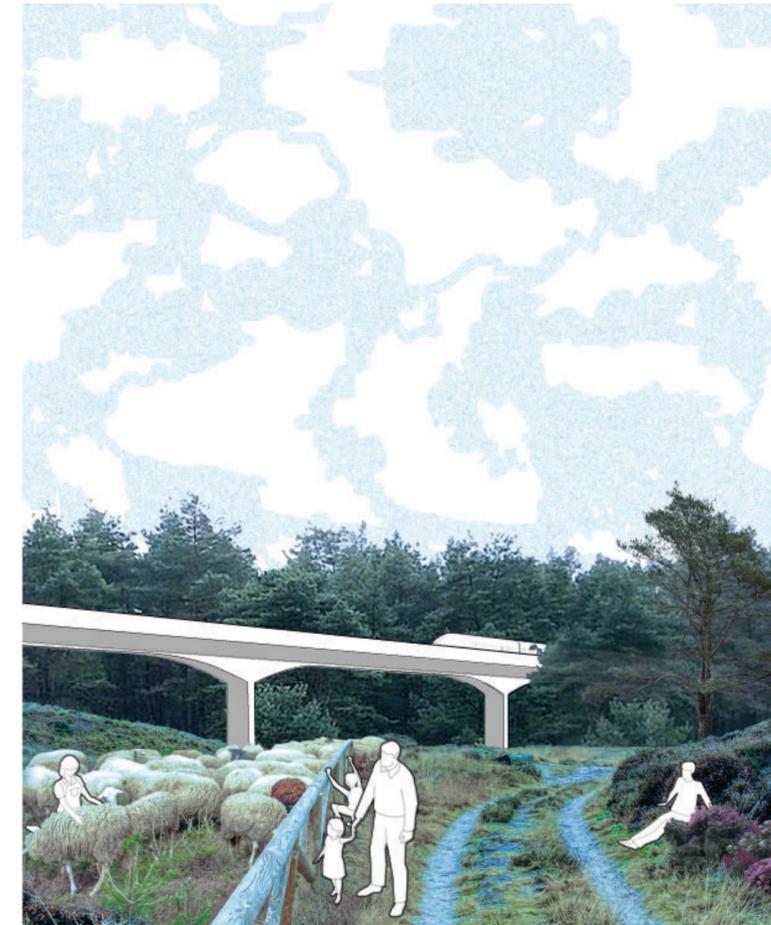


Figure 91. Impression of the first person perception of the appearing and disappearing viaduct.



Figure 90. The line in the landscape disappearing in the dense forest, where interaction with the viaduct follows its discovery.

III 3.3.3 Framing

In the forest landscape, the design principles for the implementation really focus on playing with the dense verticality and peaceful atmosphere of the place, in which the tree trunks and uneven ground cover become the protagonists.

On the one hand, when the viaduct is placed on 8 meters tall pillars, the passengers of the train will be at 13 meters above ground, and when the viaduct is placed on 13 meters tall pillars, the passengers are located at 18 meters above ground level. For the passengers this will prove to be a great difference, since in the mature forest landscape's most visual elements are the tree trunks and canopies which, seen at high speeds, respectively form a hard wall and a soft wall. The soft walls created by the canopies are ideally better views for the passengers than the hard walls created by the trunks.

On the other hand, when the viaduct is placed on 8 meters tall pillars, the perception of the landscape from an outside perspective changes, and the viaduct becomes a visual divide between the ground and the sky. The dense tree structure is separated between ground cover and canopy, like seen in Figure 92. When placed on 13 meters tall pillars, the perception of the viaduct, like seen in Figure 93, is not influenced by the structure itself. The viaduct serves as a frame to the vertical character of the forest, informing the visitor of its maturity and value.

Finally, the arch shape has been added to the frame in Figure 94, which, in this location, helps to differentiate the viaduct from the surroundings in order to form a stronger juxtaposition, not only of horizontal and vertical elements but also in size between the 50 meters span of the viaduct and the dense pattern of the forest.

The diagram represented in Figure 95 describes the effect of the frame on the human perception. The short frame in the vertical context guides the eye away from the landscape, since the structure is not perceived as a frame to the elements. The taller frame allows for a clearer perception of the structure as a contour to the elements. The soft arch reiterates the framing, drawing the eye to the dense verticality.

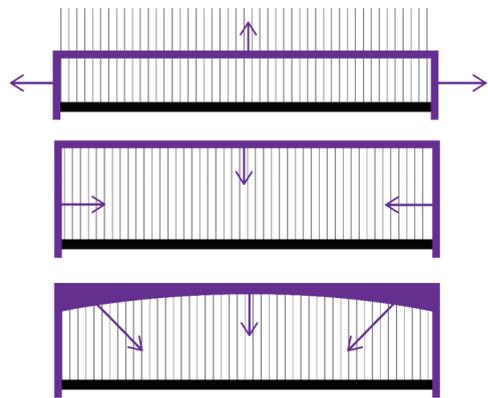


Figure 95. Diagram explaining the visual effect of the juxtaposition of the vertical landscape with the horizontal elements of the viaduct.

One of the key characters of the forest landscape is its peaceful and quiet atmosphere, which, like mentioned in the previous pages, will be affected by the sound of the high speed train on some level. A sound barrier is added to the design in Figure 96 to not only limit the noise pollution in the area, but also to imitate the softness of the canopies within the same hard woody material of the tree trunks. This barrier will only be present at the intersection with an open field, since the canopies of the trees intrinsically reduce the noise of the train already. This element will further amplify the experience of the forest for the train passengers, as well as reduce the experience of the train for the visitors of the forest.



Figure 92. Visual representation of the 8 meter tall pillars losing the focus on the landscape.



Figure 93. Visual representation of the 13 meter tall pillars highlighting the focus on the landscape.



Figure 94. Visual representation of the arched frame of the landscape, directing the views to the trunks and ground cover.



Figure 96. Sound barrier on the edge of the viaduct to further create juxtaposition between the vertical character of the forest and the horizontal elements of the line.

Chapter IV: Principles and application

IV.1 Dalfsen's landscape mosaic

The different landscape integration principles that were presented during the alignment exploration are useful tools for designing the implementation of the infrastructural technology within the different individual landscape systems. However, no landscape is bounded, interaction within different spatial experiences, species and specimens are constant and continuous.

The application of the principles requires a flexibility that reflects the overall character of the line, since the full length of the line of 67 km cannot be represented in one or two interventions.

The choice of this location was made especially to highlight the need to adapt and adjust the principles to the interaction of landscapes.

This is Dalfsen, its structure and spatial quality represents the mosaic landscape of this research. It's a historical inhabited center, characterized by pictorial views and social heritage. The railroad, in combination with the other infrastructure cuts the site, not only in terms of accessibility but also in terms of views (Figure 100).

In this area we can identify the dynamic urban landscape, recreational forest landscape, the surrounding and framing polder landscape and finally the infrastructural landscape, that forms a barrier belt within these systems (Figure 97).

In describing the straight forward implementation of the line in the landscape within this complex mosaic, the vertical barriers of the site are highlighted (Figure 98). This landscape is rich in dikes and the separation of the different landscapes is even intensified when the viaduct is implemented, resulting in a redundant and ungraceful cut landscape (Figure 99).

In order to create social and spatial opportunities in this mosaic landscape, a step by step application of the principles is required.

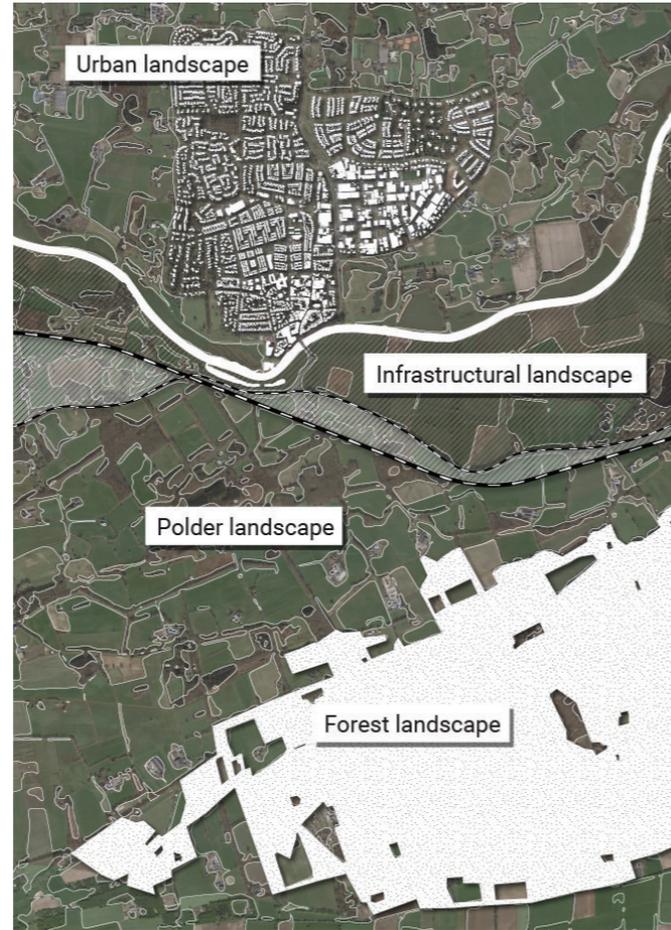


Figure 97. Landscape mosaic character(s) showing a great fragmentation due to the infrastructural belt.



Figure 100. Bird eye view of the infrastructural landscape as a barrier where the land is fragmented and left over.

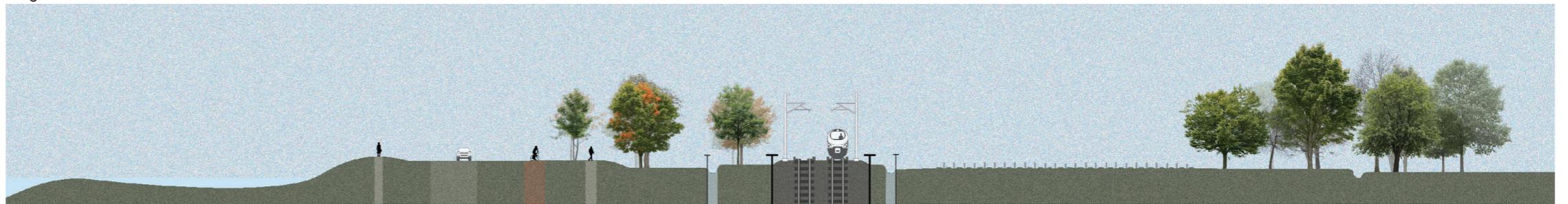


Figure 98. Section of the infrastructural landscape before the viaduct implementation showing the ditched and railroad dike as absolute barriers.



Figure 99. Section of the infrastructural landscape after the viaduct showing a redundancy in the current state, where no improvements are made to the challenge of barriers.

IV. 2 Mosaic implementation principles

The station area strategy can be applied to this situation, starting from the application of the boundary principle. The step by step approach implies the need to define the location of the station and the current openings, the to set parallel and perpendicular impact boundaries and finally creating a direct connection.

The impact boundaries are formed by two areas: the parallel impact of the barrier along the railroad, which is usually dictated by the access points of the railroad structure, and the impact boundary perpendicular to the infrastructure which is described and can only be identified by the spatial character of the site, which is the value of the landscape in the mosaic. In order to understand the impact of the railroad barrier it is important to study the current situation. The separation in Dalfsen is seen in the disconnect of the tree structures, the water bodies and water system and in the routing on site (Figure 102).

The station strategy principles are then applied step by step as follows (Figures 101):

- 1) Identify the station and the access points on the map (Figure 104, page 85);
- 2) Find the parallel impact boundary defined by the openings along the railroad barrier and the area they give access to (Figure 104, page 85);
- 3) Find the spatial character of the site and conduct an analysis based on the physical area that is highlighted within the value of the site (Figure 103, page 84);
- 4) Highlight the social value within the perpendicular impact boundary by responding to the character analysis of the area (Figure 104, page 85);
- 5) Design a slow mobility connection between these points, passing through the new station area and openings, highlighting the new connected landscape mosaic (Figure 104 page 85).

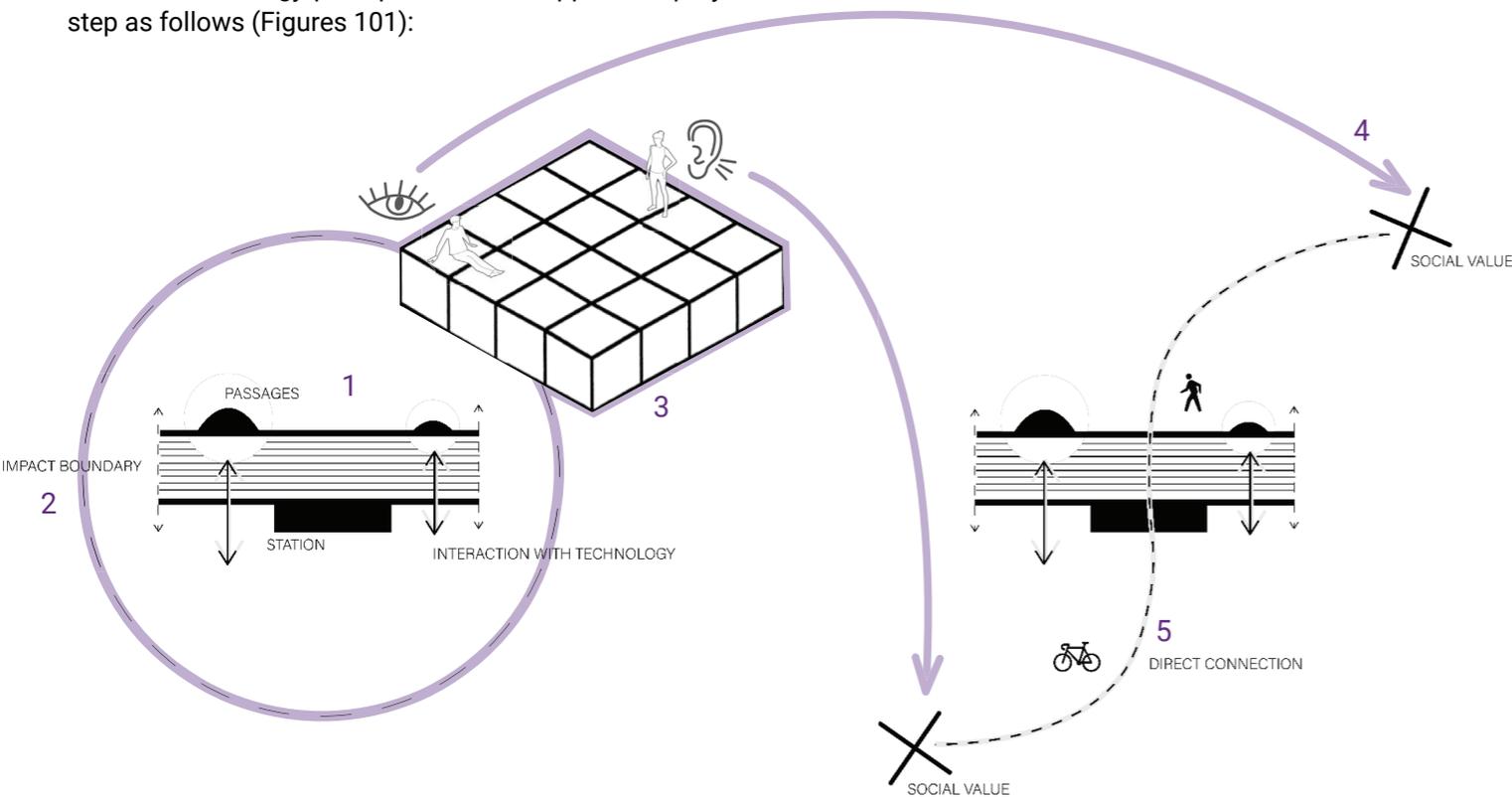


Figure 101. How to use the character perception in the station principle in 5 main steps.

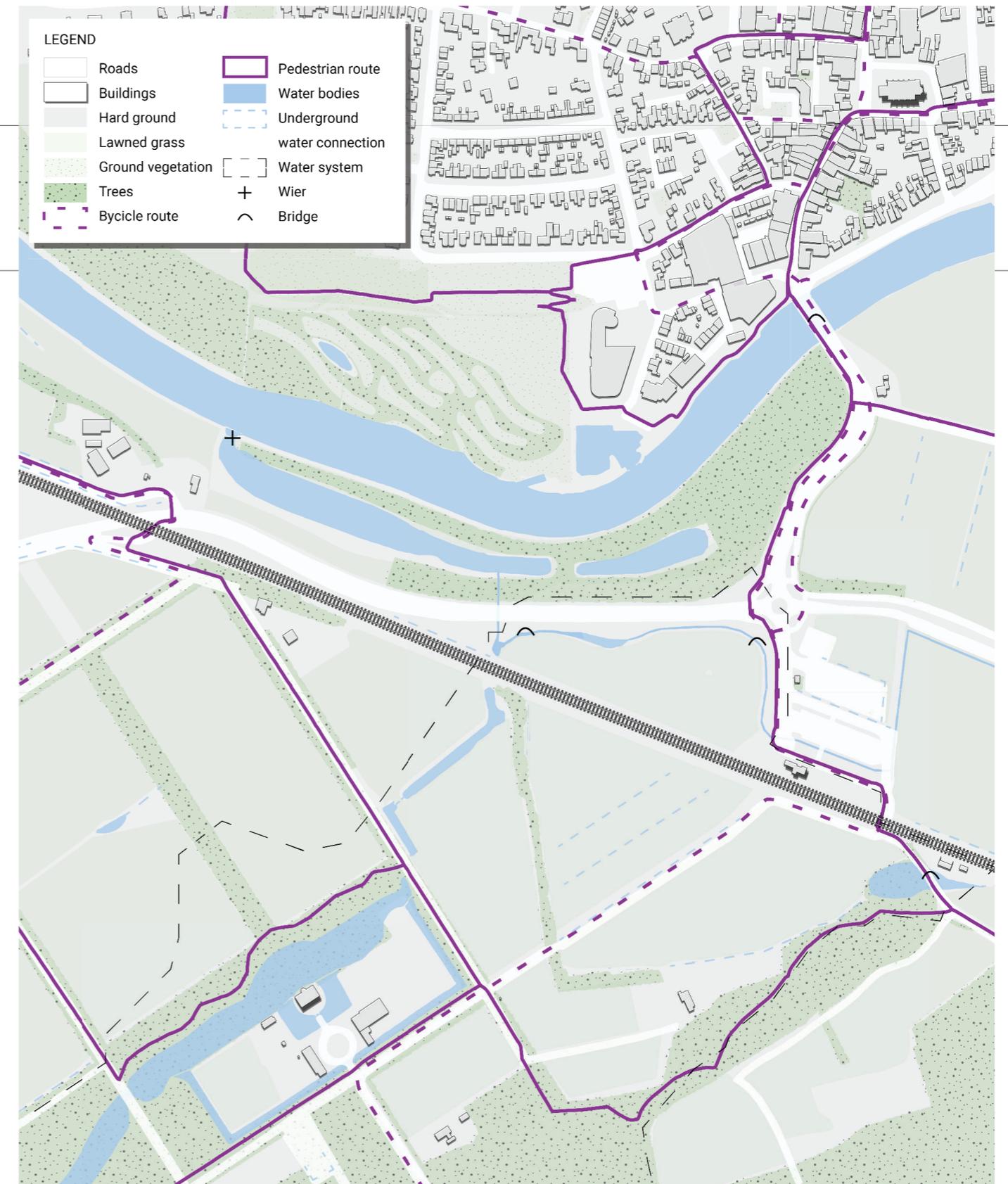


Figure 102. map showing the extent of the fragmentation and the inaccessibility of the heritage site of the Havenzade Den Berg site for pedestrians.

IV.2.1 Spatial value

The spatial character of this site, as previously mentioned is composed of a mosaic of spaces, meaning that the spatial value of this site is mixed. In the high speed dimension, however, the landscape is perceived as a polder environment that frames different densities and openesses of landscapes.

For this reason a visibility analysis is conducted in this area to shine a light on its potential perceptual character, at a 13 meters height from the ground (Figure 103).

As an output for this viewshed identification, an incredible landscape experience is unveiled, where some iconic buildings create a visual narrative of the story and heritage of Dalfsen. The Grote Kerk (1178), central in town, and the medieval Havenzade Den Berg (1480) (Figure 104).

These two monuments, as well as other landmarks in the landscape, such as De Westermolen windmill, reflect the symbolic meaning of the landscape and the social value of the site.

At this point the station area and access points have been identified, the parallel impact boundaries have been set, the spatial value of the site has led to an exploration of the perpendicular impact boundaries, and the social value has been highlighted through a new direct connection between the two heritage sites (Figure 104).

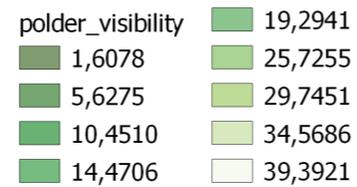


Figure 103. Vast readability of structure as seen from viaduct level as a result of the 3rd step of the station principle implementation.

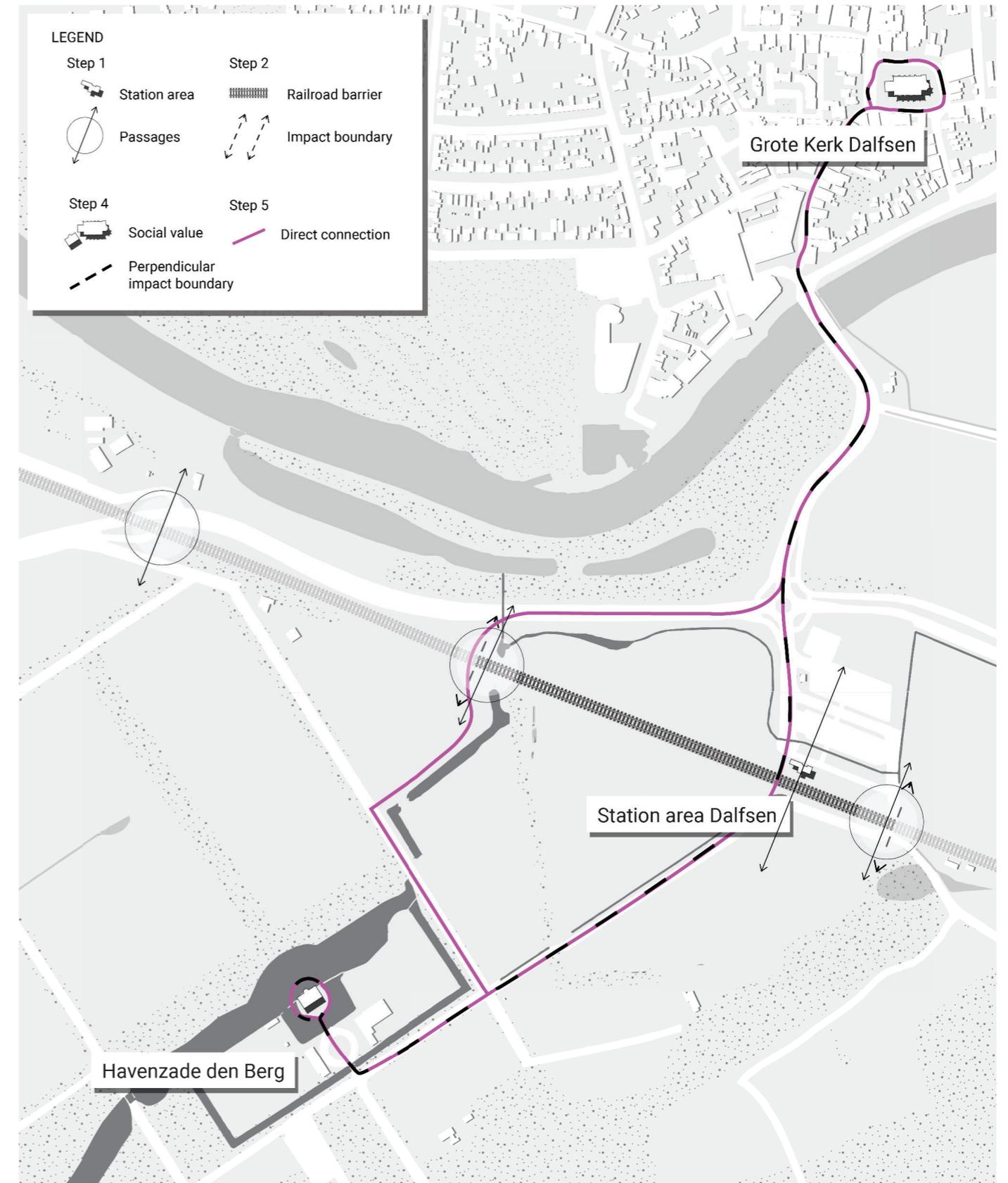


Figure 104. Result of the 5 steps approach defining the boundaries of the implementation as well as the new slow mobility route.

The Havenzade and the Church form an important connection between the people and their land, offering access to symbolic meaning of belonging within the heritage, daily amenities and recreation (Figure 105).

Dalfsen has been described in history blogs as a passing area during history. The website "DNA van Dalfsen" describes the relation between history, people and the formation of this landscape as a patch work of influences and requirements.

This place was described by a local painter and a history lover:

"For centuries, people have been passing by here, from all directions. One on the centuries-old Hessenweg or the Twentseweg, the other on the water of the Vecht, the Dedemsvaart or the Overijssels canal. People have been coming and going here for at least 5,000 years: on foot, on horseback, by boat, by ox cart or by train." and continued:

"I'll tell you: all those people who arrived here in all those thousands of years did not pass through, but stayed. I am one of them. Just like my parents and my neighbors and all our ancestors. We created the Land of Dalfsen with care, perseverance, and courage. Step by step. Little by little. Shovel by shovel, the land has been reclaimed and the canals have been dug. Even the worst bends have been removed from the Vecht for shipping purposes. Patient. Realizing that together, in small steps, we can achieve our goal." (original text translated from Dutch with Google Translate), (Verhaal Van Dalfsen - DNA Van Dalfsen).

As this land assumes the role of commuting town as well as destination, the introduction of the railroad the system in the early 1900s has allowed for this character to be on the one hand possible, and on the other hand impossible. The system has been broken and a new double trench has been created in this historical land (Figure 106).

All of these iconic places (Figure 107) represent the social value of this bounded landscape and the viaduct will now help create a direct connection and an area of interest between the two, including the current station facilities.



Figure 105. Representation of Dalfsen putting the Grote Kerk and the Havenzade Den Berg in 1825.



Figure 106. Map showing the first construction of the railroad separating the city center of Dalfsen and the Havenzade Den Berg in 1910.



Figure.107. Impression at 13 meters above ground of the open views over the heritage of Dalfsen

IV. 3 Dalfsen's Line in the Landscape

After the previously mentioned 5 steps to apply the station area strategy principle are completed, the integration of the line in the landscape can begin with site specific interventions. In this phase, the design of two nodes (Figures 108 and 109), specific to the impact boundary of this site, is presented along the landscape node (Figure 109) and the station node (Figure 108).

Using the dimensions of perception, function and symbolism, these two nodes have been designed to, not only highlight the character of the site, like previously mentioned, but also to present an alternative to the current design of the railroad on site. These two nodes and their respective immediate surroundings are in fact correctly characterized by barriers and fragmentation of the landscape.

The perceptual intervention on the site as a whole is described by the polder character exploration, as the open views over the site deserve to be highlighted. Respectively, the landscape node will provide access to the landscape overall and the station node will provide services and access to the high speed train platform.

The functional layer of the design for the line in Dalfsen's landscape is mostly focused around mobility and accessibility to the services and to the landscape, focusing on pedestrian accessibility within the area of interest, bicycle accessibility around the area of interest and redirecting car traffic away from the interested area (Figure 110).

Finally the symbolic dimension will be provided through the design of access points to the natural heritage and highlighter viewlines to the landscape (Figure 110).

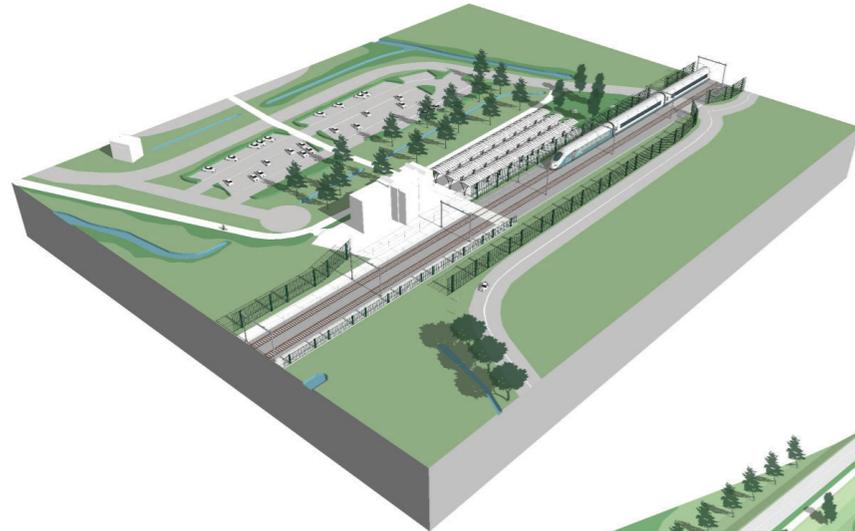


Figure 108. Station node as a great landscape barrier due to the railroad cut.

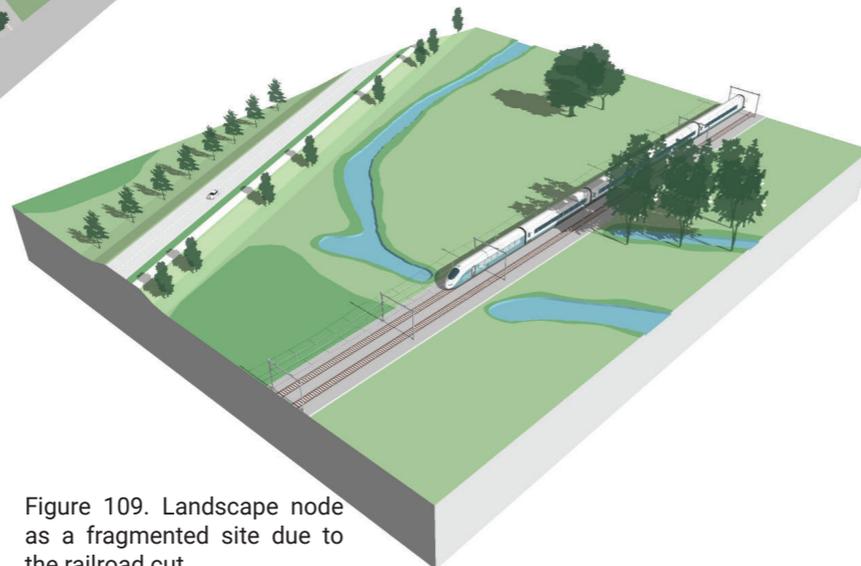


Figure 109. Landscape node as a fragmented site due to the railroad cut.

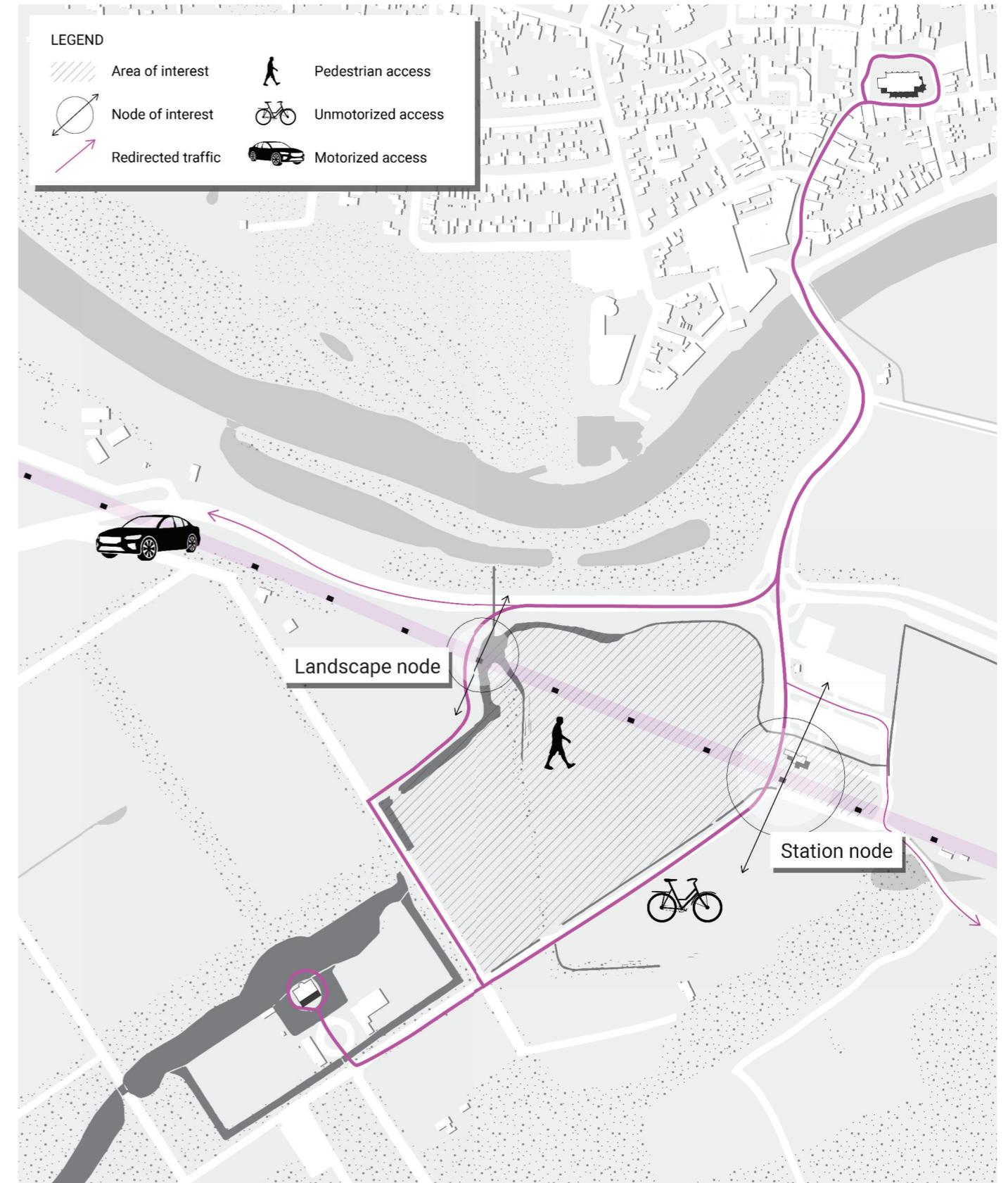


Figure 110. Final brief for the implementation of the line in the landscape based on the 5 step principle application.

IV. 3.1 Dalfsen's station node

The station node located on the eastmost extremity of the interest area presents, as previously mentioned, a large number of landscape barriers due to the railroad cut.

In Figure 111 one can recognize the station facilities building, open air train platform, bike parking and car parking barrier. Furthermore, by looking at the section

presented in Figure 114, the many gates and safety barriers can be clearly seen, separating the landscape.

The aim of the intervention on this node is to create a more readable landscape, where no horizontal obstacles are present at ground level. As can be seen in the new organization of the landscape, before the implementation of the new railroad viaduct in Figure 112 and Figure 115,

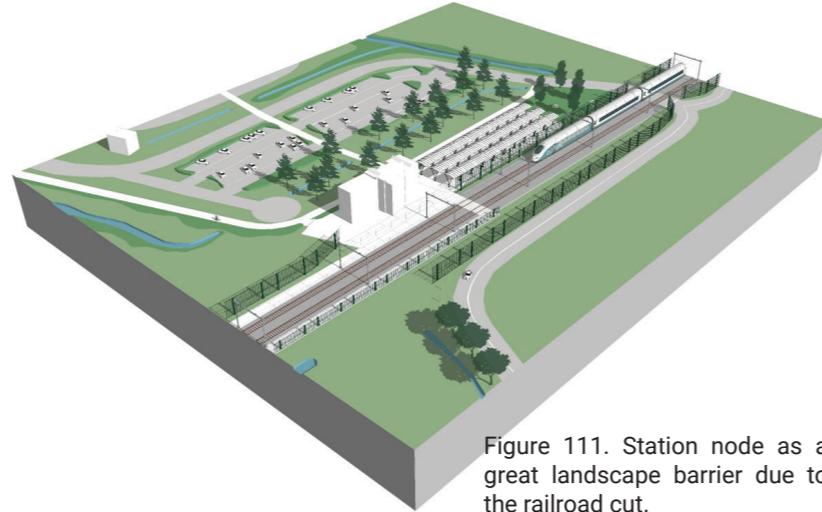


Figure 111. Station node as a great landscape barrier due to the railroad cut.

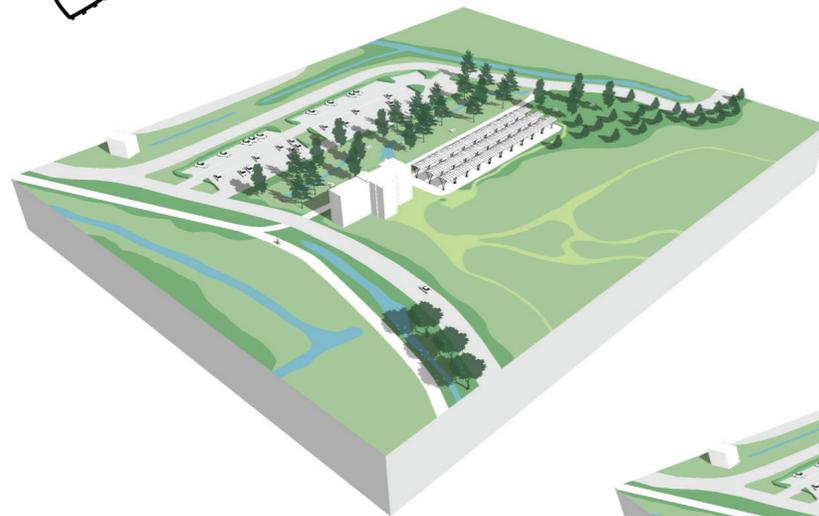


Figure 112. Intervention on the station area where the railroad cut is removed and the landscape is made open and accessible.

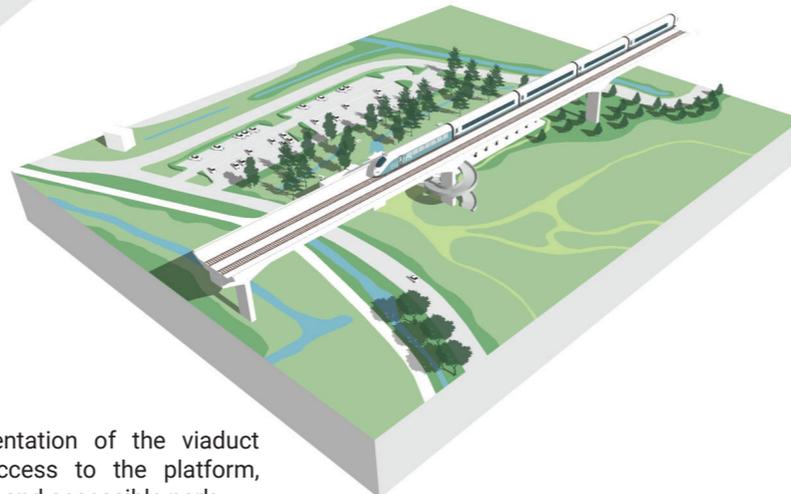


Figure 113. Implementation of the viaduct showing the new access to the platform, directly from the open and accessible park.

the traffic has been redirected creating a new landscape accessible by foot, characterized by long green views and made uncluttered by the removal of the many layers of gates and poles. The perception is clear and intuitive. The second layer of the intervention regards the functional implementation of the elevated railroad and high speed platform, as seen in Figure 113. As the horizontal character of the site is maintained and highlighted through the removal of barrier and open

visibility and accessibility of the site, the section in Figure 116 demonstrates the intuitive nature of this very readable new landscape.

The symbolic dimension of the intervention to this node represent a liberation from the disconnect between our perception and our experience in a way in which the visitor of the facilities or passenger of the train can now clearly read the functional and spatial quality of this station area, only made possible by the overpass structure.



Figure 114. Section clearly showing the magnitude of the landscape barrier created by the railroad cut.

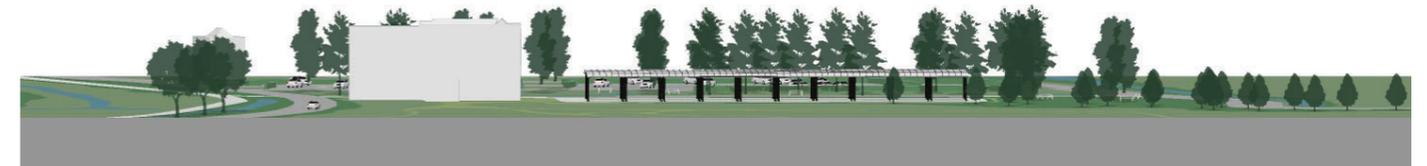


Figure 115. New section to the station landscape showing a new found readability and freedom in movement.



Figure 116. Implementation of the viaduct maintaining the accessibility and readability of the landscape.

IV. 3.2 Dalfsen's landscape node

The landscape node located on the westmost extremity of the interest area presents, as previously mentioned, an extensive and clear fragmentation of the site due to the railroad cut. In Figure 117 one can recognize the two canals being interrupted by the infrastructure, as well as the historical tree line that structurally connects this piece of land directly with the Hvenzade Den Berg. These sites are only structurally connected, since the railroad

primarily intersects this path removing all sorts of spatial connection between the inhabited center in the north and the heritage site on the south. Furthermore, the cabling and railroad dike prevent the passage from one side to the next, due to safety reasons (Figure 120).



Figure 117. Landscape node showing the railroad cut fragmenting the site.

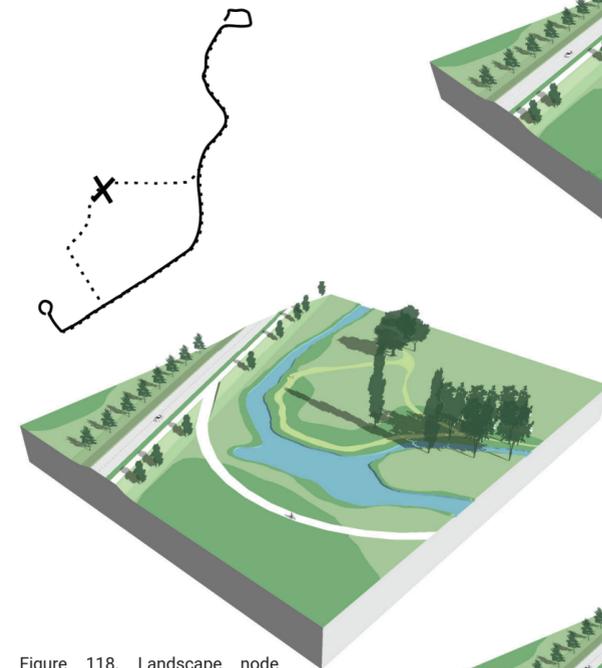


Figure 118. Landscape node showing a new connection after the removal of the railroad cut.

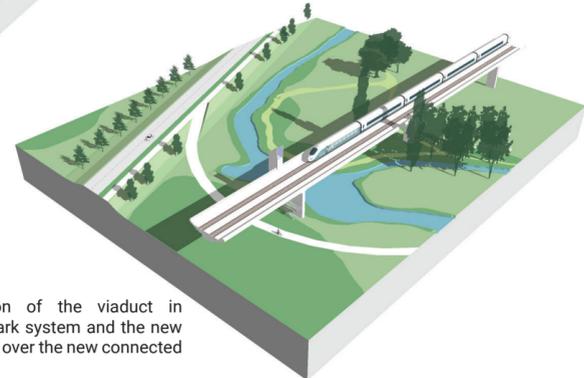


Figure 119. Implementation of the viaduct in combination with the landmark system and the new viewing tower, creating views over the new connected landscape.

The aim of the intervention on this node is to create a more accessible landscape, where no horizontal obstacles are present at ground level and where vertical elements highlight the spatial and social value of the site.

The first organizational step of the intervention, seen in Figure 118, is to create direct access to the south of the current railroad. This is done by creating a slow mobility route connection from the infrastructural dike on the

north, to the south passing by the node and remaining on the contours of the interest area. Accentuating the new connection and reduced fragmentation is the new pond that crates not only continuity but also ecological and social value, since this area will now be accessible and directly connect to the rich waters surrounding the Havenzade. The vertical landmarks visible in the section of Figure 121 create a clear readability of the space, as these trees represent an interest point in the



Figure 120. Section showing the linear railroad cut.

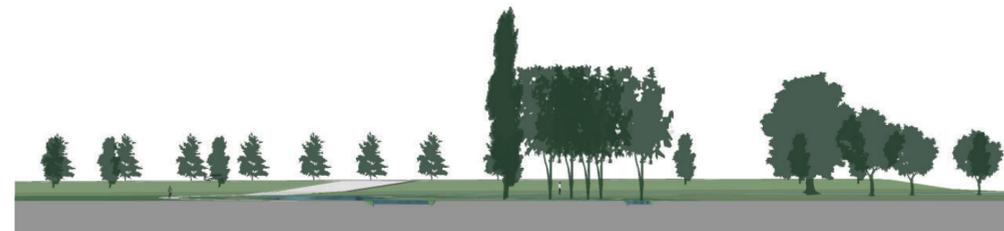


Figure 121. New section introducing the slow mobility route and landmark system.

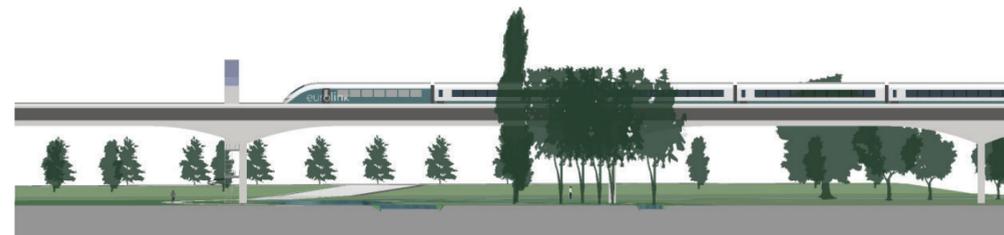


Figure 122. Implementation of the viaduct with integrated viewing tower forming the second vertical element in the landmark system.

landscape. Once the viaduct is implemented, like seen in Figure 119 and Figure 122, a new vertical element is discovered, which, in combination with the landmark cypresses, guides the visitor to discovering a new value of the landscape.

Between nature and heritage, this intervention describes perfectly the value of the site and highlights the beauty of Dalfsen's cultural landscape. This viewing tower

completes the polder principle of the double landmark framing the new social value of the place, like seen in Figure 123. Its structure allows the visitors to enter the tower from the ground level, as well as providing an escape route from the high speed railroad overpass itself.

By accessing the tower, like seen in Figure 124, the visitor will experience different views at different levels, which will present the landscape through its many layers,

mostly visible in the vertical elements.

The passengers of the train will not be disturbed by the landmarks during their trip, since at the high speed between 250 and 350 kmh motion blur makes these vertical point elements near the viaduct edge almost completely invisible, obtaining an unobstructed view to the beautiful landscape of Dalfsen (Figure 125, pages 94 and 95).



Figure 123. Mixed media collage/ model reiterating the concept of the double landmark and highlighting the horizontal character of the site.



Figure 124. Detail of the viewing tower allowing for incredible views over the landscape and social heritage of Dalfsen.



Line in the Landscape.

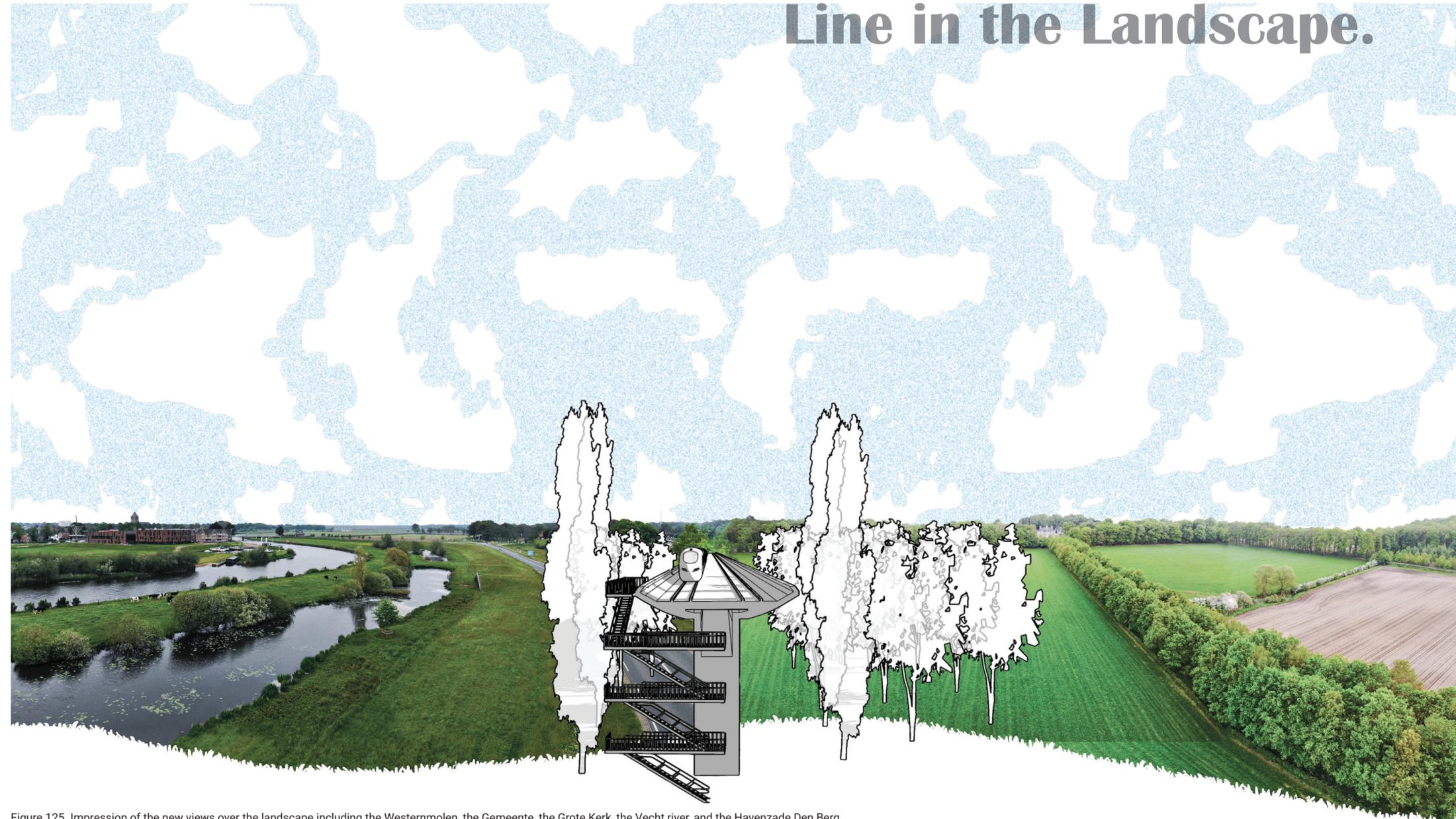


Figure 125. Impression of the new views over the landscape including the Westermolen, the Gemeente, the Grote Kerk, the Vecht river, and the Havenzade Den Berg.



Chapter V: Conclusion and Discussion

V.1 Conclusion

This research is opening the doors to a new way of implementing railroad infrastructure that is, on the one hand using classical notions of landscape structuring and landmarking, and on the other hand challenging the vision making process behind achieving a more connected and readable landscape. It set up an experimental approach in order to achieve a more socially acceptable and understandable landscape technology implementation that aims at answering the research question: “What are the social and spatial opportunities of implementing an overpass railroad technology within the Dutch cultural landscape?”

V.1.1 The line as a landscape narrative

The initial phases of the research saw the line in the landscape as a director for the research and findings that occurred. The different alignments focused on telling narratives about the landscape and its processes that went beyond a simple infrastructure, but described the relations between the people, the land and the technology that dictate the perception to different extents, in a flowscapes framework.

V.1.2 The line as a landscape connector

The interscalar implementation of the line within the different landscapes, proved to encourage a great deal of connections, be the functional accessibility allowed by the overpass structure, or the more symbolic connection that this design manages to create between the character of the sites and the social spatial values as mentioned. Both the passengers of the trains and landscape explorers are able to benefit from the newly created networks that allow for readability as well as accessibility.

V.1.3 The line as a landscape landmark

The landscape in itself is defined by horizontal and vertical elements that describe a structure on the ground as well as landmarks in the navigation system. The line in the landscape becomes part of this visual mapping in itself, creating a horizontal framing of the different sites and accentuating focal functional points within its itinerary by demarking the verticality of landmarks,

in juxtaposition with the endless viaduct line structure. Thus, the infrastructure in itself does not only carry the commission of high speed railway mobility, but also a brand new layer of landscape readability.

V.1.4 The line's social and spatial value

Overall, the line in the landscape represents the integration of landscape, people and technology on the basis of the chosen framework and methods of three dimensions of meaning explored by research through design. This project and research is of course experimental and hypothetical, creating a scenario that is not a final result, more so an extensive collection of opportunity and visions.

V.2 Discussion

Ultimately, the result of this research cannot be considered as completed or partially completed, due to the scale and multidisciplinary of the topic discussion. Without the opinion of local people, railroad experts, structural designers and regional planners this vision cannot and should not become reality. The application of this concept and design are still uncertain, as the research on this topic is not extensive yet, however this project reflects the attitude and curiosity of the landscape profession, as no boundaries are set between the infrastructure and the landscape. The strength of this project are all the unknown factors that still play an ambiguous role in the application of such a large scale innovative technology.

Chapter VI: Reflection

VI.1 Reflection

This masters thesis positions itself between the general issue of infrastructural implementation and relevant problems in Overijssel. The visions and designs here presented are highly experimental, discussing social acceptance, innovative thinking and landscape reading. The experimental framework combination and research approach culminated in visionary design principles and application that aimed at answering the research question: "What are the social and spatial opportunities of implementing an overpass railroad technology within the Dutch cultural landscape?"

VI.1.1 The acceptance of barriers

The leading statement of this research is that railroads create spatial and social barriers. This describes a cultural dilemma that sees railroad infrastructure as a threat to environmental protection and landscape connectivity, the relation between the current railway system and the viaduct structure is a tool to critique a static and formal way of planning and designing our landscape, that leaves little to no space for innovation and progress. The current railroad is seen as a cultural and environmental solution to the impact of individual motorized mobility, but this is the concept of the train machine itself, it does not extend to the infrastructure it utilizes. Why are we coming up with new trains but no new railroad systems? The conflict between applying widespread technologies that are known to cause social and spatial barriers, and experimenting with new, possible solutions is one that has been left unresolved for too many years. Now is the time to research, conceptualize and sketch these innovative solutions, since a drawing cannot make any damage to the physical world, but it can create new opportunities.

VI.1.2 A project in between reality and fantasy

The graduation studio Flowscapes and the lab Innovative Infrastructure Implementation, in which this thesis exists, describe a necessity to create meaningful new ways of approaching infrastructure and landscape flows,

as to create complex living systems that form and aid social and natural dynamics. The very pragmatic and realistic railway system that forms the biggest web of flows within the country of the Netherlands finds a clash with the absolutely visionary and exploratory concept of creating a 67 km long viaduct within the dense cultural Dutch landscape. In the research definition and design visualizations, the fictional world in which this flowscape is located aims at defining the character and atmosphere of a real place, within a vision of imagination and creativity that represents not only my own fantasy world, but also the fantasy of creating such a world through innovation and design. The most leading question in the creation of this imaginary world was "what are the boundaries of this project?" since the scale and extent of the brief reduced the limits of what reality could be within perception and meaning of the reading and writing of the Overijssel landscape. This question is one that will always be part of the discipline of landscape architecture, as our field expands and englobes larger and larger social and environmental boundaries.

VI.1.3 Proposing a concrete colossus

Unlike many design proposals, this project does not aim at providing a solution, more so it desires to open a discussion and reflection upon the sustainability and environmental impact of either infrastructural approach. In the case of the line in the landscape, one of the biggest moral questions is regarding the materialization and extent of such overpass technology. It is in fact quite absurd to propose combatting fuel pollution through a concrete colossus structure, yet the implications of testing such controversial implementations are what lead to environmental and progressive discourses in the field. The 67 kilometers itinerary, 12 meters spans and 13 to 18 meters heights signify a production of around 6 million tons of reinforced concrete. This process will emit an amount of CO2 only in the fabrication phase equal to around 65000 household consumptions for a whole year! Although this is clearly not a sustainable solution, an integration of this concept with the current railroad

applications could result in a much better solution to both the landscape barrier and line in the landscape typologies. I hope that this thesis will raise questions and solutions to the topic of green mobility and a more connected world.

VI.1.4 The role and profession of landscape architecture

Thinking in systems and adopting a layered analysis approach is crucial to the TU/Delft faculty of Architecture, Urbanism and Building Sciences' department's approach. In the Landscape Architecture MSc track, we are invited to explore what the role of a landscape architect could be in our future careers, resolving multidisciplinary matters and looking for new design approaches and strategies. This thesis contributes to the body of knowledge of the department, following the LA approach and framework of this academic year's Flowscapes graduation studio (Nijhuis et al., 2022). Furthermore, the results of the research expressed in this thesis also contribute to infrastructure implementation and design exploration. The theoretical framework used to research-through-design the boundaries, topics and opportunities of this innovative technology obtained relevancy specifically in the speed and beneficial scale of the alignment in the landscape. Moreover, it was crucial for this research to get inspired and guided by the theory of the field of landscape architecture and design, testing applications for the Three Dimensions of Meaning in the field of technological landscapes.

Aside from the educational and research relevance of this thesis, a great social implication was explored and described, as the European Commission insists on the necessity to test and implement sustainable travel technologies such as new railroad implementations (UN, 2015), (TEN-T, 2013). Based on the research on the territory, the utilization potential of this technology is still far from realization, as these processes require much more localized and multidisciplinary testing. However, a good base for future testing and exploration for this and other disciplines has been laid in the findings

of this master thesis.

VI.1.5 Process and framework

The Flowscapes framework and the Three Dimensions of Meaning framework are very open for experimentation on landscape reading and writing. This combined framework allows for many possibilities to explore different layered information for different understandings of the landscape (Nijhuis, Jauslin and Hoeven, 2015), (Nijhuis and de Vries, 2019).

The research-through-design methodology resulted in interesting findings related to methods, focus and content which truly reflected the creative and personal nature of landscape reading and writing. However, it also led to many biases which make the findings of this research less applicable to generalized solutions.

One of the most useful tools during the multi scale exploration of the Dutch cultural landscape of Overijssel through design, has been the QGIS (geographic information system) software, which allows for quick multi scale analysis and editing of spatial information comprising qualitative and quantitative spatial data. The scalability of information of this software made it possible to gather different detailed information to fit the technical and social requirements during the alignment phase of the research. However, the choice to stick with this software for reasons of organization and layering possibilities, resulted in the inevitable shrinking of the location focus, setting aside the German connection for future research. In fact, I recommend that the topic of international overpass high speed connections be researched, both from a landscape design perspective and from a marketing one. Overall the use of digital media in combination with physical mapping resulted to be an efficient way to gather information but more difficult to store as a unique research.

Chapter VII: Manifest to Art through Technology

VII.1 Landscape technology through art

The beginning of the research flourished with the concept that all these “natural” landscapes that surround us are truly the product of centuries of domestication and manipulation of the land, by the hand of technology, in the hands of people.

The windmill helped to dry the land, dykes made it livable and safer, tools made it farmable and easier to hunt, boats made it more navigable, etc. With technology came new landscapes and with new landscapes came society. The relation between men and landscape is so intertwined and personal that even the way we chose to portray our environment reveals our truest remarks.

In describing the spaces around us, we create images of landscapes which are our own interpretations of nature. What we have learned from observing our surroundings relates to the way we perceive their role in our social life. In the course of history we have continuously found it inherently impossible to avoid human-imposed lenses on nature, when describing or depicting our environment. This may be seen as an obstacle within the purist objective of the preservation of nature, but in *Landscape And Memory*, Simon Schama argues eloquently for the importance of understanding that “the cultural habits of humanity have always made room for the sacredness of nature” and that culture is “not the repudiation, but the veneration, of nature” (Schama, 1995).

Like the way in which *View of Haarlem and the Haarlemmer Meer* by Jan van Goyen, 1646. Jacob Isaacksz van Ruisdael portrayed *The Windmill at Wijk bij Duurstede* (1670), shadowed by a menacing gray cloud. The way Paul Joseph Constantin Gabriël paints *Landscape with a train* (1828 - 1903) as a distant cloud of smoke, nothing but a cutting line. Today, with the help of technology we learned how to portray the unimaginable future, in realistic and utopian renderings, as we see in technophile projects such as the NS2 high speed rail in the United Kingdom, but nonetheless people are still skeptical about said developments and technologies. For this reason we need to research the different approaches that can be applied to mitigate the use of invasive technologies in our landscape.

Therefore this project was never meant to be an absolute truth, it only reflects my own ideas on what landscape is, what its values are and how to use them socially.

“[to intervene on the landscape] is to declare explicitly or implicitly some of the designer’s more fundamental ideas about their environment.” (J.Dixon Hunt, 1992)

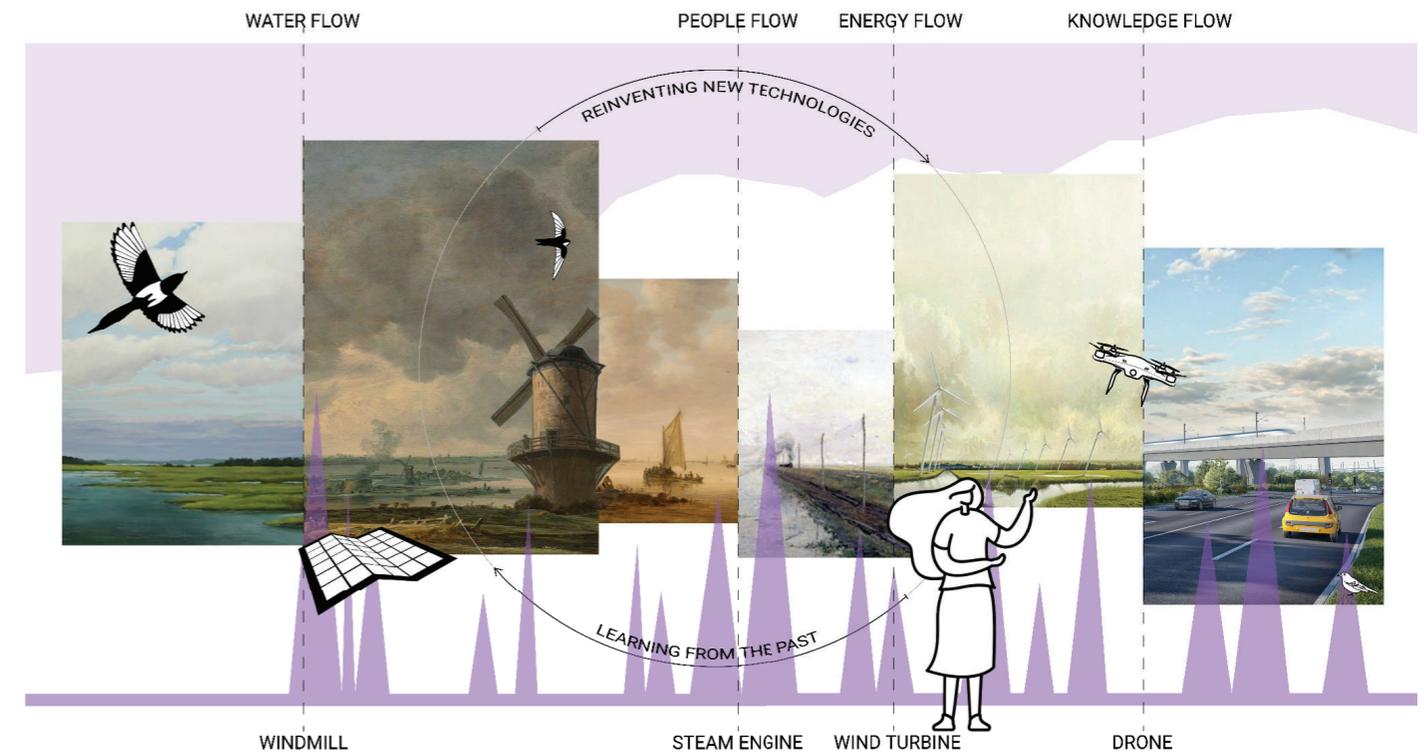


Figure 126. Conceptual collage arguing the cyclicity of landscape technology acceptance and meaning in terms of technical advancement. Showing that representation of the landscape reveals the author’s more fundamental ideas about the environment.

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