

PATTERN CATALOGUE

RECONFIGURING TRAVEL PATTERNS

Thomas van Daalhuizen
Faculty of Architecture and the Built Environment Delft
University of Technology

COLOPHON

Pattern Catalogue: Reconfiguring Travel Patterns

©Thomas van Daalhuizen 2023

All rights reserved

Cover image: Unknown, Collection RHce, nr. 0132275

Thomas van Daalhuizen

4598105

T.J.VanDaalhuizen@student.tudelft.nl | thomasvandaalhuizen@hotmail.nl

The 19th of June 2023

MSc graduation thesis in Urbanism

Pattern Catalogue

MSc Urbanism I Q4 2022-2023

TU Delft Faculty of Architecture and the Built Environment

Department of Urbanism, Julianalaan 134, 2628 BL, Delft, The Netherlands.

Research studio: Planning Complex Cities

1st mentor: Dr. Roberto Rocco

2nd mentor: Dr. Victor Muñoz-Sanz

Delegate of the Board of Examiners: Ir. Lidy Meijers

Studio Coordinators: Dr. Verena Balz & Dr. Caroline Newton

2022-2023

Disclaimer: all figures are a product of our own work, unless stated otherwise. Every attempt has been made to ensure the correct source of images and other potentially copyrighted material was ascertained, and that all materials included in this report have been attributed and used according to their license. If you believe that a portion of the material infringes someone else's copyright, please contact thomasvandaalhuizen@hotmail.nl

This pattern catalogue includes patterns that can be used to form a strategy to accomplish the vision of transitioning to a more just and sustainable transport network. The patterns are the result of an extensive analysis done for the graduation project 'Reconfiguring Travel Patterns'. The catalogue is written as part of the graduation studio Planning Complex Cities 2022-2023.

CONTENT

00 Summary	7	04 Embracing Heritage (of the mines)	61
01 Introduction	13	E1 Activate Old Mine Infrastructure	62
1.1 The Patterns	14	E2 Follow the Trail	64
1.2 Pattern Fields	16	E3 Creating destinations	66
1.3 Pattern Template	20	E4 Tell the Story	68
		E5 Mine Materials	70
02 Governance & Policies	23	05 Regenerating the garden city	73
G1 Rebooting the Planning System	24	R1 Optimising Density	74
G2 Acceleration by Experimentation	26	R2 Putting People First, not Cars	76
G3 Parking as Controlled Substance	28	R3 Wider Sidewalks	78
G4 Ease the Rules	30	R4 Become a Node	80
G5 Cross-border Concessions	32	R5 Connect to Your Surrounding	82
G6 International Commitment	34	R6 Close by Amenities & Services	84
G7 Governance Mix & Match	36	R7 Diverse community	86
G8 Engage the Community	38		
03 Networks & Infrastructure	41	06 References	89
N1 Accessible Public Transport	42		
N2 Stepless Entering	44		
N3 Give Way to Public Transport	46		
N4 Happy Commuting	48		
N5 MultiModal Backbone	50		
N6 Closing the Gap/New Connector	52		
N7 Eliminate the Edges	54		
N8 Unity in Appearance	56		
N9 Creating Hubs	58		



00 | SUMMARY

CONTENT

- 01 Introduction
- 02 What is a Pattern Language?
- 03 The Development of 'Reconfiguring Travel Patterns'
- 04 Utilising a Pattern Language
- 05 Adding to the Pattern Language
- 06 Conclusion
- 07 Want to Know More?

Trams crossing the border establishing a connection between Turnhout and Eindhoven in 1897

Photo: Unknown, Collection RHce, nr. 0132275

RECONFIGURING TRAVEL PATTERNS

A PATTERN LANGUAGE

Introduction

Urban challenges are often characterised by their complexity, making them difficult to understand and address effectively. These challenges are also known as wicked problems (Rittel & Webber, 1973) and require innovative approaches that take into account the complex relationships of various factors. One such approach is the utilisation of the pattern language 'Reconfiguring Travel Patterns' which has been specifically created for sustainable mobility transitions in the old mine district of Limburg in Belgium and the Netherlands.

What is a Pattern Language?

A pattern language is a method that describes good design practices for a particular problem field, such as the complexity of mobility transitions in cross-border regions. It is a set of interconnected patterns cards, each of which describes a specific problem and a solution that can be applied in a variety of contexts (Alexander et al., 1977). By creating a pattern language a very complex transition can be broken up into small design interventions that are easily understandable. Each pattern language can be tailored to the goal or vision of the project. The thought behind a pattern language is that the patterns cards can be used to create a coherent and holistic design, rather than just a collection of isolated solutions (Jacobs, 1992). Whilst taking into consideration the built environment, social dynamics, and governance structures. Using a pattern language will help policy makers, urban planners and even citizens to simplify and unpack urban challenges and address them.

The development of 'Reconfiguring Travel Patterns'

The pattern language is based on theory and a comprehensive analysis of the cross-border region, in this case the old mine district in Limburg in Belgium and the Netherlands. Various types of analysis were done including land use



distribution, transport network analysis, policy and governance analysis, and social network analysis. Besides that, interviews with passenger organisations helped to better ground the patterns in the existing context.

All these insights form the basis for developing patterns that reflect the unique characteristics and challenges of this cross-border region in relation to a mobility transition. The analysis led to the creation of four different categories that group the 29 possible interventions (patterns) that can contribute to realising a mobility transition:

1. Governance and Policy
2. Networks and Infrastructure
3. Embracing Heritage (of the Mines)
4. Regenerating the Garden City

The patterns address challenges such as developing new transportation infrastructure, diversifying land use planning, policy integration, actively engaging stakeholders, community building and reconnecting with the lost identity of the region.

Utilising a Pattern Language: Perspectives of Policy Makers and Citizens:

Pattern languages offer valuable tools for stakeholders to navigate the complexities of mobility transitions in cross-border regions. Two types of stakeholders will be used as an example: policy makers and citizens.

From a policy maker's perspective, "Reconfiguring Travel Patterns" provides a structured approach to understanding and addressing mobility challenges. It facilitates the analysis of diverse factors, enabling policy makers to identify priority areas, formulate effective policies, and allocate resources strategically. Pattern languages also serve as powerful communication tools, allowing policy makers to convey the vision and impact of proposed interventions to stakeholders in a clear and accessible manner. By breaking down complex challenges into manageable components, policy makers can engage stakeholders effectively, create support, and foster collaborative decision-making processes.

Citizens, on the other hand, can benefit from the pattern language by having a clearer understanding of the impact of mobility transitions

on their lives. Pattern languages provide citizens with a means to voice their concerns, insights, and aspirations regarding transportation systems and neighbourhood development. By breaking down complex issues into smaller, more tangible patterns, citizens can comprehend the implications of proposed interventions and actively participate in decision-making processes. Workshops, discussions, participatory events, and co-creation initiatives guided by individuals familiar with the pattern language approach can create opportunities for citizen engagement and enable their contributions to the development of pattern languages. This inclusive approach ensures that the resulting patterns reflect the needs and aspirations of the community, leading to more equitable and sustainable outcomes.

Adding to the pattern language

In addition to utilising the existing patterns, stakeholders can and should play an active role in creating their own patterns based on their lived experiences. By drawing on their knowledge and insights, anyone can identify patterns that highlight the unique challenges and opportunities in their communities. The contribution of any stakeholder is crucial in shaping a pattern language that captures the diverse perspectives and concerns of all involved stakeholders ranging from local communities to business and governmental bodies. I therefore invite anyone to add to this pattern language. You can make a pattern by following three easy steps. The first one is to write down the problem and link it to a solution that would contribute to a mobility transition. The second step involves thinking about the practical implications of using that pattern. Ask yourself questions like 'What would be the impact on space?' or 'What policies have to be implemented to support this pattern?'. You can even address which stakeholders are responsible for implementing the pattern you created. The last step involves grounding it in the existing pattern language. Find other patterns that have similar goals or that can be used simultaneously to strengthen one another. These patterns are the connections and show where the pattern fits in the pattern language. Just as any conventional language a pattern language is ever changing and should adapt to the current time and trends. Creating new patterns during the transition is therefore crucial to keep it up to date.

Through participatory processes, stakeholders can engage in discussions, workshops, and co-creation initiatives to refine and expand their patterns. This collaborative approach fosters ownership, empowerment, and a sense of collective responsibility for shaping their built environment.

The template in the pattern catalogue can be used to create new patterns and can help guide the process.

Conclusion

The 'Reconfiguring Travel Patterns' pattern language offers a powerful approach to addressing the complex challenges of mobility transitions in cross-border regions. By breaking down these challenges into manageable components, pattern languages provide a structured framework for policy makers and citizens to navigate and understand the intricacies of urban problems. It allows stakeholders to formulate effective strategies and empower them to actively participate in the shaping of their built environment. Not only can a pattern language contribute to the process from a design perspective, also in terms of communication it is a useful tool that can help to create a sustainable, inclusive and just multimodal network.

Want to know more?

Have a look at the thesis report 'Reconfiguring Travel Patterns' as well as the pattern catalogue that can explain more on how the theory and analysis led to the patterns. The original book "A Pattern Language: Towns, Buildings, Construction" by Christopher Alexander et al. (1977) serves as the foundational text on pattern languages, and provides comprehensive insights into the concept and its practical applications. Additionally other pattern languages such as the Cities of Making (Hill, 2020) can give more insight in the use of patterns for other specific urban challenges.

Figure 0.1 (right) Participants creating the pattern sequence during the workshop. Photo: Thomas van Daalhuizen





01 | INTRODUCTION

CONTENT

1.1 The Patterns	14
1.2 Pattern Fields	16
1.3 Pattern Template	20

*Border crossing in the middle of the small town of Galder in Noord-Brabant.
Photo: Rolf van den Broek*

1.1 | THE PATTERNS

1.1.1 Introduction

The pattern language is categorised in 4 pathways each based on the analysis. The colours of the pattern indicate which category they are a part of (fig. 1.1).

Each pattern card consists of a title, description/hypothesis consisting of the context it is embedded in, the problem that it tackles and the possible solutions. These solutions are generic and can be interpreted and adapted for a specific place. Patterns never stand on their own, each pattern is linked to another and can form a pattern language. This way the pattern language can help to provide a systemic approach, develop place-based solutions and support the transition process (Cortes Macias et al., 2021; Hill, 2020).

Each pattern also includes a scale in which it is most likely to manifest. The scales used in this pattern language are based on the nature of the mobility transition which happens in a cross-border context, therefore the scales used are:

1. Public space
2. Neighbourhood
3. City
4. Region
5. Transnational
6. Transcalar

1.1.2 Integrating Theory

Chapter two has introduced multiple theories that together form the theoretical framework that supports this research. These theories are (1) Mobility Justice (Sheller, 2018), (2) Socio-Technical Systems (Davis et al., 2014), (3) Multi-Level Perspective (Geels, 2011) and (4) Metagovernance (Meuleman, 2019). The Mobility Justice theory and Metagovernance theory have been implemented in the pattern language by translating them into different patterns. As the Socio-Technical Systems theory and Multi Level Perspective are more focussed on the transition itself they have been integrated into each pattern. The bottom of the card suggests which of the 6 parts of the Socio-Technical system the pattern is trying to influence. On the other page the

pattern indicates in what level of the Multi-Level Perspective the pattern is most likely to operate, with either being Landscape or Innovations. By adding these theories to the pattern cards, theory and practice can integrate and help steer the mobility transition, while leaving room for discussion and interpretation.

1.1.3 Process of using the pattern language

The pattern catalogue is used for the strategy making process for the thesis 'Reconfiguring Travel Patterns. Based on the analysis of the mine district a pattern language has been developed that aims for a mobility transition. With these patterns a strategy was created that considers practice and theory. The strategy consists of:

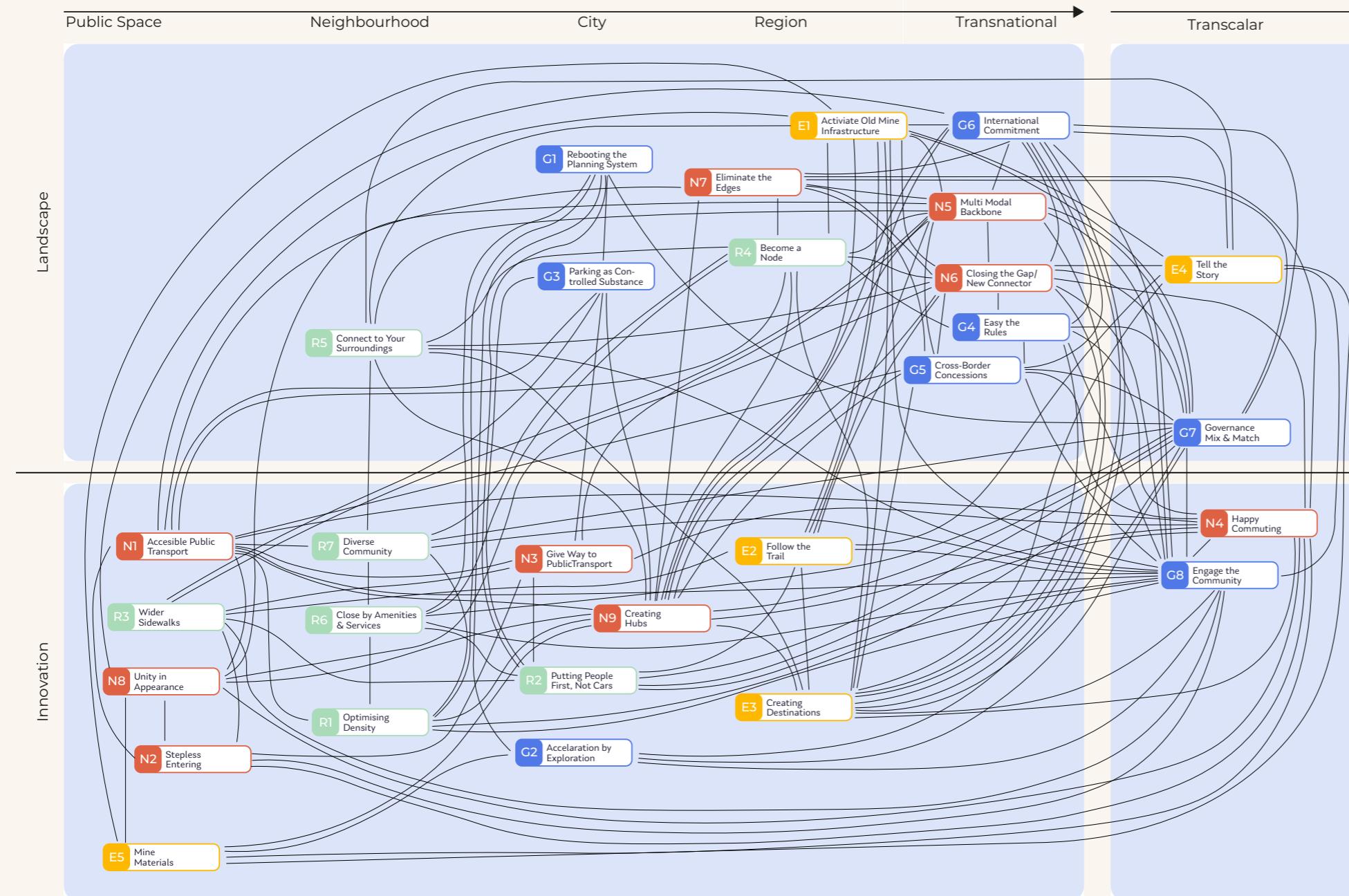
1. Pattern fields, showing the relations between each pattern,
2. A pattern toolbox, showing how each of the patterns help to achieve one or more of the strategic projects as introduced in chapter 5,
3. A phasing or sequence of how to 'play' the patterns,
4. A workshop testing the functionality of the patterns,
5. A visualisation of the transition, based on the practical implications that are part of the pattern language and the outcome of the workshop, called the synthesis,
6. Policy recommendations based on analysis, pattern language and the workshop

Only the patterns and the pattern fields can be found in this catalogue, for all the other products see the thesis report.

Figure 1.1. (right) Pathways used in the pattern language



1.2 PATTERN FIELDS



1.1.4 Pattern Field - Multi Level Perspective

This first pattern field shows all the connections of each pattern (fig 1.2). It has two axes, one for scale and the other showing in what level of the Multi-Level Perspective (Geels, 2011) the pattern is most likely to operate. Based on this pattern field multiple observations can be done.

First all, there seems to be a relation between the scale of the pattern and the level. Patterns with a larger scale such as region and transnational seem to be concentrating in the landscape level. This could be explained with the notion that interventions in the landscape level usually take more time and have a larger impact. On the other hand, the patterns focussing on public space and neighbourhood tend to operate in the innovation level. These are mostly patterns that could be used as small experiments and are easily implemented. They usually are not dependent on any other patterns and can happen on their own.

If we look at the patterns more closely there are some that have a large number of connections such as '*G8 Engage the Community*' and '*N6 Closing the Gap*'. These patterns are vital to the success of the transition and are therefore very well linked to the other patterns.

The pathways also show that they each have their own spot within the field. The Governance & Policies pathway has almost all of its patterns in the landscape level, mainly because the patterns aim for change by implementing long term strategies and try to make way for new innovations to rise. The Regeneration of the Garden City pathway on the other hand has more of its patterns located in the innovation layer. These patterns try to set examples of how a neighbourhood or city could function without the need of cars. The patterns are made up of smaller interventions that set a new standard.

Figure 1.2. Pattern field 1. Scale and Multi-Level Perspective

6.2.5 Pattern field - Socio-Technical System

The second pattern field (fig. 1.3) shows which patterns try to influence which pillar of the Socio-Technical System (STS). The STS as introduced by Davis et al. (2014) consists of 6 pillars (1) Goals/metrics, (2) People, (3) Infrastructure, (4) Technology, (5) Culture and (6) Processes/Procedures. This pattern field also includes the scales of the patterns. The closer to the centre the smaller the scale.

The first pillar Goals and Metrics doesn't have any patterns assigned as the vision is the goal and all patterns work towards this. Therefore, we could argue that all patterns try to achieve the goal in one way or another. The second pillar, People shows that there are many patterns part of the Regeneration of the Garden City pathway (Rx) that try to influence this part of the regime. Patterns such as R6 Close by Amenities try to directly influence the travel behaviour of people, where R2 creates the environment necessary to practice this behaviour. Patterns from other pathways such as N4 and G8 are also placed here due to their nature. The third pillar, Infrastructure, has almost all patterns of the Network & Infrastructure pathway (Nx). The fourth pillar of Technology has the lowest number of patterns because none of the patterns focus specifically on technological innovations. The fifth pillar, Culture, only has patterns of the Embracing Heritage pathway (Ex) assigned to it, this is due to the goal of these patterns to strengthen the identity of the region based on its history and culture. Lastly the sixth pillar, Processes/Procedures includes almost all patterns in the Governance and Policies Pathway (Gx), most of these patterns aim for a change in this pillar and all happen on a large scale which why none of these patterns are in the inner rings.

It was only after creating the patterns that the different pillars were assigned to each of them. It is intriguing to note that although these patterns operate on different scales, most of the patterns in the same pathway ended up in the same pillar.



Figure 1.3 Pattern field 2. Scale and Socio-Technical System



X PATTERN TEMPLATE

HYPOTHESIS - PROBLEM AND SOLUTION

CONNECTED TO
Xn, Xn, Xn - Relations to other patterns

REGIME - THEME - SCALE



This indicates in which level of the Multi-Level Perspective the pattern is most likely to operate.

Image: description of reference project

landscape

innovations

Theoretical Background

This section gives a short explanation and argumentation for the stated hypothesis.

Practical Implications

This section explains what the practical implications of the previously mentioned hypothesis would be like.

Sources

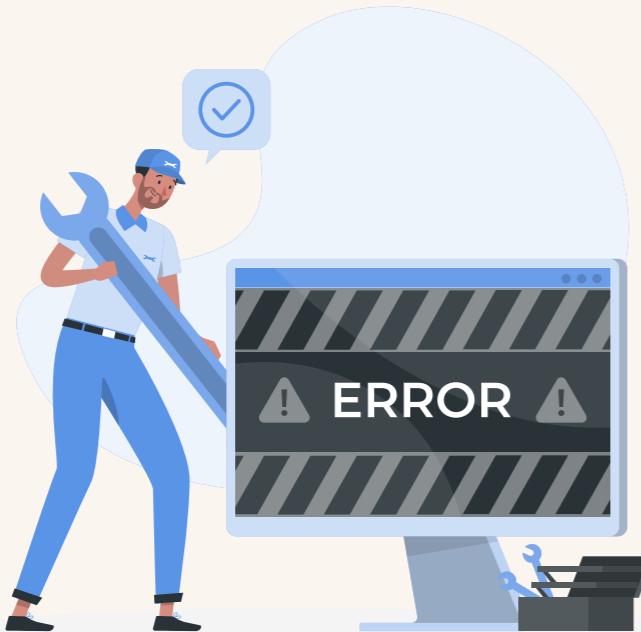
Sources used for both theoretical background and practical implications are listed here

02 | G

GOVERNANCE & POLICIES

CONTENT

G1 Rebooting the Planning System	24
G2 Acceleration by Experimentation	26
G3 Parking as Controlled Substance	28
G4 Ease the Rules	30
G5 Cross-border Concessions	32
G6 International Commitment	34
G7 Governance Mix & Match	36
G8 Engage the Community	38



Freepik by Storyset

G1 REBOOTING THE PLANNING SYSTEM

ALLOWING DIFFERENT TYPES OF LAND USE IN RESIDENTIAL AREAS CREATES THE POSSIBILITY TO PROVIDE MORE SERVICES CLOSE BY, DECREASING THE NEED TO TRAVEL WITH A PRIVATE VEHICLE.

CONNECTED TO
G2, G7, R1, R2, R6

PROCESSES - GOVERNANCE & POLICIES - CITY



landscape

innovations

Theoretical Background

Ewing & Cervero (2010) discovered walking is strongly related to higher intersection diversity, land-use diversity, and a higher number of destinations within walking distance, while vehicle miles travelled is associated with accessibility to destinations (Lee et al., 2018). When there is a balanced mix of complementary uses and activities within a local area (e.g., a mix of residences, workplaces, and local retail Commerce), many daily trips can remain short and walkable (ITDP, 2017).

Image: Street in the middle of Maasmechelen that has both living and commercial activities. There is also space for markets and other activities (Wasiak, n.d.)

Practical Implications

The land-use plan of the area will have to be updated to ensure a mix of functions. New rules on the design of the plinth can be incorporated to create a lively neighbourhood. Furthermore current regulations regarding the minimum of available parking spaces have to be reduced to ensure a better position for other types of transport.

Sources

(Ewing & Cervero, 2010)
(Lee et al., 2018)
(ITDP, 2017)
(Wasiak, n.d.)

G2

ACCELERATION BY EXPERIMENTATION

DOING TRANSITION EXPERIMENTS THAT ADDRESS SPECIFIC CHALLENGES ACCELERATES THE TRANSITION PROCESS.

CONNECTED TO
G1, G6, G7, G8, E5

TECHNOLOGY - GOVERNANCE & POLICIES - CITY



Freepik by Storyset



Image: The green village is a fieldlab where experimentation is facilitated (LDE Centre for Sustainability, 2021)

landscape

innovations

Theoretical Background

To accelerate transition processes, transition management highlights the potential of so-called transition experiments: innovative, near-term interventions or initiatives that address specific challenges in the transition process on the national, regional, or city level (Loorbach & Rotmans, 2010; Roorda et al., 2012).

Practical Implications

Emphasise accelerating the transition process by incorporating learning into policymaking, and involving stakeholders including government, public and private institutions, businesses and citizens (Loorbach et al., 2015; Nevens et al., 2013). Furthermore the development of fieldlabs at the old mining sites can help facilitate experimentation.

Sources

(LDE Centre for Sustainability, 2021)
(Loorbach & Rotmans, 2010)
(Loorbach et al., 2015)
(Nevens et al., 2015)
(Roorda et al., 2012)

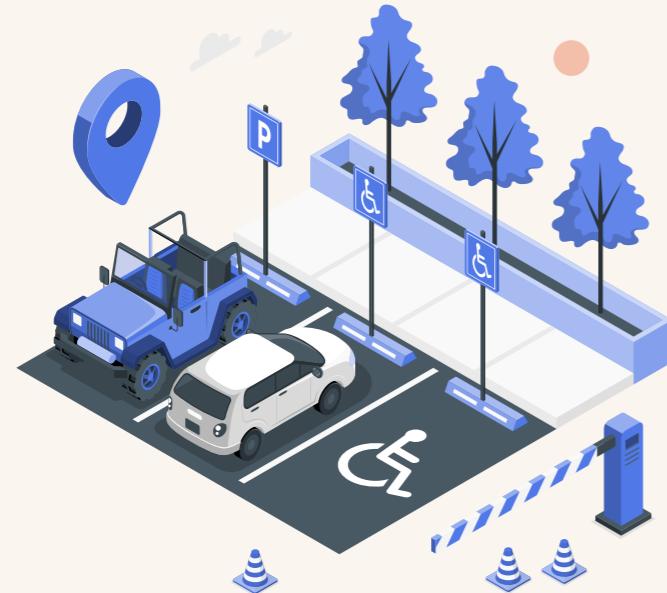
G3

PARKING AS CONTROLLED SUBSTANCE

INCREASE THE USE SUSTAINABLE MOBILITY BY REGULATING
PARKING AND ROAD USE.

CONNECTED TO
G1, G7, G8, N1, N3, N9, R2,

PROCESSES - GOVERNANCE & POLICIES - CITY



Freepik by Storyset



Image: Paid parking spaces in the city centre of Genk, Belgium
(Nelis, 2019)

landscape

innovations

Theoretical Background

Regulating parking and road use can reduce the impact of private vehicle traffic on safety and health by reclaiming space from cars and reducing noxious fumes and noise. The impacts of polluting cars occupying spaces where people spend time are especially dangerous to the health of young children (ITDP, 2017).

Practical Implications

Introduce laws that help regulate parking in specific areas. Some locations might have the opportunity to ban cars from the street which has many advantages towards using sustainable transport modes (Burgen, 2018). Land-use plans have to be updated to take off the parking requirements that are sometimes stated.

Sources

(Burgen, 2018)
(Nelis, 2019)
(ITDP, 2017)

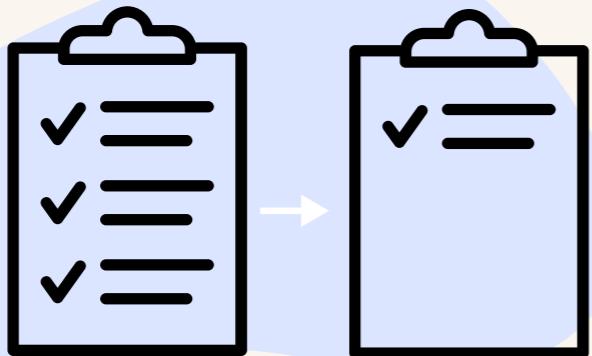
G4

EASE THE RULES

EASING THE RULES WHEN IT COMES TO CROSS BORDER WORKING AND LIVING CREATES MORE OPPORTUNITIES FOR CITIZENS AND INCREASES DEMAND FOR TRANSPORT AND OPPORTUNITIES FOR SERVICES AND JOBS.

CONNECTED TO
G6, G7, G8, N6, E3, R4

PROCESSES - GOVERNANCE & POLICIES - TRANSNATIONAL



landscape

innovations

Image: Representation of paperwork that accompanies cross-border working/living/studying Photo: Getty Images/ISTockPhoto

Theoretical Background

High mobility shows that certain criteria that need to be clear in order to correctly do taxes and get access to the right social security system start to lack clarity. This lack of clarity could lead to legal uncertainty and practical obstacles. Besides the people crossing the border being confronted with these flaws in the existing legal frameworks, also their employers and desk officers that have to apply the law are impacted (Van Ooij, 2020). Furthermore, access to services such as healthcare and education also have obstacles embodied in many forms that cross-border citizens have to fill in in order to get access to these services.

Practical Implications

Simplifying and harmonising the tax and social security systems of Belgium and the Netherlands can help people to better understand them. When it comes to other services such as education standardising qualifications and certifications could be a solution to promote cross-border studying, working, and living. Besides that, having an integrated system for health and education will increase the accessibility of health care and educational services on both sides of the border.

Sources

(Van Ooij, 2020)

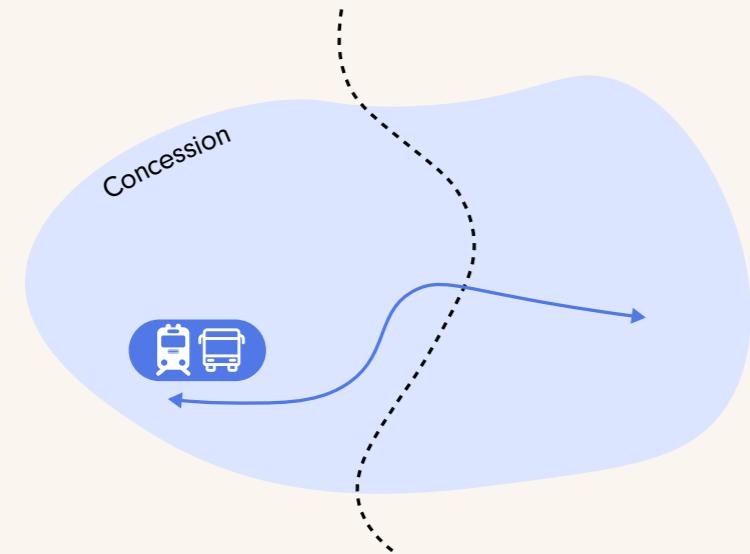
G5

CROSS-BORDER CONCESSIONS

CROSS-BORDER CONCESSIONS INCREASE CROSSBORDER PUBLIC TRANSPORT DUE TO THE REDUCTION OF ADMINISTRATIVE BARRIERS, THEY ALSO PROVIDE MORE EFFICIENT AND INTEGRATED TRANSPORT SERVICES, AND INCREASE THE ATTRACTIVENESS OF PUBLIC TRANSPORT.

CONNECTED TO
G4, G6, G7, N1, N5, N6, N7, N9, E3

PROCESSES - GOVERNANCE & POLICIES - TRANSNATIONAL



landscape

innovations

Image: A bus of Belgian operator De Lijn in the Dutch city of Maastricht (Janaa, 2010)

Theoretical Background

Increasing cross-border connections can be done by overlapping the of concession zones instead of them stopping at the border. Currently many bus services stop right at the border where their concession ends. To further integrate these cross-border concessions introducing one common payment system will be beneficial. By taking these steps public transport will be able to provide faster travel times (K. Braam, personal communication, 24 February 2023; P. Meukens, personal communication, 13 March 2023).

Practical Implications

Provinces will have to work together to put out a concession offer that crosses the border. In Belgium that means that not only De Lijn can be the only operator of public transport services. A next step in is having a shared ticket and fare system. This will further reduce the administrative barriers of passengers using these services to get to their destinations and make it more attractive to travel by public transport.

Sources

(Janaa, 2010)
(K. Braam, personal communication, 24 February 2023)
(P. Meukens, personal communication, 13 March 2023)

G6

INTERNATIONAL COMMITMENT

INTERNATIONAL COLLABORATION CAN INCREASE MOBILITY OPTIONS BY MEANS OF KNOWLEDGE-SHARING, DEVELOPMENT OF MORE EFFICIENT AND SUSTAINABLE TRANSPORT SYSTEMS, AND PROMOTING GREATER COOPERATION BETWEEN TRANSPORT OPERATORS AND AUTHORITIES.

CONNECTED TO
G2, G4, G5, G7, N5, N6, N7, N8, E1, E2, E3, E4

PROCESSES - GOVERNANCE & POLICIES - TRANSNATIONAL



Freepik by Storyset (edited)



Image: The rail bridge that connected Maastricht to Hasselt, which was renovated in 2011 (Geusens, 2022).

landscape

innovations

Theoretical Background

There are examples of international collaboration to create new connections, for instance between Maastricht and Hasselt. In 2011 the rail bridge connecting Belgium to the Netherlands was renovated. But commitments made by the Belgian government were revoked, leaving the bridge unused and waiting to be demolished (Geusens, 2022). Collaboration between Belgium and the Netherlands is the most crucial part to create cross-border connections (K. Braam, personal communication, 24 February 2023; P. Meukens, personal communication, 13 March 2023) and thus call for more strict international agreements that underpin the commitments made by all involved parties.

Practical Implications

The governments of the Netherlands and Belgium will have to start working together to facilitate a mobility transition. This means that together they have to set goals that are achievable and clear. Besides that, building a strong community will help to provide support, encouragement and accountability. Both governments will have to continuously evolve and adapt to the everchanging situations, staying flexible and responsive is important. Celebrating successes such as the opening of new corridors helps to maintain momentum and boost morale of all parties involved.

Sources

(Geusens, 2022)
(K. Braam, personal communication, 24 February 2023)
(P. Meukens, personal communication, 13 March 2023)

G7

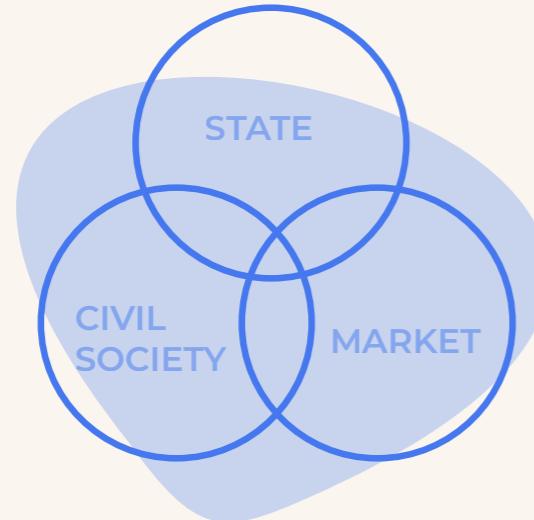
GOVERNANCE MIX & MATCH

MIXING GOVERNANCE STYLES CAN LEAD TO MORE EFFECTIVE CROSS-BORDER MOBILITY SOLUTIONS BY LEVERAGING THE STRENGTHS OF DIFFERENT GOVERNANCE STYLES AND PROMOTING COLLABORATION AND COORDINATION BETWEEN THEM.

CONNECTED TO

G1, G2, G4, G6, G8, N5, N6, N7, N9, E1, E3, R1, R2, R6, R7

PROCESSES - GOVERNANCE & POLICIES - TRANSCALAR



landscape

innovations

Image: Signing of the Schengen Agreement Weyrich, Jean. Schengen: Luxemburger Wort, 14/06/1985. Noir et blanc.

Theoretical Background

As policy making is mostly about incremental change, a new form of governance was introduced by (Meuleman, 2019), namely metagovernance. Metagovernance tries to combine the three main governance styles of (1) Hierarchical governance, (2) Market governance and (3) Network governance and aims at system change. Metagovernance is especially relevant in cross-border contexts as a survey on governance trends for sustainable development concluded that there is a need to combine different governance style. The combination of styles is needed to achieve compliance of international agreements with expanding collaborative governance (Olsen et al., 2015). Furthermore, by using metagovernance a tailor-made governance approach can be made (Meuleman, 2019) that specifically aims for a sustainable mobility transition.

Sources

(Meuleman, 2019)
(Olsen et al., 2015)

Practical Implications

Do a thorough stakeholder analysis as metagovernance involves collaboration among all levels of society with governmental, private, and non-profit organisations. Developing shared goals and values that reflect the interest of all stakeholders involved will help to guide the governance process. Furthermore, a communication framework will have to be instated to make sure all stakeholders involved are informed and engaged in the governance process. This will also help to ensure transparency and accountability. Another way to do this is making information available for everyone and by establishing feedback loops from stakeholders.



Freepik by Storyset (edited)

G8

ENGAGE THE COMMUNITY

ENGAGING COMMUNITIES IN CROSS-BORDER MOBILITY PLANNING CAN PROMOTE MOBILITY JUSTICE BY ENSURING THAT THE NEEDS AND PERSPECTIVES OF ALL STAKEHOLDERS ARE TAKEN INTO ACCOUNT IN A PARTICIPATORY AND INCLUSIVE MANNER.

CONNECTED TO
[G2, G4, G5, G6, G7, N1, N2, N4, N5, E2, E3, E4, R1, R2, R3, R5, R6, R7](#)

PEOPLE - GOVERNANCE & POLICIES - TRANSCALAR



landscape

innovations

Image: Citizen participation in process during a project about 'Recognisable Identity for the City' of the City of Brunssum in The Netherlands (Braining the Future, n.d.)

Theoretical Background

The goal of any mobility transition should be to provide mobility justice. Mobility justice can be divided into 5 different types of justice: (1) Distributive justice, (2) Deliberative justice, (3) Procedural justice, (4) Restorative justice and (5) Epistemic justice (Sheller, 2018). Procedural justice and Epistemic justice argue that information and knowledge should be accessible by the affected citizens (Petzer et al., 2020). By providing information and gathering information citizens can be involved in the process and help to achieve distributive (equal access) and deliberative and restorative justice (empowering those previously immobilised). Furthermore, communal decision making and governing "outside of capitalism and beyond the limits of national borders" can help to create mobile commons, "a socially produced shared space" (Cheung, 2020; Sheller, 2018, p.160).

Sources

(Braining the Future, n.d.)
 (Cheung, 2020)
 (Petzer et al., 2020)
 (Sheller, 2018)

Practical Implications

Engaging a community starts with identifying all relevant stakeholders. Next up, developing relationships with all stakeholders is important. This can be done by attending community events, participating in online forums, and conducting outreach to key stakeholders. But also organising focus groups and conducting surveys can help to better understand the stakeholders. All these activities can help to create a shared vision which will lead to more support from all stakeholders in regard to a mobility transition. Moreover, good communication frameworks should be in place to keep the community updated. Lastly creating advisory groups or gathering feedback on proposed plans is of importance, this way the stakeholders will be involved in the decision-making process.

03 | N

NETWORKS & INFRASTRUCTURE

CONTENT

N1 Accesible Public Transport	42
N2 Stepless Entering	44
N3 Give Way to Public Transport	46
N4 Happy Commuting	48
N5 MultiModal Backbone	50
N6 Closing the Gap/New Connector	52
N7 Eliminate the Edges	54
N8 Unity in Appearance	56
N9 Creating Hubs	58

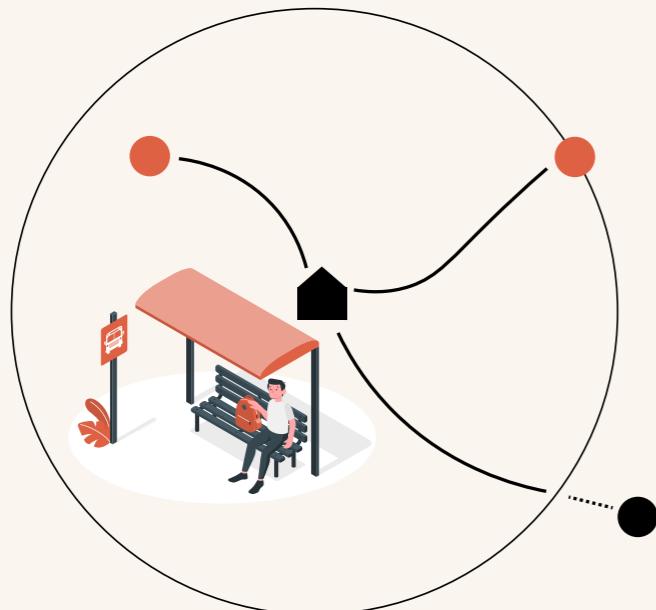
N1

ACCESIBLE PUBLIC TRANSPORT

MORE ACCESSIBLE PUBLIC TRANSPORT REDUCES THE NEED FOR TRANSPORT BY CAR.

CONNECTED TO
G8, N2, N3, N4, N7, N8, N9, E1, R1

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - PUBLIC SPACE



Freepik by Storyset (edited)



Image: 'Green' bus stop in Utrecht, The Netherlands
(Gemeente Utrecht, 2019).

landscape

innovations

Theoretical Background

Good public transport accessibility and connectivity levels are of great importance to enable improved public transport utilisation, reduction in car journeys and reduce car ownership. By doing so it will not only aid the city in achieving the targets of carbon footprint and pollution reduction, but it can also safeguard the equality of public transport access for residents (Aleksandra, 2022).

Practical Implications

When implementing public transport in the neighbourhood multiple things can be considered. First of all, the distance to the nearest stop is of importance. The distance beyond which ridership falls off drastically is about 400m for a local-stop service, and about 1000m for a very fast, frequent, and reliable rapid transit service (Walker, 2010). Furthermore, all stations should be accessible for citizens with a mobility disability.

Sources

(Aleksandra, 2022)
(Gemeente Utrecht, 2019)
(Walker, 2010)

N2

STEPLESS ENTERING

PROVIDING STEPLESS ENTRY TO PUBLIC TRANSPORT INCREASES THE USE BY CITIZENS WITH A MOBILITY DISABILITY.

CONNECTED TO
G8, N1, N4, N8, R3

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - PUBLIC SPACE



Freepik by Storyset (edited)



Image: Low floor trams in Adelaide have stepless entering at most of their stations (Hackenberg, 2010)

landscape

innovations

Theoretical Background

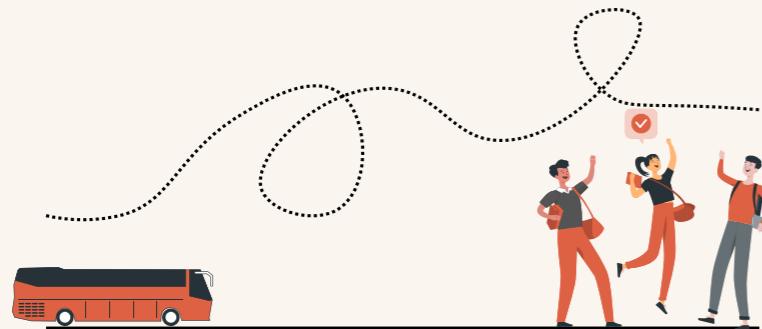
Good public transport accessibility and connectivity levels are of great importance to enable improved public transport utilisation, reduction in car journeys and car ownership. By doing so it will not only aid the city in achieving the targets of carbon footprint and pollution reduction, but it can also safeguard the equality of public transport access for residents (Aleksandra, 2022).

Practical Implications

All stations should be accessible for citizens with a mobility disability (Walker, 2010). Make sure that the level of the sidewalk matches the entrance of the buses and trams. Invest in low floor buses and trams. Moreover, reserving enough space behind and in front of the stop allows people in wheelchairs to move around.

Sources

(Aleksandra, 2022)
(Hackenberg, 2010)
(Walker, 2010)



Freepik by Storyset (edited)

N3 GIVE WAY TO PUBLIC TRANSPORT

PRIORITISING PUBLIC TRANSPORT NETWORKS INCREASE THE USE OF THESE TYPES OF TRANSPORT THAT ALSO HAVE LESS IMPACT ON THE ENVIRONMENT.

CONNECTED TO
G3, N1, N2, N4, N5, N8, R3

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - CITY



landscape

innovations

Image: Bus lanes in Vilvoorde (Belgium) give priority to passing trambusses at this intersection (DBG, 2022)

Theoretical Background

Public transport is less flexible and often journeys take longer because routes do not always go directly to the traveler's destination. Several stops are made for transfers to other routes or modes, or for other passengers on the way. As a result, buses and trams are often not seen as a real alternative to the car. Prioritisation of public transport vehicles is especially successful in areas with a medium population density, which currently can be reached only by using highly congested roads (CIVITAS, 2010).

Practical Implications

Creating reserved bus lanes creates a right of way for public transport. However enough space has to be available as well as a monitoring system to control the lanes. It is beneficial to introduce parking restriction zones in the cities in parallel to the measures. Furthermore, park and ride services should be offered at the stations of improved public transport lines (CIVITAS, 2010).

Sources

(CIVITAS, 2010)
(DBG, 2022)

N4

HAPPY COMMUTING

MAKING PUBLIC TRANSPORT AND TRANSFERRING A SMOOTH AND MEMORABLE EXPERIENCE INCREASES RIDERSHIP.

CONNECTED TO

G4, G5, N1, N2, N3, N6, N7, N8, N9, E3, E5, R2

PEOPLE - NETWORKS & INFRASTRUCTURE - TRANSCALAR



Image: The station in Genk, Belgium with transfer options and multiple services such as foods & drinks (Japplemedia, 2021)

landscape

innovations

Theoretical Background

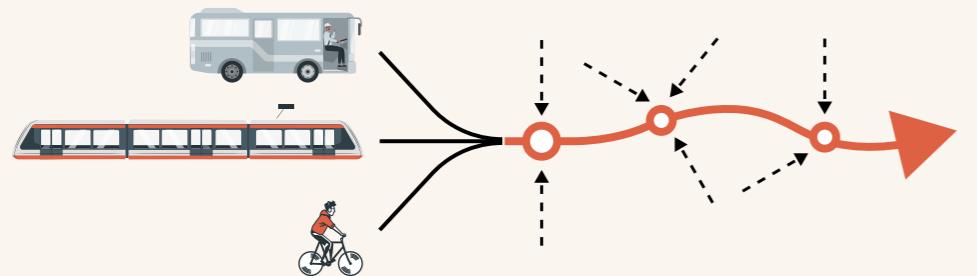
Research shows that the time spent on transfers and pre- and post-transit journeys significantly affects the perception of travel time. Measures beyond frequency enhancements, such as improving facilities and the overall travel chain, are needed to create a happier commuting experience, enjoyable and efficient (PBL, 2014). Providing better commuting experiences and faster travel times will have a positive impact on cross-border travel (K. Braam, personal communication, 24 February 2023; P. Meukens, personal communication, 13 March 2023).

Practical Implications

A comfortable journey starts by having the right timetable with a minimum of 2 services per hour. Next the amount of time people spent transferring between services is experienced longer than it actually is. Therefore, a timetable that limits the amount of transfer time between service is desirable. One way to do this is by introducing a symmetrical timetable. This should be done in combination with providing transfer passengers a pleasant environment to wait. Meaning that there should be sheltered waiting areas and where possible more services such as shops can be provided. Other options to increase passenger satisfaction include offering personal services such as personalized route planning or other means of transport for the 'last mile'. Lastly promoting safety and security is important. Providing stations and stops with adequate lighting and security/emergency protocols will help increase the feeling of safety of passengers.

Sources

(Japplemedia, 2021)
(K. Braam, personal communication, 24 February 2023)
(P. Meukens, personal communication, 13 March 2023)
(PBL, 2014)



Freepik by Storyset (edited)

N5 MULTIMODAL BACKBONE

A TRANSPORT NETWORK WITH A MULTIMODAL BACKBONE CAN ENHANCE CONNECTIVITY AND IMPROVE MOBILITY OPTIONS, LEADING TO MORE EFFICIENT AND SUSTAINABLE TRANSPORTATION.

CONNECTED TO
G5, G6, G7, G8, N1, N4, N6, N8, N9, E1, E2, E3, R3, R4

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - TRANSNATIONAL



landscape

innovations

Image: Multimodal Corridor in Hilversum the Netherlands
(Prorail, 2021)

Theoretical Background

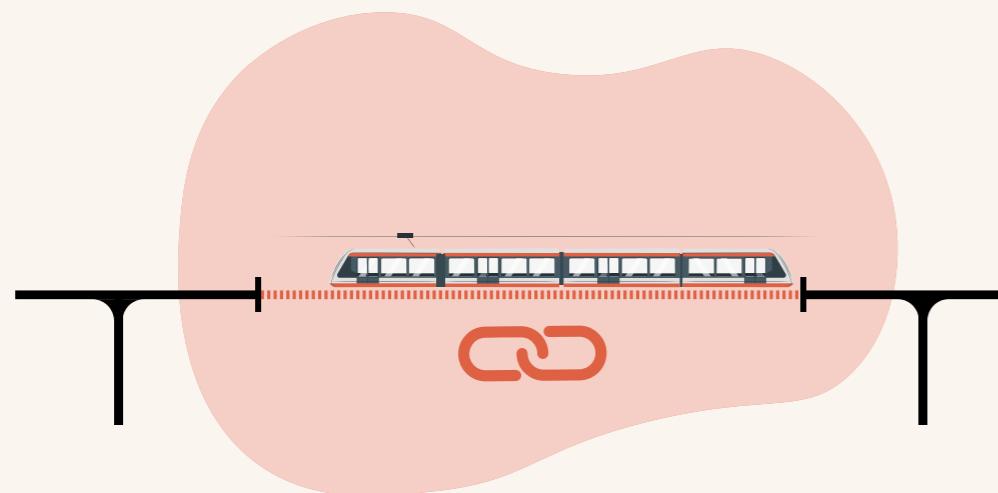
The introduction of a multimodal backbone is anticipated to result in substantial beneficial outcomes, including the encouragement of active transportation modes and public transit, integration of urban areas, enhanced accessibility, environmental preservation, and improved quality of urban living. The establishment of multimodal corridors serves as an alternative planning approach that prioritizes walking, cycling, and public transportation (Tsigidinos et al., 2021). In other regions of the world that are very car focused such as the US this approach has proven successful (Transportation Policy Research Center, n.d.).

Sources

(Prorail, 2021)
(Tsigidinos et al. 2021)
(Transportation Policy Research Center, n.d.)

Practical Implications

Spatial interventions needed to support a Multi Modal Backbone include the creating of multiple transfer hubs where passengers can switch services or mode of transport. The whole length of the backbone should support different transportation methods to attract as many users as possible. This means that space has to be reserved to account for the different infrastructures such as biking lanes, bus lanes and rail corridors. Having safety measures implemented is also of importance as the speeds between the different transport methods differ greatly. Safety measures could include guarding rails and safety walls or appropriate distances between the infrastructure that can be filled with green space. In dense urban areas this clustering of infrastructures will most likely not be possible. When clustering is not possible different routes should be integrated in the urban fabric with a minimum number of obstacles. Furthermore, there should always be a way to that the routes are still part of the backbone.



Freepik by Storyset (edited)

N6 CLOSING THE GAP/ NEW CONNECTOR

CLOSING THE GAP BETWEEN THE TWO BORDER REGIONS WITH A NEW CONNECTOR IN TERMS OF SERVICES AND INFRASTRUCTURE WILL INCREASE THE ACCESSIBILITY TO SERVICES AND AMENITIES FOR CITIZENS ON BOTH SIDES OF THE BORDER.

CONNECTED TO
G4, G5, G6, G7, G8, N5, N7, N8, N9, E1, E2, E3, E4, R4, R5

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - TRANSNATIONAL



landscape

innovations

Image: Bridge in Nijmegen, The Netherlands serving as a connection for slow transport and trains (Gemeente Nijmegen, 2012)

Theoretical Background

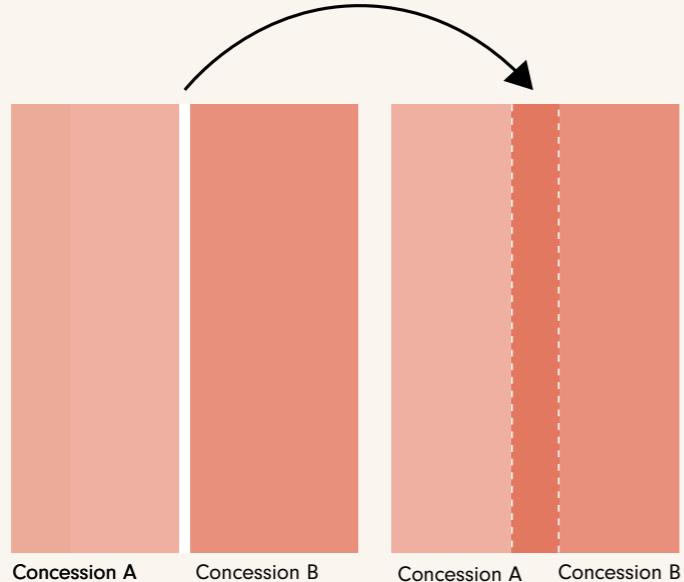
Enhancing overall connectivity within the region facilitates the operation of agglomeration economies, that will lead to increase of agglomeration benefits. Currently agglomeration benefits such as positive benefits in regards to jobs and services are not present in border regions (Marlet et al., 2014). Closing the gap will enable residents to become part of a larger "market" (Lakshmanan, 2011) and thus increase their opportunities to make use of services and jobs that are across the border.

Practical Implications

In order to close the gap between the two regions investments in infrastructure will have to be made. As the border crossing is not only an administrative border but also a physical one, the river Meuse there will have to be a river crossing. This means that either a bridge or a tunnel will have to be constructed connecting both parts of the infrastructure networks. This bridge will have to support multiple transport modes, such as trains, busses, biking and walking. As this connector will fulfill an important role it has to be reliable and be equipped for a large number of movements. Such structures have a large footprint and this should be taken into account when designing the connector. As on both sides of the river there are existing structures landownership could form an obstacle. Some structures might have to be removed, this will result in a long process that should be governed very carefully with involved of the community.

Sources

(Gemeente Nijmegen, 2012)
(Marlet et al., 2014)
(Lakshmanan, 2011)



N7

ELIMINATE THE EDGES

AN OVERLAP IN CONCESSIONS WILL ENSURE THAT THERE WILL NO LONGER BE 'EDGES' IN THE REGION THAT SEE LESS TO NO SERVICE OF PUBLIC TRANSPORT

CONNECTED TO
G5, G6, N1, N5, N6, N9, R4

PROCESSES - NETWORKS & INFRASTRUCTURE - REGIONAL



landscape

innovations

Image: Buses from two different operators at the bus station of Maastricht (Wildschut, 2018)

Theoretical Background

Currently only the Netherlands makes use of concessions, however Belgium has transport regions which function in a somewhat similar way. In both countries passenger organisations observe that there is not enough overlap between concession zones or transport regions resulting in gaps or edges where there is little to none public transport available (P. Meukens, personal communication, 13 March 2023). By rearranging the current zones to overlap more these edges or gaps can be prevented. Overlapping can reflect better connectivity and more competition in the network which can lead to improved services (Al Kaysi & Abbany, 2002).

Practical Implications

Overlapping the edges of concessions can only be done by restructuring the concession regions. This could increase the competition for routes where both concession regions overlap. Therefore, clear rules should be in place on how to service these parts of the regions. Examples are: sharing the services in these parts between two operators or setting them up in close collaboration. These details should be incorporated in the tender procedure.

Sources

(Al Kaysi & Abbany, 2002)
(P. Meukens, personal communication, 13 March 2023)

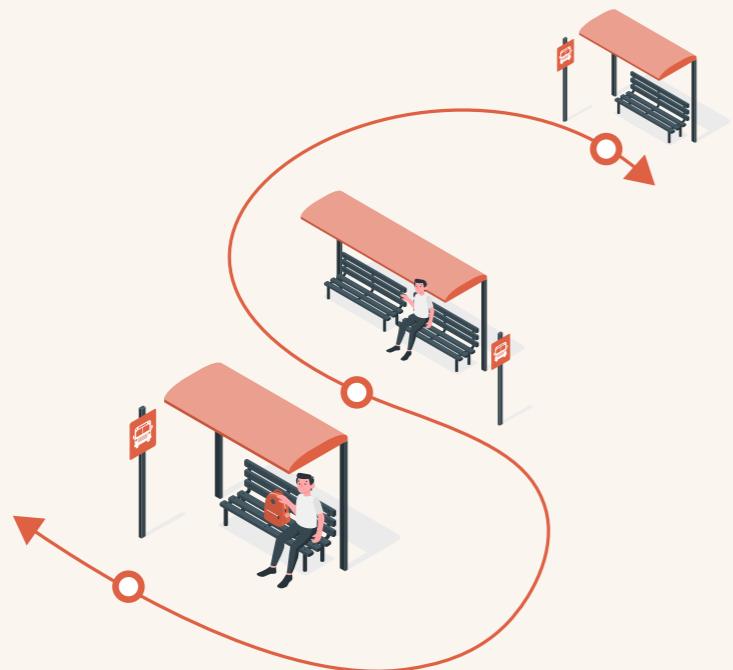
N8

UNITY IN APPEARANCE

GIVING ALL STOPS AND IMPORTANT HUBS IN THE NETWORK A SIMILAR LOOK AND FEEL WILL INCREASE THE FEELING OF HAVING ONE COHESIVE NETWORK ON BOTH SIDES OF THE BORDER THAT HAS A SIMILAR LEVEL OF SERVICE.

CONNECTED TO
G6, N1, N2, N4, N9, E5

INFRASTRUCTURE - NETWORKS & INFRASTRUCTURE - PUBLIC SPACE



Freepik by Storyset (edited)



Image: Skjoldskiftet city tram station in Bergen, Norway (Mo, 2017)

landscape

innovations

Theoretical Background

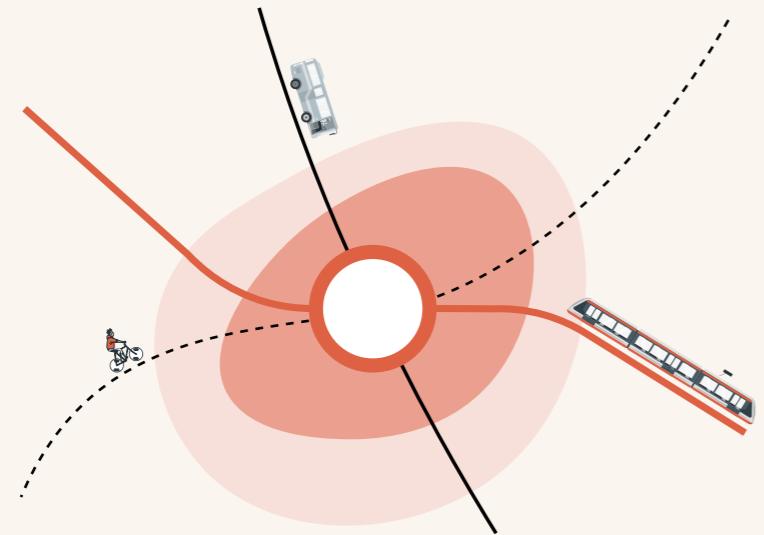
Having a cohesive network is not only based on providing services that connect the different nodes in the network but also includes the recognisability of this network. In both the Netherlands and Belgium certain networks have a specific design language accompanying them to ensure their recognisability. For instance, the R-net in the Netherlands, but also in an international context creating coherent design languages has been used. The Bybanen in Bergen takes it a step further by also giving each stop a similar look and feel by using the same design elements. This coherent design was part of the design guide that prescribed how each station and part of the network was to be developed (Norsk Form & City of Bergen, 2005). Having a coherent design language can contribute to having a recognisable visual identity (Amerio, 2020).

Sources

(Amerio, 2020)
(Mo, 2017)
(Norsk Form & City of Bergen, 2005)

Practical Implications

Provide all stops of busses, trams and trains as well as branding with a similar design language. This design language has to include materials, colours and form. Examples that can be used to strengthen the unity are having the same station design, using the same branding on all vehicles and information displays and including rest areas with a similar design language on parts of the network that don't have any public transport stops but are mostly used by cyclists or pedestrians.



Freepik by Storyset (edited)

N9 CREATING HUBS

CREATING DIFFERENT MAIN TRANSPORTATION HUBS THROUGHOUT THE REGION WILL ENSURE THAT CITIES NOT IN VICINITY OF THE BACKBONE WILL BE WELL CONNECTED TO THE NETWORK.

CONNECTED TO
G5, G6, G7, N1, N4, N5, N6, N7, N8, E1, E3, E5, R1, R4, R5

INFRASTRUCTURE/TECHNOLOGY - NETWORKS & INFRASTRUCTURE - CITY/REGION



landscape

innovations

Image: Intermediate transfer hub in Wythenshawe, UK combining tram, bus and bicycles (Sadler, 2015).

Theoretical Background

There are generally two types of systems: (1) point-to-point and (2) hubs-and-spokes. As a network structure, hub-and-spoke allows greater flexibility within the transport system through a concentration of flows. By having hubs and the concentration of flows there can be an increase in services which enhances connectivity and accessibility. Furthermore, these hubs also lead to increased service levels for passengers (Rodrigue, 2020). The spokes coming from this hub can connect to cities that are further away from the backbone in order to provide them the same level of service.

Practical Implications

Create routes that directly link to the transportation hubs and minimise travel time between the less serviced regions and the core of the transport network. The transportation hubs should function as a welcoming place and thus need to have facilities such as toilets, shops and food and drink options. The transportation hubs should be serviced by different types of transport modes such as trains, buses, trams and slow transportation. As many citizens use their bikes to get to transportation hubs bicycle parking has to be incorporated in the design of the transportation hub. Furthermore transferring between different travel modes should be as easy as possible, this can be achieved by positioning the stops of the transport modes close to one another. The garden cities found throughout the region and close to the rail network can function as access hubs for their surroundings.

Sources

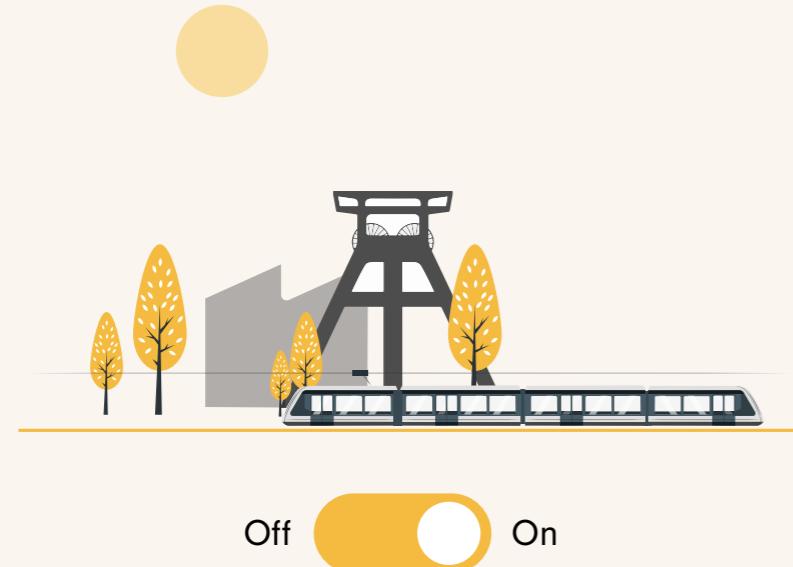
(Rodrigue, 2020)
(Sadler, 2015)

04 | E

EMBRACING HERITAGE (OF THE MINES)

CONTENT

E1 Activate Old Mine Infrastructure	62
E2 Follow the Trail	64
E3 Creating destinations	66
E4 Tell the Story	68
E5 Mine Materials	70



Freepik by Storyset (edited)

E1 ACTIVATE OLD MINE INFRASTRUCTURE

REUSING THE OLD RAIL INFRASTRUCTURE CAN ACT AS A BACKBONE FOR THE NETWORK CREATING AN EASY WAY TO CONNECT ALL OF THE REGION WHILE TAKING INTO ACCOUNT THE HISTORY.

CONNECTED TO
G6, G8, N1, N5, N6, N9, E2, E3, E4, E5

INFRASTRUCTURE - EMBRACING HERITAGE (OF THE MINES) - REGIONAL



Image: Old mine rail in Belgium in As (Yasmina, 2020)

landscape

innovations

Theoretical Background

The rail infrastructure in the Limburg mining district has always been a crucial part of the region's development, and it has the potential to play a vital role in its future (Coenen & IBA Parkstad (Heerlen), 2015). The existence of these mine rail remnants (OpenStreetMap Contributors, 2023) creates opportunities to reactivate the network and to provide better cross-border connections. The development of these connections could have a significant impact on the economy of the region and could lead to increased mobility for people living in the area.

Practical Implications

The old mining rail infrastructure has a very different state throughout the region. Some parts of the old rail have been demolished where others are still in use. This means that in some parts new tracks will have to be laid or heavily renovated. Furthermore, the route has some bridges that haven't been regularly checked. Therefore, these bridges have to be thoroughly checked and repaired when needed. Besides that, the rail network in Belgium is mostly single tracked and has a lot of track that isn't electrified. Passing loops to support the number of trains running have to be placed as well as catenary to electrify the route.

Sources

(Coenen & IBA Parkstad (Heerlen), 2015)
(OpenStreetMap Contributors, 2023)
(Yasmina, 2020)



Freepik by Storyset (edited)

E2 FOLLOW THE TRAIL

CREATING A CROSS-BORDER WALKING AND BIKING HERITAGE TRAIL SYSTEM THAT FOLLOWS THE OLD MINING ROUTES THROUGHOUT THE REGION, WILL ALLOW VISITORS TO EXPLORE THE REGION AND LEARN ABOUT ITS MINING HISTORY WHILE PROVIDING GREEN SPACE AND STIMULATING CARBON-FREE ACTIVITIES.

CONNECTED TO
G6, N5, N6, E1, E3, E4, R2

CULTURE - EMBRACING HERITAGE (OF THE MINES) - REGIONAL



landscape

innovations

Image: Old stone mountain in Beringen Belgium repurposed as one of the stops in a biking trail (Lenaerts, 2021)

Theoretical Background

Heritage trails are pathways designed for walking, hiking, and biking that connect significant historical landmarks. Balancing the valuable space and historic significance of the sites, sustainable developments heritage trails can be seen as a solution. In addition to granting access to cultural sites, heritage trails provide environmental benefits in two distinct ways. Firstly, they promote activities that are free from emissions, such as walking or biking, thereby reducing carbon footprints. Secondly, these trails serve as green spaces that help offset carbon emission (Mills, 2021).

Practical Implications

Providing a good biking and walking infrastructure is necessary to promote movement of visitors throughout the mine region. Having easy access to other transport modes can increase the number of visitors. In order to do this the trail should always come back to transit hubs where people can either start or end their journey. Furthermore, there should be bike rental locations at these transit hubs, this way everyone is able to follow the trail and doesn't need to bring their own bike. These locations can also be used to construct visitor centres. Creating a cohesive route with information panels and visitor centres will account for a full experience where moving around the region and learning about the region starts to become one.

Sources

(Lenaerts, 2021)
(Mills, 2021)



Freepik by Storyset (edited)

E3 CREATING DESTINATIONS

CREATING DESTINATIONS CAN BOOST HERITAGE TOURISM, COMMUTING AND CONNECTIONS BETWEEN DIFFERENT PARTS OF THE REGION. HAVING DIFFERENT TYPES OF DESTINATIONS WILL CREATE A NETWORK THAT PROMOTES THE EXCHANGE OF PEOPLE, KNOWLEDGE AND CULTURE.

CONNECTED TO
N5, N6, N9, E1, E2, E4, R4, R5

CULTURE - EMBRACING HERITAGE (OF THE MINES) - REGIONAL



landscape

innovations

Image: Be-Mine a leisure hub in Maasmechelen on the old premises of the Eisden Mine (TheBicesterCollection, 2021)

Theoretical Background

The cities along the old mine infrastructure all have a different character based on their surroundings. Some are more industrial and others are surrounded by leisure activities (European Environment Agency, 2020). Further amplifying these characters can help to increase accessibility of services that are connected to the different cities. Having them become a node in a network opens up the possibility to share knowledge and culture also increasing the economic space of the cities in the region (Marlet et al. 2014).

Practical Implications

To create destinations, the old mining sites will have to be redeveloped. Some sites are suitable for educational facilities where others are more focused on leisure. Ensuring each heritage site has its own character will help to create a network where all heritage sites together provide all functions necessary. Especially in the Netherlands, the old mining facilities have almost all been demolished. This means that around the Dutch heritage sites other means of connecting with the past should be found. You could think about rebuilding some of the old structures or designing new structures that house facilities by using the same historic materials. Furthermore, the heritage sites themselves should try to connect as much as possible with their surrounding as each surrounding will provide grounds for the 'destination' that can be developed. For instance, in areas where there is a clustering of additional education additional educational facilities located at the heritage sites could form the connection.

Sources

(European Environment Agency, 2020)
(Marlet et al., 2014)
(TheBicesterCollection, 2021)

E4

TELL THE STORY

EDUCATING CITIZENS AND VISITORS ABOUT THE MINES WILL CREATE MORE UNDERSTANDING FOR THE UNIQUE CONDITIONS OF THE REGION AND CAN BOOST TOURISM.

CONNECTED TO
G6, G8, E1, E2, E3, E5, R5

CULTURE - EMBRACING HERITAGE (OF THE MINES) - TRANSCALAR



Freepik by Storyset (edited)



Image: Roode Beek visitor centre in Limburg (NL) (Eropuit in Limburg, 2022)

landscape

innovations

Theoretical Background

After the mines in Limburg closed down the region lost its identity (Coenen & IBA Parkstad (Heerlen), 2015). Regional identity is grounded in the regional history, in the surrounding landscape, in a special language or dialect dominating in the region in question, or in other specific regionally bounded conditions. In the case of Limburg the mines can be seen as the specific regionally bounded conditions. Telling the story of the mines can thus help create that regional identity that can lead to the (positive) feeling of a collective towards a region or formed by a region. But also to have inhabitants produce and reproduce social cohesion by their practical consciousness and actions and thereby form a regional community (Pohl, 2001).

Practical Implications

To educate citizens and tourist about the mining heritage of the region visitor centres can be set up along the backbone. Each visitor centre could have its own focus point based on the area's specific past. Furthermore, information along the routes of the network explaining why the landscape looks the way it looks can provide a way to tell the story. Especially linking the past to what can still be seen today is important for everyone to understand the impact of the mining industry on the regions.

Sources

(Coenen & IBA Parkstad (Heerlen), 2015)
(Eropuit in Limburg, 2022)
(Pohl, 2001)



Freepik by Storyset (edited)

E5 MINE MATERIALS

USING MATERIALS THAT CAN BE TRACED BACK TO THE MINING HISTORY FOR CONSTRUCTING, STATIONS, REST AREAS, ETC. WILL FURTHER ANCHOR THE HERITAGE OF THE REGION INTO THE TRANSPORT NETWORKS.

CONNECTED TO
G2, N4, N8, E1, E4

CULTURE - EMBRACING HERITAGE (OF THE MINES) - PUBLIC SPACE



Image: Overview of materials used at the Wilhelmina Mine in The Netherlands (DSM, 1946)

landscape

innovations

Theoretical Background

A coherent design language can contribute to having a recognisable visual identity (Amerio, 2020). This design language can be used to enhance the region identity. Reconnecting with the mining heritage can help to create a new regional identity (Pohl, 2001). To integrate this identity mine materials can be used as part of the design language to further anchor the regions mining history in the new network.

Practical Implications

Materials related to mining activities are mostly brick, steel, concrete, wood and coal. These materials could be used for the construction of different buildings. As these materials are mostly made from non-renewable raw materials it is advisable to reuse existing materials as much as possible or use bio-based versions of the materials with similar characteristics. Another way to incorporate these materials while taking into account sustainability is through process of urban mining.

Sources

(Amerio, 2020)
(DSM, 1946)
(Pohl, 2001)

05 | R

REGENERATING THE GARDEN CITY

CONTENT

R1 Optimising Density	74
R2 Putting People First, not Cars	76
R3 Wider Sidewalks	78
R4 Become a Node	80
R5 Connect to Your Surrounding	82
R6 Close by Amenities & Services	84
R7 Diverse community	86



Freepik by Storyset (edited)

R1

OPTIMISING DENSITY

OPTIMISING DENSITY WITHIN THE GARDEN CITIES WHERE POSSIBLE CREATES MORE DEMAND FOR TRANSIT NETWORKS AND SERVICES.

CONNECTED TO
N1, N9, R6, R7

TECHNOLOGY - REGENERATING THE GARDEN CITY - NEIGHBOURHOOD



landscape

innovations

Image: De Schatkamer in Utrecht is an example of a small scale densification in a residential area (TenBrinke Group, 2018)

Theoretical Background

Higher density neighbourhoods create more demand for transit network and access to destinations within walking distance. Density is not overcrowding: It means optimal balance of people, opportunities, and quality housing near sustainable transport options (ITDP, 2017).

Practical Implications

There are many solutions to optimise density in different areas. Examples are adding new buildings to the area if there is any empty space or topping up qualified buildings. Keep in mind that enough open space is left to be able to access green spaces such as parks. This is especially important when it comes to the garden cities. Adding more residential, office and commercial buildings will increase the use of space and could take away from the character of the neighbourhood. Therefore it is important to think about the principles of a garden city and incorporate them into the design. Some garden cities might be able to expand into neighbouring neighbourhoods.

Sources

(ITDP, 2017)
(TenBrinke Group, 2018)

R2

PUTTING PEOPLE FIRST, NOT CARS

PRIORITISING SOFT TRANSPORT NETWORKS FOR WALKING AND CYCLING INCREASES THE USE OF THESE TYPES OF TRANSPORT THAT ALSO HAVE LESS IMPACT ON THE ENVIRONMENT.

CONNECTED TO
G3, N3, N4, E2, R3, R6

PEOPLE/INFRASTRUCTURE - REGENERATING THE GARDEN CITY - CITY



Freepik by Storyset



Image: Pedestrian Zone in Amsterdam City Centre
(RossHelen, 2017)

landscape

innovations

Theoretical Background

Examples in other cities show that when cars are banned from large part of the cities centre CO₂ emissions went down with 70%, and nearly three-quarters of what were car journeys are now made on foot or by bicycle (Burgen, 2018).

Practical Implications

Create car-free zones in areas to allow for walking and cycling as the main method of transportation. The effect of these car-free zones will create more traffic along the edges to these zones. Park and ride locations have to be placed at strategic locations in order to let people park their car outside the car free zone and use other means of transportation to get to their desired destination. Within the car-free zones extra parking facilities for bikes should be available as there will be an increase in the use of soft transportation methods to reach the destinations within them. Having these car free zones connected to large transit hubs can increase the use of public transport. Lastly, within the car-free zones previously dedicated space for cars can be repurposed for bikes.

Sources

(Burgen, 2018)
(RossHelen, 2017)

R3

WIDER SIDEWALKS

WIDER SIDEWALKS ALLOW FOR BETTER WALKABILITY.

CONNECTED TO
G3, G8, N2, N5, E2, R2

INFRASTRUCTURE/PEOPLE - REGENERATING THE GARDEN CITY - PUBLIC SPACE



Freepik by Storyset (edited)



Image: Neighbourhood in Limburg with wider sidewalks allowing for more space for pedestrians (Saelmans, n.d.)

landscape

innovations

Theoretical Background

Dedicating more space to pedestrians will increase their comfort level. To ensure all different groups of society are able to comfortably walk around a minimum of 1.8m of sidewalk should be available where possible. This should increase to 2.5 meters in areas where there is a lot of traffic or space to accommodate for a more pleasant environment (Gemeente Leiden, 2013).

Practical Implications

Investigate the number of people that uses the sidewalk during peak times to evaluate the current width and if an increase is needed. While doing this it is important to take into account possible obstacles on the sidewalks that decrease the width of the free path. In addition to the wider sidewalks, the roads can also be transformed into a bike road. This means that bikes are the main form of transportation on these roads and cars have to drive very slowly as they are considered to be a guest on these roads.

Sources

(Gemeente Leiden, 2013)
(Saelmans, n.d.)

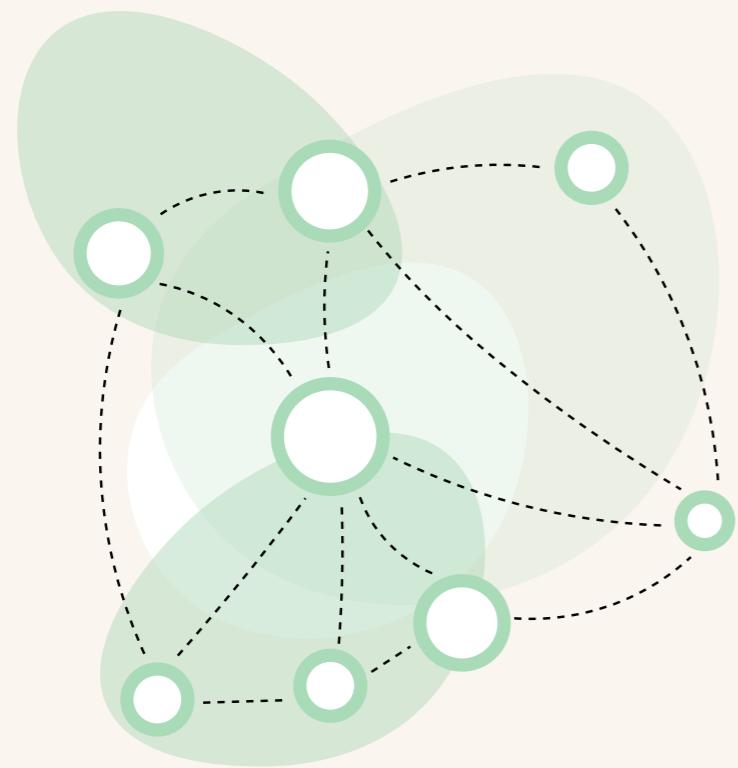
R4

BECOME A NODE

BECOMING A NODE IN A MOBILITY NETWORK WILL INCREASE ECONOMIC ACTIVITY AND ENHANCE THE OVERALL LIVABILITY AND RESILIENCE OF A COMMUNITY.

CONNECTED TO
N1, N5, N6, N9, E1, E3, R5

TECHNOLOGY - REGENERATING THE GARDEN CITY - REGIONAL



landscape

innovations

Image: Fietssnelweg F45, Oudenaarde, Vlaanderen, België
(FrDr, 2020)

Theoretical Background

Become a node in the network opens up the possibility to share knowledge and culture, also increasing the economic space of the cities in the region (Marlet et al. 2014).

Practical Implications

To become a node, garden cities will have to connect with other nodes in the network. This can be done by creating physical connections in terms of infrastructure but also by investing in collaboration networks. Having a speciality as a node will work in its advantage. This could be specialities such as the available knowledge on particular subjects but also physical factors such as available resources or landscape that make the node unique can be used to add value to the network.

Sources

(Marlet et al., 2014)
(FrDr, 2020)

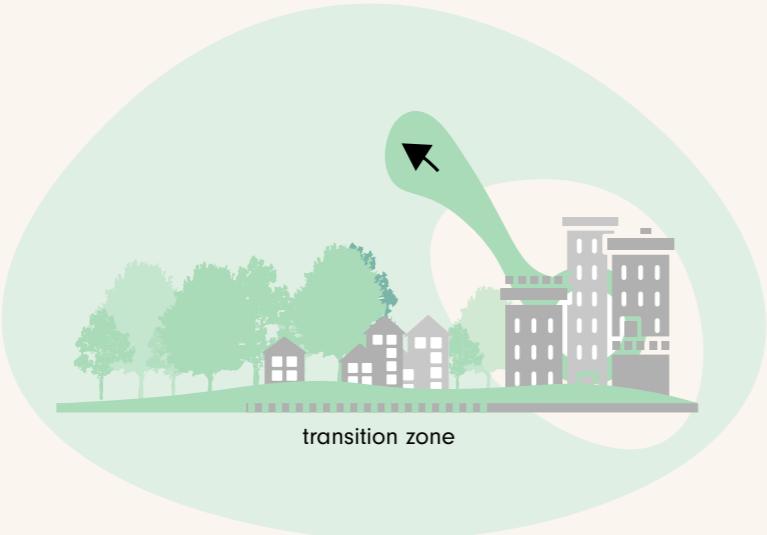
R5

CONNECT TO YOUR SURROUNDING

CONNECTING GARDEN CITIES WITH THEIR SURROUNDING LAND USES WILL GIVE THEM A UNIQUE CHARACTER AND PLACE WITHIN THE NETWORK. THIS WAY MANY DIFFERENT TYPES OF LAND USE WILL BE CONNECTED TO THE NETWORK.

CONNECTED TO
G8, N5, N6, N9, E1, E4, R4

TECHNOLOGY - REGENERATING THE GARDEN CITY - NEIGHBOURHOOD



landscape

innovations

Image: Urban Farms as an example of a transition zone between urban and agricultural regions (Linda N., 2008)

Theoretical Background

The cities along the old mine infrastructure all have a different character based on their surroundings. Some are more industrial and others are surrounded by leisure activities (European Environment Agency, 2020). Further amplifying these characters can help to increase accessibility of services that are connected to the different cities. To do that (garden) cities have to connect with their surroundings to ensure that they are not only the city but also different types of land use are represented in the network.

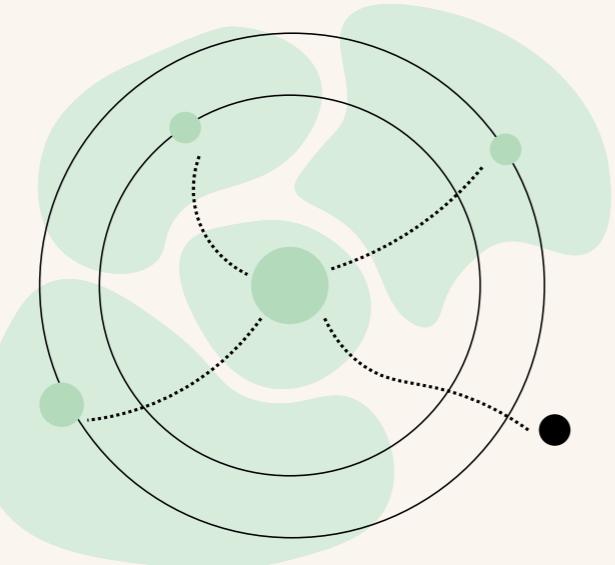
Practical Implications

To connect to the surrounding landscape of the garden cities a transition zone can be developed, pulling the function or land use of the garden cities' surroundings in and giving it a more outspoken character. This transition zone can be created by adding similar functions of the surroundings on the edges of the garden city itself. If the garden city is surrounded by industries, urban manufacturing could be given a place in the urban fabric or when it is surrounded by mostly agriculture urban farming could be integrated. At the transit hubs there should also be an indication of the characteristics of its surroundings. By doing this, passengers get a better understanding of the character of the area.

Sources

(European Environment Agency, 2020)
(Linda N., 2008)

R6



CLOSE BY AMENITIES & SERVICES

HAVING AMENITIES CLOSE BY AND SPREAD THROUGH THE URBAN FABRIC INCREASES THE ACCESSIBILITY FOR CITIZENS AND CREATES SOCIAL INTERACTIONS.

CONNECTED TO
G1, G8, N1, R1, R2, R4, R7

PEOPLE - REGENERATING THE GARDEN CITY - NEIGHBOURHOOD



landscape

innovations

Image: Small shopping area providing the neighbourhood with easy access to amenities & services (Wasik, n.d.)

Theoretical Background

“Mixed-Use” patterns of development are fundamental. A diversified land-use configuration can provide effective provision of various housing types, amenities, services, and movement options. This ultimately leads to a lively public realm within which people are encouraged to engage in daily social interactions (Alipour & Galal Ahmed, 2021).

Practical Implications

Lo temo conserum esto dolum voluptatiam voluptum si
Pellentesque sed cum illiget et force sunt in plenem
tempor, que prat. Sed ut quisque pereat, sim et ut
intra accessus vellet debet in non est. Creating spaces
that can allow us to destination as well as a place to meet
and interact, but encourage voluntary contact with
the community, as well as the possibility of social interaction with
the environment. This is not only a way to increase the quality of life
but also to promote a sense of belonging and social cohesion. This
can be achieved through the use of green spaces, pedestrian
areas, and public transportation infrastructure. It is also important
to encourage the use of local businesses and services, which can
create a sense of community and support local economies.

Sources
(Alipour & Galal Ahmed, 2021)
(ITDP, 2017)
(reference)



Freepik by Storyset (edited)

R7

DIVERSE COMMUNITY

EMPHASIZING DIVERSITY AND CULTIVATING A DIVERSE COMMUNITY AS A FUNDAMENTAL PRINCIPLE IN REIMAGINING THE PHYSICAL AND SOCIAL STRUCTURES OF A GARDEN CITY ENHANCES EQUITY IN MOBILITY.

CONNECTED TO
G7, G8, N1, R1, R4, R5, R6

PEOPLE - REGENERATING THE GARDEN CITY - NEIGHBOURHOOD



landscape

innovations

Image: A mobile community centre from housing corporation Wonen Limburg (Studio Maatwerk, n.d.)

Theoretical Background

The goal of any mobility transition should be to provide mobility justice. Mobility justice can be divided into 5 different types of justice: (1) Distributive justice, (2) Deliberative justice, (3) Procedural justice, (4) Restorative justice and (5) Epistemic justice (Sheller, 2018). Distributive, Deliberative and Restorative justice all are concerned with making sure all citizen groups have equal access to mobility options. This means that in surrounding new transport networks different citizen groups have to be housed as well. Only then are you able to achieve mobility justice. Therefore the promotion of a diverse community is crucial and should be implemented when reimagining the physical and social structures of garden cities in the region.

Sources

(Sheller, 2018)

Practical Implications

Having a diverse community requires the right distribution of different types of housing, education and job opportunities. Therefore, garden cities should include more social housing and a bigger variety of housing types in terms of target groups as well as price. Most houses in garden cities are single family homes and don't account for single occupants or elderly that are in need of more care. To provide these different housing types current houses could be renovated or new projects could be started to house a variety of different groups all part of society. In order to build community facilities such as shared gardens, community buildings and playground can provide the necessary social interaction. Furthermore, the neighbourhoods should be well connected to all types of education and jobs.



06 | REFERENCES

- Al Kaysi, I., & Abbany, A. (2002). Service Design in Competitive Tendering of Bus Routes. *Journal of Public Transportation*, 5(1), 61–86. <https://doi.org/10.5038/2375-0901.5.1.4>
- Aleksandra, J. (2022). *Private car or public transport? - What effects does the service accessibility have on public transport utilisation in the City of London* [Preprint]. In Review. <https://doi.org/10.21203/rs.3.rs-1431695/v1>
- Amerio, M. (2020). Doha Metro Project: 3TI lesson learned. *Transportation Research Procedia*, 45, 866–873. <https://doi.org/10.1016/j.trpro.2020.02.082>
- Braam, K. (2023, February 24). *TU Delft Thesis Sustainable Mobility Limburg (Rover)* [Online Video Meeting].
- Braining the Future. (n.d.). *Herkenbare identiteit voor de stad* [Photo]. <https://brainingthefuture.nl/projecten/ontwikkelen-van-een-herkenbare-identiteit-voor-de-stad>
- Cheung, N. (2020). Mobility Justice: The Politics of Movement in an Age of Extremes: Mimi Sheller. Brooklyn, NY: Verso, 2018. vii and 224 pp., bibliography, index. \$95.00 cloth (ISBN 978-1-7887-3095-2); \$26.95 paper (ISBN 978-1-7887-3092-1); \$9.99 electronic (ISBN 978-1-7887-3094-5). *The AAG Review of Books*, 8(3), 138–139. <https://doi.org/10.1080/2325548X.2020.1760059>
- CIVITAS. (2010). *CIVITAS II Policy Advice Notes 07 Public Transport Priority* (No. 07). https://civitas.eu/sites/default/files/civitas_ii_policy_advice_notes_07_public_transport_priority.pdf
- DBG. (2022). Eerste 'slimme busbaan' van Vlaanderen is een feit. https://www.nieuwsblad.be/cnt/dmf20220102_94586426
- DSM. (1946). *Overzicht Staatsmijn Wilhelmina* [Photo]. <https://www.demijnen.nl/collectie/foto/overzicht-staatsmijn-wilhelmina-1/220/?keys=wilhelmina&tid=&index=14&page=2&over=1>
- Eropuit in Limburg. (2022, January 5). Bezoekerscentrum Roode Beek. *Eropuit in Limburg*. <https://www.ropuitinlimburg.com/site/bezoekerscentrum-roode-beek/>
- European Environment Agency. (2020). *Corine Land Cover (CLC) 2018* (Version 2020_20u1) [Dataset]. <https://land.copernicus.eu/pan-european/corine-land-cover/clc2018?tab=mapview>
- Ewing, R., & Cervero, R. (2010). Travel and the Built Environment: A Meta-Analysis. *Journal of the American Planning Association*, 76(3), 265–294. <https://doi.org/10.1080/01944361003766766>
- FrDr. (2020). *Fietssnelweg F45, Oudenaarde, Vlaanderen, België* [Photo]. https://commons.wikimedia.org/wiki/File:Fietssnelweg_F45_Oudenaarde_03.jpg
- Gemeente Leiden. (2013). *Handboek kwaliteit openbare ruimte*. https://www.publicspaceinfo.nl/media/uploads/files/LEIDEN_2013_0002.pdf
- Gemeente Nijmegen. (2012). *Snelbinder brug Nijmegen* [Photo].
- Gemeente Utrecht. (2019). *Green bus stop in Utrecht* [Photo].
- Geusens, J. P. (2022). *Spoorbrug Maastricht* [Photo]. <https://www.1limburg.nl/nieuws/1658686/iconische-spoorbrug-maastricht-dreigt-te-verdwijnen>
- Hackenberg, N. (2010). *Low Floor Trams in Adelaide* [Photo]. <https://upload.wikimedia.org/wikipedia/commons/f/f5/AECExtensionCitadisFlexity.jpg>
- Hill, A. (2020, April 16). *Foundries of the Future: A Guide For 21st Century Cities of Making*. Cities of Making. <https://citiesofmaking.com/foundries-of-the-future/>
- ITDP. (2017). *TOD Standard*. https://itdpdot.org.wpengine.com/wp-content/uploads/2017/06/TOD_printable.pdf
- Janaa. (2010). *Bus from 'De Lijn' in Maastricht* [Photo]. https://nl.m.wikipedia.org/wiki/Bestand:De_Lijn_bus_Maastricht.jpg
- Japplemedia. (2021). *Station Genk* [Photo]. https://upload.wikimedia.org/wikipedia/commons/c/c6/Station_Genk_Gebouw.jpg
- Lakshmanan, T. R. (2011). The broader economic consequences of transport infrastructure investments. *Journal of Transport Geography*, 19(1), 1–12. <https://doi.org/10.1016/j.jtrangeo.2010.01.001>
- LDE Centre for Sustainability. (2021). *The Green Village FieldLab* [Photo].
- Lee, S., Koschinsky, J., & Talen, E. (2018). Planning tools for walkable neighborhoods: Zoning, land use, and Urban form. *Journal of Architectural and Planning Research*, 35, 69–88.
- Lenaerts, L. (2021). *Avonturenberg op de mijnterril* [Photo]. <https://www.bikerepublic.be/blog/bikes-and-belgium-fietsroutes/fietsenlangs-de-mijnen-en-het-water-inberingen-bb-wintereditie-route-5>
- Linda N. (2008). *New crops* [Photo]. <https://www.flickr.com/photos/22748341@N00/2737299930/>
- Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability transitions research: Transforming science and practice for societal change. *Annual Review of Environment and Resources*, 42, 599–626.
- Loorbach, D., & Rotmans, J. (2010). The practice of transition management: Examples and lessons from four distinct cases. *Futures*, 42(3), 237–246. <https://doi.org/10.1016/j.futures.2009.11.009>
- Marlet, G. (Gerardus A., 1970-, Oumer, A. M. 1980-, Ponds, R. (R. H. F.), Woerkens, C. M. C. M. van (Clemens M. C. M., 1967-, & Berg, N. van den red/eindred. (2014). *Groeien aan de grens: Kansen voor grensregio's*. VOC Uitgevers; WorldCat.org.
- Meukens, P. (2023, March 13). *TU Delft Thesis Sustainable Mobility Limburg (TTB)* [Online Video Meeting].
- Meuleman, L. (2019). *Metagovernance for Sustainability: A Framework for Implementing the Sustainable Development Goals* (1st ed.). Routledge. <https://doi.org/10.4324/9781351250603>
- Mills, R. (2021). Active History: Creating Sustainable Cities Through Heritage Trails. 2021 *IEEE European Technology and Engineering Management Summit (E-TEMS)*, 131–135. <https://doi.org/10.1109/E-TEMS51171.2021.9524899>
- Mo, T. (2017). *Skjoldskiftet city tram station in Bergen, Norway* [Photo]. https://commons.wikimedia.org/wiki/File:Skjoldskiftet_stasjon.jpg
- Nelis, C. (2019). *Parking spots in Genk* [Photo]. https://www.hbvl.be/cnt/dmf20190608_04450210
- Nevens, F., Frantzeskaki, N., Gorissen, L., & Loorbach, D. (2013). Urban Transition Labs: Co-creating transformative action for sustainable cities. *Journal of Cleaner Production*, 50, 111–122. <https://doi.org/10.1016/j.jclepro.2012.12.001>
- Norsk Form, & City of Bergen. (2005). *Read Design Guide—Bergen Kommune*. <https://www.yumpu.com/en/document/view/33687210/read-design-guide-bergen-kommune>
- Olsen, S. H., Zusman, E., & Cadman, T. (2015). Trends in the international sustainable development policy discourse: Compliance, collaboration or both? In M. Bengtsson, S. H. Olsen, & E. Zusman (Eds.), *Achieving the Sustainable Development Goals: From Agenda to Action* (2nd ed., pp. 43–68). Institute for Global Environmental Strategies (IGES). http://portal.gms-eoc.org/uploads/resources/1901/attachment/00_All_Achieving_the_SDGs.pdf#page=63
- OpenStreetMap Contributors. (2023). *OSM Standard* [Map]. <https://www.openstreetmap.org/#map=12/50.9643/5.7939>
- PBL. (2014). *Bereikbaarheid verbeeld 14 infographic over mobiliteit, Infrastructuur en de stad*. <https://www.pbl.nl/publicaties/bereikbaarheid-verbeeld#:~:text=Niet%20alle%20reistijd%20weegt%20even,verschillende%20fasen%20van%20de%20reis.&text=Niet%20alleen%20de%20kwaliteit%20van,ook%20de%20afstemming%20tussen%20beide.&text=Bij%20reizen%20gaat%20het%20niet,tijd%20die%20je%20kwijt%20bent>
- Petzer, B. J. M., Wieczorek, A. J., & Verbong, G. P. J. (2020). Dockless bikeshare in Amsterdam: A mobility justice perspective on niche framing struggles. *Applied Mobilities*, 5(3), 232–250. <https://doi.org/10.1080/23800127.2020.1794305>

- Pohl, J. (2001). Regional Identity. In *International Encyclopedia of the Social & Behavioral Sciences* (pp. 12917–12922). Elsevier. <https://doi.org/10.1016/B0-08-043076-7/02488-8>
- Prorail. (2021). *HOV in 't Gooi* [Render]. <https://www.prorail.nl/nieuws/bewuste-bouwers-trofee-voor-project-hov-t-gooi>
- Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155–169. <https://doi.org/10.1007/BF01405730>
- Rodrigue, J.-P. (2020). Chapter 2 – Transportation and Spatial Structure. In *The Geography of Transport Systems* (5th ed.). Routledge. <https://doi.org/10.4324/9780429346323>
- Roorda, C., Frantzeskaki, N., Loorbach, D., Van Steenbergen, F., & Wittmayer, J. (2012). Transition Management in Urban Context. *Guidance Manual-Collaborative Evaluation Version*.
- RossHelen. (2017). *View on the square full of tourists near the Old church during the sunny weather in Amsterdam* [Photo]. [https://www.shutterstock.com/nl/image-photo/amsterdam-netherlands-august-07-2017-view-705039511?ir-clickid=0yZ2QIXo2xyNURfyYVz-Bu1K2UkAVA6VNky2H180&irgw-c=1&utm_campaign=TinEye&utm_content=108110&utm_medium=Affiliate&utm_source=77643&utm_term="](https://www.shutterstock.com/nl/image-photo/amsterdam-netherlands-august-07-2017-view-705039511?ir-clickid=0yZ2QIXo2xyNURfyYVz-Bu1K2UkAVA6VNky2H180&irgw-c=1&utm_campaign=TinEye&utm_content=108110&utm_medium=Affiliate&utm_source=77643&utm_term=)
- Sadler, K. (2015). *Wythenshawe transport interchange* [Photo]. <https://www.intelligenttransport.com/transport-news/16736/6-million-wythenshawe-transport-interchange-complete/>
- Saelmans. (n.d.). *Suffolkstraat Nederweert* [Photo]. <https://www.saelmans.nl/aanbod/woningaanbod/nederweert/koop/huis-6668319-Suffolkstraat-22/>
- Sheller, M. (2018). *Mobility justice: The politics of movement in the age of extremes*. Verso.
- Studio Maatwerk. (n.d.). *Mobiel Buurthuis*. Studio Maatwerk - Vormgeving in de Openbare Ruimte. Retrieved 18 June 2023, from <http://www.studiomaatwerk.nl/portfolio/mobiel-buurthuis/>
- Ten Brinke Groep. (2018). *De Schatkamer, De Meern* [Render]. <https://www.wonenindeschatkamer.nl>
- TheBicesterCollection. (2021). *Be-MINE* [Photo]. <https://www.thebicestercollection.com/maasmechelen-village/nl/lokale-attracties/bemine>
- Transportation Policy Research Center. (n.d.). *Multimodal Transportation Corridors*. Texas Transportation Institute. Retrieved 14 June 2023, from <https://static.tti.tamu.edu/tti.tamu.edu/documents/policy/congestion-mitigation/multimodal-transportation.pdf>
- Tsigdinos, S., Nikitas, A., & Bakogiannis, E. (2021). Multimodal corridor development as a way of supporting sustainable mobility in Athens. *Case Studies on Transport Policy*, 9(1), 137–148. <https://doi.org/10.1016/j.cstp.2020.11.004>
- Van Ooij, E. (2020). Highly mobile workers challenging Regulation 883/2004: Pushing borders or opening Pandora's box? *Maastricht Journal of European and Comparative Law*, 27(5), 573–597. <https://doi.org/10.1177/1023263X20940137>
- Walker, J. (2010, November 5). Basics: The Spacing of Stops and Stations. *Human Transit*. <https://humantransit.org/2010/11/san-francisco-a-rational-stop-spacing-plan.html>
- Wasiak, Y. (n.d.). *Market on the Pauwengraaf in Maasmechelen* [Photo]. <https://www.maasmechelenleisurevalley.be/mode-shoppen.html>
- Wildschut, D. (2018). *Busses in Maastricht Busstation from two different operators* [Photo]. <https://www.grenstreinbus.be/busverbinding.php?provincie=3&id=18>
- Yasmina. (2020). *Treinen op een zijspoor: Kolenspoar As* [Photo]. <https://roadtrips-metkids.com/2020/05/16/kolen-spoar-as-2020/>

