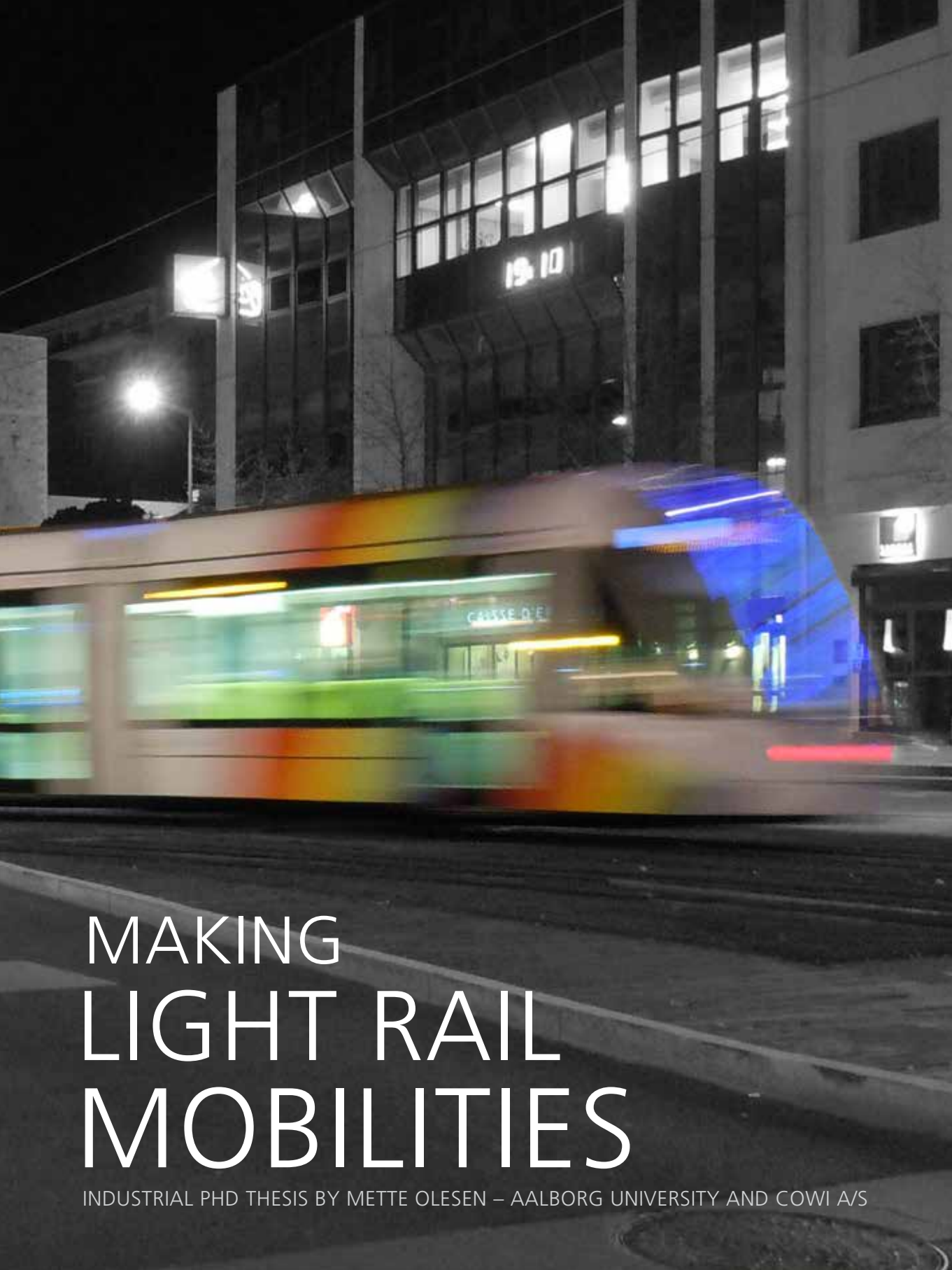
Making Light Rail Mobilities

Olesen, Mette

Publication date:
2014

Document Version
Early version, also known as pre-print



MAKING LIGHT RAIL MOBILITIES

INDUSTRIAL PHD THESIS BY METTE OLESEN – AALBORG UNIVERSITY AND COWI A/S

COLOPHON

Making Light Rail Mobilities
Industrial PhD Thesis
January 2014

Department of Architecture, Design & Media Technology
Section for Urban Design
Centre for Mobilities and Urban Studies (C-MUS)
Aalborg University, Denmark

COWI A/S
Department for Urban Planning and Transport

Supervisors
Claus Lassen
Niels Melchior Jensen

Printed by: akprint, Aalborg

CONTENTS

PREFACE & SUMMARY

PREFACE

This thesis contributes to the debate on light rail mobilities in both research and planning practice. The thesis approaches this debate from a strategic urban- and mobility-planning perspective and also supplements the more rational economic and technical sides of the debate, where focus has been more on the choice of technologies and the socio-economic outcomes of such projects. From the outset, the thesis acknowledges the importance of such debates but also sees an interesting and lacking political and strategic perspective in this mobility mode. Since practice shows that many light rail projects are built despite being impractical from an economic perspective, there must be other stronger rationales governing the decision to build them, and these rationales are important elements to include and critically reflect upon in the debate. Since the rationales in many cases seem to be based on discourses around urban development, regeneration and redesign, it is also relevant to unfold how these mobilities materially and spatially become an integrated part of city morphology, and which spatial and strategic effects this has from an urban development perspective.

The thesis is the result of an interesting journey into a subject that was completely new to me. Educated as an urban planner, I have always been interested in the societal trends and discourses that have been influential in the ways our cities develop. My interest in history and politics has guided the research process and is of great importance to the outcome of the thesis. Furthermore, my shift from the urban planning and mobilities research group to the urban design research group in 2012 has also impacted the end result of the thesis. The new research environment provided insight into the architectural and urban design perspective, which piqued my nascent interest in the material and spatial side of light rail mobilities. I became aware of the way strategic prioritisations can be physically traced as 'frozen discourses' in the urban environment, and this perspective proved to be important for the theoretical discussions and findings in the thesis.

I started this work with the ambition of writing a thesis consisting of a collection of articles, where the aim from the beginning was to publish three journal articles. The richness of the empirical data collected as well as my personal desire to explain all the complex findings from each case study, however, proved to be too extensive to fit this rigid journal style. Therefore, this thesis has evolved into a hybrid composed of a monograph and a collection of journal articles. The thesis is therefore structured in two major parts, where the first part contains the research design and in-depth case analysis, and the second part contains the two journal articles that outline the findings of some of the cases analysed. The second part also contains a 'takeaways for practice' section, as well as the overall conclusions of the thesis.

I have put my heart into this work for the last three years, and have nearly turned into one of the 'rail freaks' whose enthusiasm for the complexity and history of railways amazed

me when I started my thesis. Many other people have also had great influence on the work I present in this thesis. First I have to thank my two supervisors, Claus Lassen and Niels Melchior, for their valuable comments and support throughout the research process. I also want to thank the interviewees who have contributed to this thesis who are all mentioned by name in chapter 6, and all the people involved in 'Danish light rail practice' who also provided great insight into the complex process of making light rail mobilities. I want to thank COWI for making this work possible, and my colleagues at COWI, who have been of great support in the research process on both a personal and the professional level - it has been a real pleasure being a part of the team and having the opportunity to interact with practice. I also want to thank my colleagues in the Urban and Mobility Planning Research Group at the Institute of Planning, where I spent the first two years of my Ph.D., and my new colleagues in the Urban Design Group at the Institute of Architecture, Design and Media Technology, where I spent the last year. You have all contributed with interesting perspectives and comments on my work that I greatly appreciate, and you have laughed at my lame humour in the lunchroom, which is equally appreciated and has made the last three years a wonderful time. I want to say a special 'thank you' to some of my Ph.D. colleagues: Maria, Ditte, Simon, Cathrine, Anne, Ida, Tina, Jacob, Jacob, Anne Marie, Morten and Nina - thank you for all the great moments in which we have shared our experiences, enthusiasms and frustrations. It has been great having you all as part of this journey. I would like to thank the TSU group at Oxford University who hosted be for a research visit in the autumn 2013. Finally, I want to thank my husband Bo, for being as enthusiastic as I am about my topic; thank you for listening to all my talk about light rail planning with the same curiosity through all three years. During this process you have even sometimes managed to deliver the central point better than I when friends and family have shown interest in the theme! Also thanks to my family for their support throughout the process - I was glad to have such a caring and loving base to stand on during the most frustrating parts of this process.

I hope you will all enjoy my contribution to the light rail debate!

Mette Olesen, Aalborg
January 2014.

SUMMARY

This PhD thesis provides a qualitative perspective on light rail mobilities, as a tool in strategic urban development of mid-sized European cities (100.000-350.000 inhabitants). The thesis is a contribution to the debate of the relevance and value of light rail systems, and should be seen as a supplement to the technical and economic analyses of such systems. The PhD thesis is a result of three year collaboration between COWI A/S, department of Urban Planning and Transport, in Aalborg Denmark, and Aalborg University Department of Architecture and Media technology.

Through the recent years, light rail has been introduced as a strategic tool in urban development in the larger Danish cities. This has created attention to, an interest in, the potentials, values and effects of such systems. This PhD thesis is thus initiated by the need for knowledge concerning the potentials of light rail in a strategic urban development perspective. This means, that the thesis has been oriented towards a qualitative analysis of light rail project in mid-sized European cities, which are comparable in size with the Danish light rail projects. By ascribing a qualitative perspective to the analysis, the thesis approaches light rail projects as 'more than transport projects', by providing insight to the history, rationale and political ideologies which has been governing the decision to implement light rail in selected mid-sized European cities. Theoretically, the thesis is based in the 'new mobilities paradigm', though which it is argued, that it is important not only to attend to the technical and physical aspects of mobility. Attention must also be given to the political, social and cultural relations in which mobility and mobile technologies are embedded. Empirically, the thesis is based in case studies in four mid-sized European cities: Bergen in Norway, Angers in France, Bern in Switzerland and Freiburg in Germany. These cases illustrates 4 cities, 4 different histories, 4 planning approaches, 4 light rail systems and 4 light rail visions. The purpose of including different national contexts has been to analyse which societal conditions that has been governing, firstly, the decision to implement light rail in the given context, and secondly, the local concept, hereunder the layout and design of the system and the adaptation to and implication for the urban environment.

The thesis is based in the following main research question and sub questions:

How are light rail mobilities politically and culturally produced and materially and spatially practiced in mid-sized European cities, and how can this knowledge be used in future decision-making processes for light rail projects?

- 1. Why are light rail systems implemented in mid-sized European cities, and what is the rational basis for the decision to implement them?
- 2. How have light rail projects changed urban spaces and mobility hierarchies in the selected cases of mid-sized European cities, and which factors have affected this process?

- 3. How can the knowledge derived from the questions above be used in future decision-making processes for light rail projects?

As underlined by the research questions, the thesis contains both a political-discursive dimension and a material-spatial dimension in order to analyse and explain how and why light rail projects are designed in the concrete local contexts analysed. The thesis has turned out to be a hybrid between a monograph and a collection of articles. Therefore the thesis consists of two parts, which also reflects this hybrid structure:

Part 1 (chapter 1-7) Research design and empirical analysis: Contains introduction to the problem presented in the thesis, position of the thesis within the existing literature, theory, methodology and the four case analyses. Part 1 thus creates the background for the transverse analysis presented in part 2.

Part 2 (chapter 8-11) Extract of central themes: This part contains the two journal articles which has been produced based in the findings in part 1. Part 2 furthermore contains a decision making tool oriented towards practice. This tool introduces methods to include qualitative perspectives and values into the decision making process for future light rail projects. This part finally contains the conclusions of the thesis.

The main conclusions of the thesis can be summarized in the following 5 points:

Point no. 1: Light rail mobilities should be studied in context, in relation to the cultural and political practices in which the project is embedded. Experiences of implications and practices of light rail mobilities are thus not universal and there is no one answer to the light rails potential as an urban development tool, it is dependent on the specific example studied. This means that, the implications of light rail mobilities should be understood in relation to the choices made in all phases of the decision making process: from vision to plan to implementation. The vision and the rationale behind the light rail project can hence prove to have a great importance for the performance of the light rail system, in relation to specifically defined parameters. If the concept of the light rail project has been to create new urban spaces and support future urban development, these decisions can have implication for travels speeds and accessibility of the light rail system. Conversely, can the concept be to implement the light rail in tracks that are completely segregated from the urban environment, in order to generate possibilities for higher travel speeds. This concept can though prove to have limited effect on remodelling the street layout and creating restrictions for car traffic in the light rail corridor - a concept that is often used as an argument in the light rail corridor.

Point no. 2: Analytically, the political and cultural production and material and spatial practice of light rail mobilities in mid-sized European cities should be understood by the interaction between 'language' and 'materiality'. It is argued, that light rail projects should not only be understood by their political and cultural embedment, but also based on their

materiality, which is potentially influential in regards to, redefining existing planning practices and re-organise urban spaces and mobility-hierarchies in the city. This means that, analytically there needs to be focus on the relation between the social and technological innovations and the way in which these affects each other. The light rail is thus not a 'passive technology' in a context; it is an active part in re-defining the context in which it is implemented (through new planning practices, new street environments, restrictive policies and new mental and physical links in the city). The political, cultural and spatial context is also important in regards to the conceptual approach to light rail projects in each city. This means, that there are many local 'translations' of the light rail vision which should be used as a basis for understanding potentials and implications.

Point no. 3: Discourses of light rail mobilities has a universal character that can be understood as a 'travelling idea' within spatial planning. The case analysis in the thesis proves that there exists a 'universal language of light rail mobilities', and this is part of articulating the role of light rail in strategic urban development. The identification of central discourses for and against light rail mobilities in each case, provided insight to the societal trends and political ideologies in which light rail projects is embedded in both a local and global perspective. The problem is though, that the argumentation for light rail projects are often on a very general level, and herby it does not relate to concrete local prioritisations taken in each local project to secure success of the different strategic focus. To provide a brief example, light rail is often articulated as a mean to attract car drivers to public transport. The case analysis however show, that prioritisations on the light rail alone does not encourage less congestion, such an effect is very dependent on the supplementing political prioritisations for restricting car traffic. Hereby it can be argued, that the light rail is often considered as a 'technological fix', which has not been put into context. This is a tendency that is specifically evident for the qualitative factors in light rail project, and this is why these general discourses of light rail mobilities should be supplemented with concrete initiatives to have an actual validity in the decision making process.

Point no. 4: Different material and spatial concepts and practices have been guiding the practice of Light Rail Mobilities in mid-sized European cities, and thus have different implications on urban spaces and mobility hierarchies. Hereby it is important to understand that the light rail idea is not universal; there are many different conceptual translations of the light rail ide in the local contexts. The concept of the light rail can be based in such different conceptual approaches such as: applying the light as a planning tool in the re-generation of deprived urban area (as in Bern and Angers). The argument for implementing a light rail can be grounded in the wish of creating an efficient and fast transport mode that can compete with the private car (as it was intended in the suburban parts of Bergen light rail). The light rail can be seen as a part of a national upgrading of the public transport system supplemented by introduction of hourly operating schemes, car-sharing schemes, attractive ticketing agreements and high frequencies (as it was the case in Bern). Finally, the light rail can be an integrated part of a urban development strategy, which objective is to pedestrianize the city centre and restrict access for car traffic and creating a branding

value for the city in regards to both a tourism, business and settlement perspective (as it is the case in Freiburg). The light rail is thus part of different strategic relations and can contribute to added strategic urban value in combination with additional initiatives. It is thus important not only to evaluate light rail projects in an infrastructure perspective, but also by the strategic urban development in which the project is embedded.

Point no. 5: There is a need for methods to include qualitative perspectives and values in the planning of light rail projects in the future. This is in order to enhance the strategic value of such projects which is not included in traditional decision support tools such as transport models and socio-economic analysis. Likewise, it is necessary to categorise and concretise qualitative values for decision makers, in order to provide them with tools that can implement general visions in concrete initiatives that support the potential for a positive outcome. In chapter 10 of the thesis, a methodology is provided to included qualitative values in the decision making process. This method should be seen as a supplement to the existing quantitative decision support tools which has primarily been based on transport models and socio-economic analysis.

DANSK RESUMÉ

Denne Ph.d. afhandling bidrager med et kvalitativt perspektiv på letbaner som et strategisk byudviklingsværktøj i middelstore Europæiske byer (100.000- 350.000 indbyggere). Afhandlingen skal ses som et bidrag til debatten om letbanesystemer og er tiltænkt som et supplement til de mere tekniske og økonomiske analyser af sådanne systemer. Ph.d. afhandlingen er resultatet af et 3 årigt samarbejde mellem COWI A/S afdelingen for By- og trafikplanlægning i Aalborg, samt Aalborg Universitet, Institut for Arkitektur og Medieteknologi.

Igennem de senere år er letbaneprojekter blevet introduceret som strategiske byudviklingsværktøjer i de større danske byer. Der er derfor en særlig bevågenhed på potentialet, værdien og effekterne af sådanne systemer. Dette Ph.d. projekt er initieret af behovet for at skabe mere viden om letbanens potentialer i en bystrategisk sammenhæng, og er herved rettet mod en kvalitativ analyse af letbanesystemer i middelstore Europæiske byer, der i størrelse er sammenlignelige med de danske letbaneprojekter. Ved at tillægge et kvalitativt perspektiv anskuer afhandlingen letbane projekter som 'mere end transport projekter', og afhandlingen søger hermed, at skabe indsigt i den historie, de rationaler og politiske ideologier der har været styrende for valget om at implementere letbane i mellemstore europæiske byer. Teoretisk er afhandlingen funderet i det 'ny mobilitets paradigme', hvorigennem det argumenteres for, at det er vigtigt ikke alene at fokusere på de tekniske of fysiske aspekter af mobilitet, men også de politiske, økonomiske, sociale og kulturelle relationer hvori mobilitet og mobile teknologier er indlejret. Empirisk er afhandlingen funderet i case studier i fire mellemstore europæiske byer: Bergen i Norge, Angers i Frankrig, Bern i Schweiz samt Freiburg i Tyskland. Disse cases illustrerer 4 byer, 4 forskellige historier, 4 planlægningstilgange, 4 letbanesystemer og 4 letbanevisioner. Formålet med at inddrage forskellige nationale kontekster er at analysere hvilke samfundsmæssige forhold der har været styrende for: 1. beslutningen om at implementere et letbanesystem, 2. det lokale koncept, herunder udformning og design af systemet og dets indpasning og påvirkning i bymiljøet.

Ph.d. afhandling tager således afsæt i følgende problemformulering og underspørgsmål:

Hvordan er letbaneprojekter politisk of kulturelt produceret, samt materielt og rumligt praktiseret i mellemstore europæiske byer, og hvordan kan viden herom anvendes i fremtidige beslutningsprocesser for letbaneprojekter?

- 1. Hvorfor implementeres letbanesystemer i udvalgte mellemstore europæiske byer, og hvad er de bagvedliggende rationaler herfor?
- 2. Hvordan har letbaneprojekter medvirket til at ændre bymiljø, urbane strukturer samt mobilitetshierarkier i de udvalgte cases, og hvilke faktorer har haft betydning for valg af koncept og design?

- 3. Hvordan kan den viden der udledes af ovenstående spørgsmål anvendes i fremtidige beslutningsprocesser for letbaneprojekter?

Som det understreges i forskningsspørgsmålet, tillægges afhandlingen både en politisk-diskursiv dimension samt en materiel rumlig dimension, for at analysere og forklare både hvorfor og hvordan letbane projekter er udformet i konkrete kontekster. Afhandlingen er endt som en hybrid i mellem en monografi of en samling af artikler. Afhandlingen består således af to dele som underbygger denne hybride struktur:

Del 1 (kapitel 1-7) Forsknings design og empirisk analyse: Indeholder introduktion til afhandlingens problemstilling, position indenfor eksisterende forskning, teori, metode samt de fire case analyser. Del 1 danner således baggrund for de tværgående analyser præsenteret i del to.

Del 2 (kapitel 8-11) Uddrag af centrale temaer: Indeholder to artikler der er udarbejdet på bagrund af analyserne i del 1, samt en beslutningsmodel rettet mod praksis der introdu -cerer metoder til at inkludere kvalitative perspektiver og værdier i beslutningsprocessen for fremtidige letbaneprojekter. Denne del indeholder ligeledes afhandlingens konklusion. Afhandlingens konklusioner kan opsummeres i følgende 5 centrale pointer:

- Pointe nr. 1: Letbaner skal studeres i kontekst, i relation til de kulturelle og politiske praksisser heori projektet er indlejret. Erfaringer om letbaneprojekter er således ikke universelle og der findes ikke et entydigt svar på letbanes potentiale som byudviklingsværktøj, det afhænger af det specifikke projekteksempel. Dette betyder, at effekter af letbaneprojekter skal forstås i forhold til valg taget i alle faser af beslutningsprocessen: fra vision til planlægning og implementering. Visionen og rationalet bag et letbaneprojekt kan således forventeligt have stor betydning for den effekt letbanen får i forhold til udvalgte parametre. Hvis konceptet er at skabe nye byrum og byudvikling samt at servicere de central områder af byen, kan dette have implikationer for rejsehastighed og fremkommelighed. Hvis letbanen omvendt integreres i eget tracé afskærmet fra bymiljøet, kan det ikke forventes, at letbanen har den samme effekt på bymiljø og restrektioner for biltrafik i midtbyen.

- Pointe nr. 2: Analytisk, skal den politiske og kulturelle produktion samt materielle of rumlige praksis af letbaneprojekter i mellemstore europæiske byer forstås igennem interaktionen mellem det diskursive og det materielle. Det argumenteres for, at letbaneprojekter ikke alene skal forstås ud fra deres politiske og kulturelle indlejring, men også ud fra letbanens materialitet der i høj grad kan være medvirkende til at redefinere eksisterende planlægningspraksisser, samt omorganisere byens rum of mobilitetshierarkier. Hermed bør der analytisk være fokus på relationen mellem det sociale og teknologiske innovationer, og måden hvorpå disse påvirker of redefinerer hinanden. Letbanen er hermed ikke en passiv teknologi i en kontekst, den er en aktiv part i at redefinere den kontekst hvori den indgår (nye planlægningspraksisser, nye gaderum, restriktive politikker, nye mentale og

fysiske forbindelser i byen). Omvendt er den politiske, kulturelle og rumlige kontekst også med til at forme letbanes koncept og design. Herved opstår der mange lokale 'oversættelser' af letbanevisionen, som må danne basis for at forstå letbanens potentialer og implikationer.

• Pointe nr. 3: Diskurser for letbaneprojekter kan siges at have en universel eller generel karakter, der kan anses som en 'rejsende ide' indenfor strategisk planlægning. Caseanalyserne viste, at letbaneprojekterne, i de fire cases analyseret, er funderet i mange af de samme diskurser. Dermed kan det siges, at der eksisterer et 'universelt sprog for letbaner', og dette er med til at italesætte hvilken rolle letbaneprojekter potentielt kan spille i byudvikling. Udpegningen af de centrale diskurser for og imod letbaner i de enkelte projekter giver en indsigt i de samfundstendenser og politiske ideologier som letbaneprojekter er en del af i både et lokalt og et globalt perspektiv. Problematikken er dog, at argumentationen for letbaneprojekter ofte forbliver på de generelle niveau, og hermed ikke forholder sig til de konkrete lokale prioriteringer der foretages i det enkelte projekt for at sikre forskellige strategiske satsninger. Et eksempel er, at letbaneprojekter ofte italesættes som et middel til at tiltrække bilister til den kollektive trafik. Caseanalyserne viser dog, at letbanen alene ikke forårsager mindre trængsel, en sådan effekt er i høj grad afhængig af supplerende politiske prioriteringer for at reducere biltrafik. Hermed kan letbanen virke som et 'teknologisk fix' der ikke sættes i kontekst. Dette er en tendens der særligt gør sig gældende for de kvalitative faktorer i letbaneprojekter, og derfor bør disse generelle diskurser i den visionære fase suppleres med konkrete initiativer for at have en reel gyldighed.

• Pointe nr. 4: Forskellige materielle og rumlige praksisser har haft indflydelse på konceptet bag letbaneprojekter i mellem store europæiske byer, og har hermed betydning for letbanes implikationer i byrum of mobilitetshierarkier. Hermed er det vigtigt at skabe forståelse for, at letbanebegrebet ikke er universelt, der er mange forskellige konceptuelle oversættelser af letbanebegrebet der gør sig gældende i konkrete lokale kontekster. Letbanens koncept kan være baseret på så forskellige konceptuelle tilgange som: at anvende letbanen som løftestang i fysisk nedslidte og socialt udsatte boligområder (som i Bern og Angers). Ønsket om at etablere en letbane kan være grundet i at skabe et effektivt og hurtigt transportsystem, der kan konkurrere med privatbilen (som det har været hensigten på forstadsdelen af letbanen i Bergen). Letbanen kan ses som et led i en national opgradering af den kollektive trafik, suppleret med introduktion af timemodel, delebilsordninger, attraktive billetordninger og høje frekvenser (som det har været tilfældet i Bern) og letbanen kan være en integreret del af en byudviklingsstrategi, der har til formål at fredeliggøre bymidten for biltrafik og skabe en brandingværdi for byen i både et turisme-, erhvervs- of bosætningsperspektiv (som det er tilfældet i Freiburg). Letbanen indgår således i mange strategiske sammenhænge og kan være medvirkende til at skabe en bystrategisk merværdi i samspil med øvrige initiativer. Hermed er det også vigtigt ikke alene at evaluere og vurdere letbane projekter ud fra et infrastrukturperspektiv, men også ud fra det strategiske byudviklingskoncept hvori den ofte indgår som et centralt element.

• Pointe nr. 5: Der er et stigende behov for også at inkludere kvalitative perspektiver og værdier i planlægningen af letbaneprojekter, for at fremhæve den potentielle strategiske værdi der er knyttet til sådanne projekter, og som ikke medtages i transportmodeller og samfundsøkonomiske analyser. Samtidigt er det nødvendigt, at kategorisere og konkretisere konkrete kvalitative værdier for beslutningstagere, for at give dem redskaber til at udmønte visioner for kvalitative værdier i konkrete initiativer, der understøtter potentialet for et positivt udbytte. Afhandlingen fremsætter i kapitel 10 en metode til at inkludere kvalitative værdier i beslutningsprocessen om letbaneprojekter, disse skal ses om et supplement til den eksisterende beslutningsstøtte, som primært er baseret på transportmodeller og samfundsøkonomisk analyser.

PART 1

INTRODUCTION

1

1.INTRODUCTION

1.1 MULTIPLE REALITIES OF LIGHT RAIL

QUOTE

'some will object, we're dealing with technologies, not passions; with drawings, not plots; with logics, not sociology; with economic calculus, not Machiavellian calculations. Ah, but they're wrong! The two sets come together in research rooms and administrative council rooms'. Latour (2002) p. 101.

Coming from an educational background as an urban planner it has been an interesting and challenging research process to study the production of light rail mobilities in both research and practice. The practices, skills, perspectives and logics that I brought to the research process as an urban planner have indeed been challenged by research in more technical disciplines, such as transport engineers and economists, and their practices of working with transport and mobility issues. This is mostly because the tools, methods and logics of these practices are very different from the practices I have been taught throughout my education. Discovering the political side of light rail projects has amazed me just as much as the insight into the more technical aspects of light rail. The many stories, rationals, visions, logics, dreams and beliefs that are tied to this transport object are overwhelming, and this vision for light rail harks back to the 1960s and '70s, when the old tram networks still played a crucial role in the urban transport system, before cars revolutionised the way we organise our cities.

Light rail is an object that materialises many political discourses in the urban environment, discourses that go beyond the issues of transport, travel time and construction cost. Light rail is an urban project that is used as a strategic planning tool in the development of cities for the future, and many political discourses and ideologies are embedded in this transport technology. Because the realities of light rail mobilities are multiple, there are many controversies as to how light rail projects should be planned, evaluated and implemented. As it has been exemplified by my own experience, there seem to be two basic categories for how to deal with light rail planning: the technical and economic practices that deal with technical system design, optimisation, flow and socio-economic benefits, and the aesthetic, architectural and political practices beyond transport, which deal with visions for future city development, urban design, urban regeneration and 'softer' normative issues linked to this transport technology. When such multiple realities exist, the question becomes: how can we understand and practice light rail planning in a way that acknowledges these multiple realities?

I would like to briefly provide an example of the complexity of some of these 'multiple realities' (Mol, 2002) using a story from my personal experience in dealing with the topic. I was invited to give a speech at the annual public transport conference in Denmark. The subject for my presentation was 'The Light Rail Factor'. My talk was concerned with whether there is any evidence that light rail is more attractive to passengers than a similar bus solution, and, if this was the case, could we then produce a factor that could be used in calculations of potential patronage as input to the basis for future decisions? In my talk I reviewed the available research findings concerning the existence of such a factor, and showed examples in which the factor had been confirmed and in which it had been rejected by various researchers. The review of previous research furthermore

showed that if such a factor existed, it was highly context dependent in terms of the 'size' in which it would occur, ranging through everything from 25% more passengers using light rail solutions than bus solutions down to hardly any traceable difference (see also Olesen (2012a)). My presentation pointed out that we should not be too caught up in the technological fetishism of defining one universal factor for the potential attractiveness of light rail to users, since no such universal factor exists, and that there is no one answer to the success of light rail systems. Success and failure are highly dependent on context and factors such as policy packaging, integration with existing network, frequency of service, integration in urban areas. Furthermore, the purpose of my presentation was to draw attention to the fact that light rail could not only be described in a quantitative way as a pure transport system, since many of the political objectives for such systems go beyond transport purposes. It is also necessary to include explanatory qualitative factors to understand how light rail systems are embedded in a wider discourse for the liveable city and in political discourses such as urban competitiveness, social inclusion and sustainable urban development. After my presentation all the participants at the conference mingled at the coffee tables, and a man came up to me to discuss my conclusions. He thought I had made an interesting presentation by emphasising the many different contextual and qualitative elements in a light rail project, but he opposed my objection to defining a specific size for the light rail factor, as he claimed 'the business needs such a factor'. For this reason he encouraged me to continue my search for 'the magic number' that would be helpful in fostering support for light rail systems in the future.

What can we learn from this story? I think that there are many things to learn. First of all, my point about understanding contextual factors as important indicators for the success of light rail system was acknowledged by the man that approached me, but he also claimed that 'the light rail business' needed some universal factors in order to cope with technical performance requirements. That led me to think, why is this so? I think that we find the answer in the technological and economic discourse that strongly influences the practice of planning light rail mobility and transport planning in general. This discourse prescribes that the social and political complexity inherent in infrastructure projects should be reducible and measurable in order to evaluate the potential value of such projects. In the tools and models that are used to plan new infrastructure there is not much ability to handle the great complexity that is often inherent in these projects, a complexity that also goes beyond transport issues. The challenge is that light rail projects can be perceived as hybrids of infrastructure projects and urban projects, and since strategic visions and logics for urban development, redesign, regeneration and liveability can be hard to express in terms of measurable outcomes, these values are often set aside in the technical modelling and planning of the system, to the frustration of many in more qualitatively oriented disciplines.

QUOTE
'No technological project is technological first and foremost… this is the image of engineers held by people who think technology is neutral' Latour (2002) p. 39.

In this thesis I will allow the political and spatial complexity of light rail projects to unfold by also emphasising the qualitative aspects of the production and practice of light rail mobilities, which prove to play an important role in the decision-making process. I will ar-

gue that it is important to understand the political and spatial practices in which light rail projects are entangled in order to evaluate the potential and challenges of such mobilities from a strategic urban development perspective. Furthermore, it is also important remember the historical background of light rail projects so as not to ignore the embeddedness of mobility networks in the cities where they are placed.

The research process has taught me that it is a challenging process to disentangle the discursive, spatial and technical practices of light rail mobility and find one 'right' or 'wrong' answer to the potential of light rail mobilities because this object is associated with so many different practices and ideals. The attributes that the light rail holds as an object are not essential; they are gradually imparted to the object as they are formed in relation to different practices. This is also why the potential and challenges of light rail mobility must be understood in relation to these practices. In order to allow analysis of context-dependent complexity, this thesis will apply a qualitative case study method to analyse the complex social, political, cultural and spatial entanglements of light rail mobilities that have emerged within Europe since the 1980s (Groneck, 2003; Levinson, Allen, & Hoey, 2012). The analysis has been limited to light rail practices in mid-sized European cities of 100.000-350.000 inhabitants. The reason for this is that the Danish light rail practice on which this thesis is based has been largely influenced by the Western European context. The focus on mid-sized European cities is also an analytical delimitation, since the focus in Denmark has been on smaller cities that do not have the same demand for or passenger levels on public transport as the major capitals. Thus the objectives for implementing light rail schemes are based on very different logics and rationales than simply capacity and transport flows. Before I go into the theoretical orientations that have guided the analysis and findings of the thesis I will elaborate on the emergence of a light rail discourse from a Danish and European perspective.

QUOTE
'The Tramway is the urbanistic idea of the century.'
Former mayor of Nantes Alain Chénard MVG (2008).

1.2 THE DEVELOPMENT OF A EUROPEAN LIGHT RAIL PRACTICE

Tramways or 'light rail' are an urban railway system that often runs on electricity. Unlike metro systems, which are highly segregated from the street environment, the light rail runs on a track at the street level on the 'front side' of the city and is often integrated into very central city districts. The tracks can be either segregated from other traffic in so-called dedicated 'right-of-way' or integrated with other modes of transport. Another characteristic of light rail materiality is that they often have low floors that allow easy boarding at ground level and wide doors that enable high efficiency in boarding the vehicles. Countries, regions or cities often have unique nicknames for their light rails. In Switzerland and Munich light rail is referred to as the 'tram'; in Vienna and Leipzig it is called the 'bim' or 'bimmel', referring to the German word for jingle (MVG, 2008). Each nickname reflects the special cultural relationship of a city's residents to its light rail. The light rail materiality can also express the cultural identity of the city and its residents; for example, the 'nose' of the light in Reims, a city in the Champagne district of France, is shaped like a champagne glass, and in Besançon, France the light rail vehicles are named after local heroes. In this sense light rail infrastructures can carry great symbolic and cultural value

that goes beyond the function of transport. Certain places, cultures and societies give particular kinds of mobility particular kinds of meaning, meanings that might even cross over cultures (Adey, 2010). This is why it is essential to understand that mobilities are cultural, ideological and embedded in local political discourses, and are not only technical infrastructure (Jensen, 2013). Light rail systems are almost an extreme case of this cultural embeddedness of mobility systems.

Denmark has recently entered the 'light rail discourse', with plans of implementing light rail systems in the four major cities of Denmark: Ring 3 in the greater Copenhagen area, Aarhus, Odense and Aalborg. The first light rail system is under construction in Aarhus, and is estimated to open before the year 2017, when Aarhus will be the European cultural capital of the year (Sekretariatet for Fonden Aarhus 2017, 2013; Letbanen, 2013). The light rail is thus an important strategic element of the 'cultural capital' discourse and the general strategy for urban development in Aarhus. The first initiatives to reintroduce the tram vision in Denmark were taken in the 1990s (Melchior, 2008). In this period political representative from the prospective light rail cities found inspiration for the light rail vision on study tours abroad to modernised tram cities such as Bordeaux, Nantes, Strasbourg and Freiburg. The emerging interest in light rail in Europe through the 1970s and 1980s was fostered by a strong environmental discourse and a problematisation of increasing automobility, as well as the struggle for space that was evident in many cities. Furthermore, the oil crisis of the 1970s made it clear that there was a need to advance alternatives to the increasing car ownership that challenged future urban development and the liveability of cities (Hass-Klau, Crampton, & Benjari, 2004). Today light rail is perceived as an important driver for sustainable urban development in many European cities, and light rail technology is closely associated with the 'liveable and sustainable city discourse' (MVG, 2008) (see also chapter 6 and 8).

The history of light rail is tinged with nostalgia, since the tram was the first form of motorised urban transport. Many European cities adopted it at the beginning of the 20th century, enabling citizens to get around on longer distances. The introduction of the car as the dominant transport technology, however, reorganised society and the spatial organisation of cities and everyday life (Urry, 2004), a trend that has been highly criticised: *'Many cities, in their automotive euphoria had liquidated their trams: today they are regretting this throw-away mentality and are labouring to build new lines' (Urs Heller, cited in (MVG, 2008)).*

Furthermore, historians have proven that the car manufacturer General Motors played a crucial role in the closure of US tramways: GM bought the systems in order to close them down (Urry, 2007) (Note 1). Today many North American and European cities are entering what is often framed as a 'tram renaissance' (MVG, 2008; Groneck, 2003; Hass-Klau, Crampton, & Benjari, 2004; Ministry for Ecology, Sustainable Development and Energy, 2012) in which inner city redevelopment has been closely related to the implementation of a light rail system for spatial, environmental and aesthetic reasons and in order to

NOTE 1
See also the documentary 'Taken for a Ride', available on YouTube at http://www.youtube.com/watch?v=Ob2bYUtxlxs.

combat congestion. Medium-sized cities, especially, argue for this solution as a way to upgrade the existing public transport network from bus to light rail, however, these cities do not necessarily implement this upgrade due to capacity issues.

In different national contexts it is possible to speak of the development of 'national light rail practices'. These practices are closely linked to the development of national policies supportive of the light rail vision and certain local practices as to how these light rail projects are implemented in each city. In crude terms the 'French model' for light rail mobility is associated with the spatial redesign vision, in which the light rail corridor is transformed in totality, with a façade-to-façade redesign and the light rail is a tool in urban development and design. The high aesthetic aspirations that are built into the new tramways in France have caused a light rail scheme or model that has had an influence worldwide. Between 1985, when the first modern light rail opened in Nantes, and 2012 twenty cities in France have adopted this model in building their own light rail systems (MVG, 2008; Ministry for Ecology, Sustainable Development and Energy, 2012). The 'German model' for light rail mobility is not as famous for its aesthetic value as the French practice. However, in Germany light rail has also been closely related to urban development, with the most paradigmatic case being in the city of Freiburg, where urban development and light rail go hand in hand. Germany has been called 'the land of the tramway' (MVG, 2008) since it has the greatest number of tramways in Europe, with around 60 cities 'involved in the light rail renaissance. A general characteristic of UK tramways is that many of them run in completely separate rights of way, often on abandoned light railway alignments, with characteristics often more comparable to heavy metro systems. This means that they do not integrate with the city (to the same degree as French light rail systems often do) and thus function more as a pure transport technology. A challenge for UK light rail schemes has been the market-driven planning approach to public transport. Deregulated bus services made it difficult to fit the light rail systems into the overall urban transport system, and this caused challenges in meeting passengers' needs. Today there are eight light rail systems in the UK (Note 2) and others have been planned, but since the government has denied funding, these schemes are unlikely to proceed (TheTrams.co.uk, 2013). These are just some examples of the great variety of light rail practices in the European context. The many national and local visions and ideologies of light rail mobility have had great influence on the spatial and cultural implications that the light rail vision has had in different cities; therefore, in an analytical sense, light rail should not only be understood from this cultural and historical perspective.

NOTE 2
Croydon, London's docklands, Birmingham, Manchester, Sheffield, Newcastle, Nottingham and Blackpool.

1.3 LIGHT RAIL AS ANALYTICAL OBJECT

The purpose of this thesis is to create new knowledge and understanding of the cultural, social and spatial embeddedness of light rail mobilities that go into the practice of implementing them. Light rail is placed at the centre of this thesis as the analytical object and the thesis focus on the qualitative aspects of creating such systems. The purpose is to create practice-based knowledge that can feed into the development of the Danish light rail planning practice and supplement the more quantitative knowledge of light rail as a

transport system. Case study analysis is used as the research design in the thesis. Inspired by (Flyvbjerg 1991; 2006) the practical context-dependent rationality is best understood by case studies, and since light rail mobilities are produced in different practical contexts we must attend to this practical experience to understand the complexity inherent in such projects. The thesis is thus not an analysis of the technical features of a transport infrastructure, and will therefore not provide insight to the technical and operational details of the various schemes. However this knowledge will be included when relevant to explain the socio-technical context of such systems. Empirically, the thesis is based on four qualitative case analyses in selected mid-sized European cities: the light rail projects in Freiburg (Germany), Bern (Switzerland), Bergen (Norway) and Angers (France). These cases are selected because they are examples of old and new networks implemented in mid-sized European cities in different national contexts. The cases are significantly different in terms of legislation, culture, policies, localisation and budget and will provide the empirical basis for studying a maximum of variation in light rail practices. A narrative phronetic approach to planning research has been used in the case analysis in order to develop rich descriptions and interpretations of light rail planning from the different actors involved in this process (Flyvbjerg, 2004).

The thesis is grounded in the 'New Mobilities Paradigm' or the 'Mobilities Turn' (Urry, 2000; Sheller & Urry, 2006; Lassen & Jensen, 2006; Cresswell, 2006; Kaufmann, 2002; Urry, 2007; Adey, 2010; Jensen, 2013), which takes into account the economic, social and cultural organisation of distance and not just the physical aspects of movement (Urry, 2007, p. 54). This brings a more holistic perspective to the study of transport systems. In line with the argument of John Urry (2007), I argue in the thesis that 'there is too much transport in the study of travel and not enough society and thinking through the complex intersecting relations between society and transport' (p. 20). Furthermore, the thesis draws on science, technology and society studies (STS), specifically on actor–network theory, which provides the thesis with theoretical insight into the social, political and cultural values in technological innovation and how these innovations affect society, politics, culture and space. The approach has also been called the ethnography of technology; it has been argued that the material as well as the social is crucial in understanding the social (Latour, 2005; Yaneva, 2009).

QUOTE

'There is too much transport in the study of travel and not enough society and thinking through the complex intersecting relations between society and transport'. Urry (2007) p. 20.

1.4 RESEARCH QUESTIONS

The aim of the research questions is twofold: to understand the political objectives behind the decision to build light rail systems, and to analyse how these discourses have materialised in the urban environment and to what extent these materialisations have changed mobility practices and the urban environment. Through the research process it became clear that the production and practice of light rail mobilities should be understood in relation to the various stages that such projects enter (see figure 1). In previous studies of light rail (see chapter 2) attention has to a large extent been paid to the performance of the systems and little attention has been given to the genesis or history of these systems or the more qualitative implications they have in the urban environment.

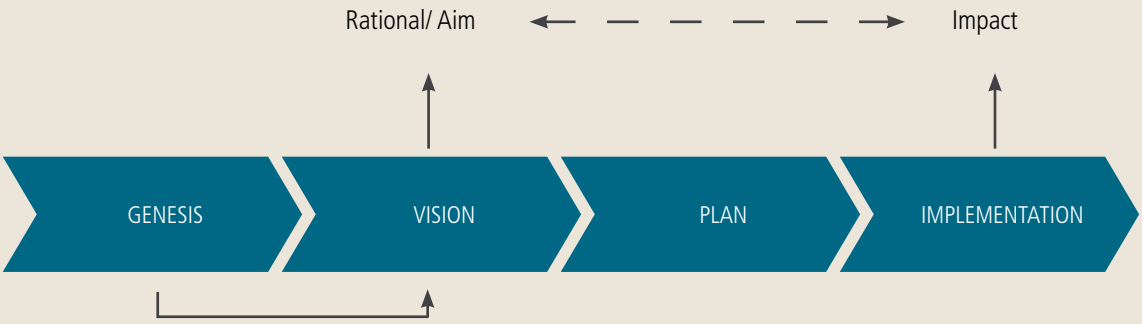


Figure 1: Implementation process for light rail. Illustration of a complex decision-making and planning process that in reality is not as linear as is shown here. The rationality and aim of the project developed in the initiating phases, are of great influence for the impact of the project.

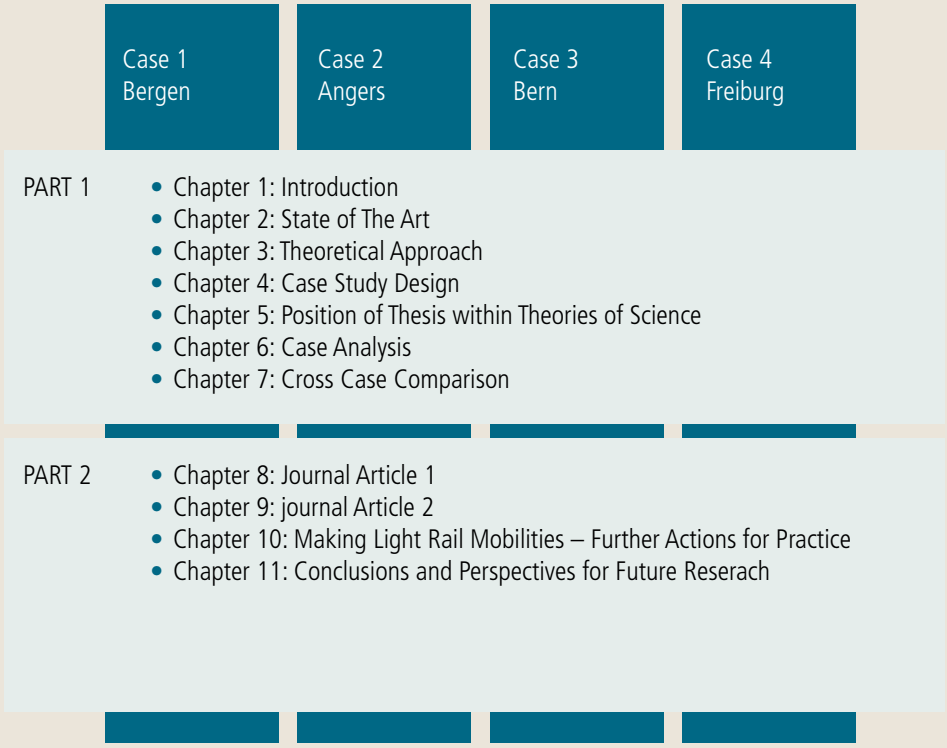


Figure 2: Thesis structure.

In the preliminary stages - what can be called the 'vision phase' - the political and discursive practices play a crucial role. In this stage, the visions and rationalities of future urban development are framed, different rationalities and discourses compete, and the most powerful discourse enters the planning phase. Crucial decisions regarding the concept and objectives for the project are decided in the planning phase that is essential in understanding the actual outcomes of the system. Later, the project enters an important stage when funding should be allocated. Practices for funding are very different in the various national contexts. Funding schemes are crucial in the realisation of the systems and the enactment of the multiple realities of the potentials of light rail schemes is highly evident in the discussion of the societal values of light rail projects. Finally, the many discourses and objectives materialise or 'freeze' (Dovey, 2008) in the built infrastructures and urban environments in the implementation phase. These spatial reorganisations influence the mobility practices and urban environments in the corridor and the city. Besides understanding the different phases, it is important to understand the key events that allow a project to enter the next stages in the planning process, since this knowledge can tell us much about which decisions and arguments are the most powerful and lead to a materialisation of the vision. These phases have been important guidelines in the analytical approach applied.

Taking these considerations into account, the main research question of the thesis is formulated as follows:

How are light rail mobilities politically and culturally produced and materially and spatially practiced in mid-sized European cities, and how can this knowledge be used in future decision-making processes for light rail projects?

- 1. Why are light rail systems implemented in mid-sized European cities, and what is the rational basis for the decision to implement them?
- 2. How have light rail projects changed urban spaces and mobility hierarchies in the selected cases of mid-sized European cities, and which factors have affected this process?
- 3. How can the knowledge derived from the questions above be used in future decision-making processes for light rail projects

Each of the supplemental research questions contributes to answering the main research question. The following section elaborates how the various chapters in the thesis contribute to answering the research question by explaining the overall structure of the thesis.

1.5 THE STRUCTURE OF THE THESIS

This PhD thesis has been written as a hybrid between a collection on of journal papers and a monograph. The thesis consists of two major parts (see figure 2). In part one the theoretical, methodological and empirical basis of the thesis is elaborated. Case analysis

of the four selected European cases is also included in this part. The case studies can be read separately for those who seek specific information on a given city and context. In part two the central findings and conclusions of the thesis are presented. This part includes the two journal articles that are a major outcome of the analysis presented in part one. The articles correspond to sub-research questions 1 and 2. The articles are based on cross-case analysis, but not all cases are included in these two articles. The strategy was to include the empirical evidence that underlined the purpose of each article. Therefore, the Freiburg case is not discussed in either of the articles; however, it still provides an important knowledge base for the overall outcome and conclusions of the thesis. Furthermore, in part two, a decision-making model is introduced on the basis of the findings in the thesis; the development of this decision-making model seeks to answer sub-research question 3.

By chapter, the thesis is structured as follows:

PART ONE

- Chapter 2, State of the Art: Presents a review of the existing research around light rail mobilities in order to position the thesis scientifically. The review is structured around central themes in light rail research that are of importance for the scope of this thesis. These themes have been used as a knowledge foundation and this knowledge has been taken from an interdisciplinary mobility perspective framed under 'the new mobilities paradigm'. The review furthermore shows that there have been no previous studies of light rail mobilities based in the mobilities paradigm; there have, however, been several studies of other related transport technologies from this perspective. Some of the most central studies are cited in the review. The review concludes that there is a need to fill the gap that exists in the literature regarding the social, cultural, spatial and material production of light rail mobilities as a supplement to the more performance-oriented analysis previously conducted.
- Chapter 3, Theory: This chapter presents the theoretical approach applied in the thesis. The chapter argues for the need for a relational understanding of light rail mobilities, which takes as its point of departure the new mobilities paradigm and furthermore draws inspiration from a relational and post-structuralist understanding of mobilities, inspired by actor–network theory. The chapter introduces an analytical model for understanding the political and cultural production and material and spatial practice of light rail mobilities in the four cases examples. This analytical model draws on discourse analysis to unfold and understand the political framing and cultural production of light rail mobilities analytically, and spatial analysis is applied in order to map the material and spatial implications of the light rail project in the four case studies.
- Chapter 4, Methods: The chapter introduces the case study design, the method and the practical approach to data collection in the thesis. The thesis is based on qualitative case studies in four mid-sized European cities: Bergen, Angers, Bern and Freiburg. In the chapter the criteria for selecting the four cases is explained and the concrete

methodologies for data collection are elaborated. A mixed methods approach has been applied in the case analysis combining qualitative expert interviews, document analysis, field studies and phenomenological mapping of the light rail corridors.

- Chapter 5, The Position of the Thesis within Theories of Science: This chapter positions the knowledge produced in the thesis within the theories of science. The thesis has been conducted using a pragmatic approach, not focusing on universal theoretical laws but arguing that light rail mobilities must be studied in its concrete practical context or situation in order to deal with the complexities of the multiple realities that exist around this transport technology. The act of inquiry should be understood beyond the distinction between social and natural sciences, meaning that the creative and pluralistic pragmatic approach is more concerned with the problem than with choosing the 'right' methods; the methods therefore depend on the problem to solve.
- Chapter 6, Case Analysis: This chapter contains the analysis of the four European case studies - Bergen, Angers, Bern and Freiburg - that provide the empirical foundation of the thesis. The cases are analysed separately in order to allow room for the rich empirical material, but the cases are compared in both a conclusion to the case analysis section (chapter 7) and in the two journal articles (chapter 8 and 9), which are introduced in the second part of the thesis. The cases are analysed using the analytical model introduced in chapter 3, which means that each case is analysed in terms of its discursive and institutional dimension and its material and spatial dimension. The case analysis shows how the light rail projects in each of the four European cases are politically and culturally produced and materially and spatially practiced. It is shown how Bergen is a pioneering city in the Norwegian context, introducing a light rail system for which it must not only fit this new infrastructure into the physical surroundings but also frame it politically and discursively to fit into policies and the minds of decision makers. Angers is an extreme case of the extensive redesign and urban development thinking and aesthetic rationales that are present in many French light rail projects. The case of Bern illustrates how a new light rail extension to an existing tram network has been framed in a discursive, institutional, spatial and material context. In Bern the new extension to Bern West has been used in an urban development and redevelopment process, and provides interesting perspectives on the challenges of extending an existing network to new parts of a city. Freiburg is a paradigmatic case of integrated and holistic mobility planning and consistent policies within sustainable urban development. It explores how a city has kept its old tram network in a period where many other cities chose to close theirs; this history means that the old tram network has been an integrated part of urban and transport policy for decades.
- Chapter 7: Cross Case Analysis: In this chapter some of the central themes found in the case analysis in chapter 6 are analysed and compared across cases. The themes will be structured arround the two dimensions in the analytical model introduced in chapter 3, which has also been guiding the structure for the case analysis. This is the discursive-institutional dimension as well as the material-spatial dimension.

PART TWO

- Chapter 8, Journal Article 1, Framing Light Rail Projects - Case studies from Bergen, Angers and Bern: This article provides insight into the political, discursive and material production of light rail mobilities in a European context. It identifies the planning rationales behind the systems and the policies that have been supportive of this light rail vision. Finally, the article identifies the practical challenges and potentials that have been connected to the different local frames of light rail mobility that can be used in future planning practices. In relation to the analytical framework provided in chapter three, this article corresponds to an analysis of the discursive and institutional dimension. The article has been accepted (January 2014) for publication in the journal: Case Studies on Transport Policies.
- Chapter 9, Journal Article 2, Exploring 'Light Rail Scapes': Material and Spatial Concepts of Light Rail Mobilities: Light rail is a modernisation of the old tram system and is a popular tool in urban development strategies in many European cities. Through a case study, this article focuses on the main idea and vision behind light rail projects in two mid-sized European cities Bergen and Angers, and how this vision has materialised in, what in the article is framed as a 'light rail scape'. The article argues that it is important to understand the differences in materiality and spatiality of light rail systems, since this has implications for its function as a mobility mode and its integration with urban space. The article explores the concrete design of light rail systems as transit space. This is in order to create an understanding of the meaning of such mobilities and the way in which they interact with, and re-configures, urban space and cultures. Theoretically, the study is founded in the new mobilities paradigm. In relation to the analytical framework provided in chapter three, this article corresponds to an analysis of the material and spatial dimension. The article has been submitted to Space and Culture, January 2014.
- Chapter 10, Further Actions for Practice: Based on the findings in the thesis, this chapter provides a qualitative tool that can be used to guide future decision-making processes for light rail projects. This chapter argues that there is a need for a decision-making tool that incorporates strategic qualitative factors into the production of light rail mobilities in addition to the more objective traffic models and cost–benefit analyses. It is a simple tool based on reference cases in which it is possible to benchmark the potential qualitative effects of the strategic layout of the light rail system compared to the qualitative effects of existing comparable light rail systems. In this sense it is possible to trace the contextual dynamics and strategic decisions that can be helpful in meeting project objectives. The tool should serve as a guideline for practice in all parts of the decision-making process and be used to visualise the contextual and cultural differences in light rail projects that can have important effects on potential outcomes.
- Chapter 11, Conclusion and Perspectives for Future Reserach: This chapter presents the main findings of the thesis based on the problem formulated in the research

questions. The conclusion is structured around five central points to take away from this thesis derived from the theoretical, methodological and empirical findings in the thesis. The chapter further presents three central themes for future research.

STATE OF THE ART

2

2. STATE OF THE ART

2.1 PROLOGUE

This chapter identifies and reviews state-of-the art-research in light rail mobility in order to position the thesis within the existing pool of research. Furthermore secondary sources such as consultancy reports etc. are included when relevant to further explain central arguments. Previous studies on light rail and/or urban transit can be roughly categorised into two major fields: the conventional perspective on transport planning and decision-making and the interdisciplinary mobility perspective. The central themes in these two fields will be outlined through a review of the existing literature in order to position the scientific contribution of this thesis. The existing themes within light rail research will be the starting point for the review, and the knowledge derived from the review will be placed in a wider mobility perspective. Previously no studies of light rail mobilities have been conducted by applying an interdisciplinary mobility perspective; there are, however, several studies of the production and practice of other transport technologies and urban transit systems that have been conducted from a socio-technical mobility perspective. Some of the central studies within this field are included in the review. This is done in order to create a foundation for linking the previous studies on light rail with a new interdisciplinary mobility perspective, which is one of the objectives of this thesis. In the following sections the major arguments from the two fields of research will be outlined.

2.2 PREVIOUS STUDIES ON LIGHT RAIL PLANNING

In the transport planning literature there seem to be four major themes emerging around light rail mobilities that are relevant for the scope of this thesis. These themes concern decision-making for light rail, performance of the systems, light rail and urban development potentials and the light rail vs. bus rapid transit debate. Acknowledging that there are other emerging themes related to the systemic design of the systems, the above themes are the ones addressed in this literature review because they are central to thescope of the thesis. The following sections provide a brief overview of these main themes.

2.2.1 Decision-making

Much research around light rail mobilities originated in the late 1980s and early 1990s. An obvious explanation for this is what can be called the 'tram revival' in Western Europe, as described by Bottoms (2003) and Groneck (2003), beginning with the introduction of the first modern tram (or light rail system) in Nantes, France in 1985. Since then, many Western European cities have expressed the desire to provide viable, affordable and attractive alternatives to the automobile through the implementation of light rail. Many see light rail as a means to create liveable and sustainable cities and to structure urban development (Bottoms, 2003). One of the reasons for this increased focus is that light rail systems are simpler than metro systems; light rails often run at street level and thus have lower construction costs than metro systems. The cost of operation for light rail is usually much cheaper, as well. For this reason, light rail systems have been considered in

many mid-sized cities (Mackett & Sutcliffe, 2003), and some new light rail systems have been constructed in cities of only around 100.000 inhabitants in France (SYSTRA, 2012).

Prior research on decision-making for light rail systems has pointed to two criticisms of the typical decision-making process for light rail: the economic irrationality of the decision to implement light rail systems and the perceived superiority of light rail systems over bus rapid transit in terms of regularity and image (Bruijn & Veeneman, 2009). Through case studies of the implementation of light rail systems in the Netherlands, Bruijn and Veeneman (2009) show that judgement as to whether or not light rail systems are the right solution should not be based solely on the performance of the transport technology itself. Rather, it should be considered as part of a wider picture, including revitalisation of the city centre, developing new office real estate, greening transport and refurbishing existing railroads. In this regard light rail systems may be the right solution to bring actors together to create momentum for improving regional mobility options. In practice light rail often fits into the scheme of urban renewal, transport planning and environmental concerns, and thus is an important tool in planning practice. The choice to build light rail has in many cases been a political choice, firmly rooted in the sustainable development ethos, which enables planners to take a new approach to urban mobility and urbanisation projects. According to the French Ministry of Ecology, Sustainable Development and Energy, light rail has become a tool for branding cities, since construction of a light rail often implies a desire to renew the image of a town to attract business, residents and visitors (Ministry of Ecology, Sustainable Development and Energy, 2012). In France dedicated funding for guided right-of-way public transport schemes has made it attractive for cities to implement light rail. The transport tax, or versement transport, implemented in 1982, provides a unique opportunity for financing public transport infrastructure investments and operating deficits. If a guided right-of-way system is introduced, such as light rail or guided bus then the tax rate can be higher so the tax is flexible and in many ways favours light rail solutions (Hass-Klau, Crampton, & Benjari, 2004). In this sense a political momentum for light rail mobilities has existed and still exists in many countries. Studies by Knowles (2006) show how UK light rail schemes were a key component of plans to improve personal mobility in conurbations. In 1998 the government launched its Integrated Transport Policy and its 2000 Ten Year Transport Plan, which made it attractive for many cities to implement light rail schemes in the following months. However, after only two years, the financial support for light rail schemes was withdrawn because the evaluation carried out by the National Audit office (2004) showed that the systems where too expensive and should not be considered outside London. These two examples from the European context illustrate the role of the state in dedicating funding for light rail schemes. This funding has been a crucial part of the distribution of light rail schemes in many European cities.

Researchers have underlined the irrationality of decision making for light rail systems. Edwards & Mackett (1996), in their examination of the implementation of new urban transit systems in the UK in the 1990s, have described how light rail systems have been favoured

in the decision-making process despite the fact that cost–benefit analysis showed that bus rapid transit systems were more cost efficient. The objectives of building new systems in the UK case were not related solely to transport needs, but must be viewed in the broader context of the socio-economic needs of the city. The light rail systems were considered politically to be a more attractive technology than busses due to their image and perceived comfort. The study Edwards & Mackett (1996) identified two major objectives behind the construction of light rail systems: transport issues and economic and development issues. This shows that decisions are not based on purely objective transport criteria, i.e., the factors traditionally evaluated through cost–benefit analysis. The decision to build light rail extend beyond the transport issues, important arguments have been the positive image of such systems towards passengers and as an element in city branding. It is also argued that light rail is more attractive to car drivers and other similar public transport modes and can facilitate modal shifts (Edwards & Mackett,1996).

2.2.2 Performance

One of the main studies on performance of light rail systems, conducted by Babalik (2000) and Babalik- Sutcliffe (2002), shows that while some systems have been successful in achieving the desired outcomes, many systems have failed to be as successful as expected in terms of improving public transport and the urban environment. Studies show that in many cases the introduction of a light rail system has not resulted in reduction of traffic congestion or improvement of air quality. Furthermore, studies from the UK indicate that light rail gains modal share mostly at the expense of bus shares (Lee & Senior, 2013). It has also previously been argued that ridership forecasts for light rail have been overestimated (Pickrell, 1992), and the same has been evident in studies of rail transport in general (Flyvbjerg, 2003). An evaluation of light rails systems in the UK was carried out by the National Audit Office (2004). This study showed that even though some modal shift from car to light rail was registered, the free space on the roads had been filled up with new car drivers; light rail had therefore not created a radical modal shift, just produced more mobility. Furthermore, the light rail ridership suffered from deregulated bus schemes that affected patronage (The National Audit Office, 2004). The study further found that the significance of light rail with regard to changes in cultural production in a city and the role that these systems play in urban lifestyles, which were also important factors in the introduction of the systems, have not been sufficiently clarified. Other studies support the evidence that many light rail projects haven't reached expected patronage levels and often do not attain the expected outcomes with regard to passenger forecasts, modal shifts from car to public transport and generating urban development (Kain, 1988; Mackett & Edwards, 1998; Richmond, 1998).

A study by Babalik-Sutcliffe (2002) analyses the factors behind the success of light rail systems in terms of their performance with regard to reaching a high level of patronage, being cost effective, increasing total numbers of public transport usage, reducing car traffic and having a positive impact on land use and urban growth patterns. The factors involved in success were identified as urban factors (vitality of the CBD, urban form, level of

public transport usage), planning factors (integration into urban projects and bus services, urban renewal schemes), operating policies (frequent service, travel cards, marketing and image) and supportive urban policies (transit-oriented development, pedestrianizing city centres, urban renewal projects). One of the important lessons to be learned from this study is that the success of light rail systems is greatly dependent on their integration with land use policies and the implementations of supportive policies to, for example, reduce traffic congestion. The study shows that these are often not achieved in the US and UK contexts. The systems must also be well integrated with the existing public transport network in order to be successful and to act as an important strategic element of the overall vision for urban development and mobility of cities (Babalik-Sutcliffe, 2002).

2.2.3 Urban Development and Economic Impact

One of the important arguments justifying a light rail solution is the urban development potential that the dedicated infrastructure holds, which is also often seen as an important element in attracting businesses and new housing projects to the transit corridor and increasing land values. These are indirect effects beyond those that are normally associated with the light rail as a transport infrastructure. The impacts of light rail systems can largely be divided into two main groups: direct effects and indirect effects. Direct effects are immediate consequences of the operation of transport infrastructure. Indirect effects can comprise a much wider variety of impacts, such as business location decisions, city image and a rise in real estate value, and can be roughly categorised into spatial, social and economic effects. A basic rule is that indirect effects are, in turn, caused by direct effects (Buck Consultants, 2000; Tørset & Meland, 2002). If these indirect strategic effects are perceived as important elements in the projects objectives by decision makers, they should be incorporated throughout the integral decision-making process. This means that from the very beginning, indirect effects should play a role in deliberations and compromises (as it was also argued in chapter 1).

In the Danish context a study has concluded that there is the potential to increase land values in proximity to public transport stations outside of metropolitan areas by a value of +4-8%; this value is highest closest to the stations and decreases to zero around 1.500 meters from the station (Lundhede, Panduro, Kummel, Ståhle, Heyman, & Thorsen, 2013). Several studies have been done regarding the potential economic impacts in light rail and urban transit corridors; these studies examine both European and global contexts (Hass-Klau, Crampton, & Benjari, 2004; Buck Consultants, 2000; Gospodini, 2005; Handy, 2005). Overall this research shows that urban transit in some cases has had an effect on investments in the corridor, whereas in other cases there has been no impact. The studies underline that it is hard to isolate the direct effects of the light rail system from external effects that can affect real estate prices in the corridor, such as land use policies, regional development trends and forces, availability of land to develop and other physical characteristics. A main conclusion, however, is that the dedicated light rail infrastructure has the potential to attract businesses and facilitate urban regeneration and urban development. Some of these effects are, however, first evident on a long-term basis and are strongly

reliant on supportive policies.

A study from the US (Cervero, 2007) shows that the land use potential of light rail is moderately high where there are pro-development policy environments and other complementary forces (see also Duncan (2011) for the importance of zoning policies to achieve the desired development impact of light rail). The ability to develop land and a suitable physical setting around light rail stations is an important condition for positive land use changes. The US cases show that where light rail alignments were mainly chosen to minimise construction costs, often by choosing an alignment with old rail corridors, it has resulted in a poor development potential. This is why an alignment in central urban catchment areas and the downtowns of cities is crucial in order to utilise the development potential of light rail, as it has been argued by Hardy (2005).

In the literature it is evident that the scale of potential land use, urban development and regeneration effects varies significantly in different contexts, and there are also some downsides to the economic impact of light rail. In a positive sense, infrastructure projects can work as catalysts for urban development, redevelopment and regeneration, but the scale of their effects varies depending on factors such as supportive policies that encourage transit-oriented development as well as physical limitations such as existing urban structures. Potential downsides can be social exclusion of low-income populations, long-term residents, the transformation of the area's social identity and speculation by developers (Gospodini, 2005; Hass-Klau, Crampton, & Benjari, 2004). Furthermore, it has previously been argued that economic gains in light rail corridors are simply the product of the redistribution of growth from some areas to others. Thus the value created in transit corridors cannot be characterised as additional value for the city or the region as a whole, but should be seen as a prioritisation of growth in certain corridors (Handy, 2005).

2.2.4 The Light Rail–Bus Rapid Transit Debate and the Rail Bonus

In research and in practice there has been a debate on the choice of technology, especially regarding the attractiveness of rail over bus. This debate has been especially prominent in the European context. Cities have repeatedly cited the flexibility of light rail systems in their ability to meet a diverse set of goals, despite the fact that light rail systems are a more expensive solution for smaller cities than prioritised bus systems, such as bus rapid transit (Deng & Nelson, 2011; Hodgson, Potter, Warren, & Gillingwater, 2013). A study by (Bruijn & Veeneman, 2009) concludes that bus rapid transit systems seem to lack the mythical 'allure' often associated with light rail systems that can help mobilise various actors in support of the process (see also Wirasinghe, Kattan, Rahman, Hubbell, Thilakaratne, & Anowar, 2013; Wright, 2005, Weinstock, Hook, Replogle, & Cruz, 2011). Vuchic (2000) and Hensher (2006) also point out that the differences considered in decision-making processes and the choice between light rail systems and bus rapid transit are not only a matter of technology, but also a matter of the type of service, its image and impacts. A politician's rationale for light rail might go beyond the rationale of an economist or engineer, and, obviously, polishing light rail systems' allure by manipulating numbers

further undermines the rationality of the wider process. This is why the choice of whether and how to realise light rail systems can be seen as a multi-actor decision-making process: to make the right decision requires the involvement of a wide range of experts and stakeholders that might have other perspectives on the decision to implement light rail systems that go beyond the economic rationale provided in socio-economic analysis (Bruijn & Veeneman, 2009).

The superiority of rail-based public transport over bus-based alternatives has also been termed 'the rail bonus' in the literature and in public policy discussions. The rail bonus is said to reflect, among other aspects, the stronger commitment of the public transport operator to rail-based modes, as well as the higher reliability and better comfort of such modes (Axhausen, Haupt, Fell, & Heidl, 2001). However, the existence and potential size of such a factor proves to be very difficult to prove and define (Tørset & Meland, 2002; Ben-Akiva & Morikawa, 2002; Scherer, 2009). The assumption behind this factor is that passengers, and especially car drivers, have a preference for rail transport due to attributes such as comfort, regularity and image, which it is argued are attributes unique to light rail (as compared to busses and bus rapid transit). However, existing research on the topic has both demonstrated and rejected that such a factor exists (Tørset & Meland, 2002; Axhausen, Haupt, Fell, & Heidl, 2001; Pickrell, 1992). Some studies have argued that this factor does not exist (Ben-Akiva & Morikawa, 2002), while others have identified the attractiveness of rail systems to be up to 25% higher for light rail than similar bus systems (Scherer, 2009). Both of the cited studies were carried out in an urban context, but they were in different national contexts and applied different methodologies. The inconsistency in the results around the existence and size of this potential rail factor proves that there are many context-dependent factors that influence the preference for rail-borne traffic compared to similar bus solutions, and attention must therefore be paid to the more complex local constellations that influence the performance of light rail (see also Olesen (2012a)).

2.3 STUDIES OF URBAN TRANSIT FROM A MOBILITY PERSPECTIVE

Conventional traffic planning, including planning of public transport, has mainly been placed in the empirical analytical paradigm, with an emphasis on questions that have been linked to how transport should be planned and managed in a cost-effective way. The aim of this planning approach has often been to reduce physical barriers to and external and internal costs of transport (Oldrup, 2000). This conventional approach has to a large extends focused on benefit optimisation and management of the risks that are associated with an increasing demand for transport. The measures used in this approach have had an overriding focus on quantitative measures such as travel time and capacity and have paid less attention to the more interdisciplinary social-spatial understanding of the societal rationales behind the production of mobility. Conventionally, transport has analytically been perceived as objective movements from A to B through time and space (Lassen, 2011). Mobility scholars, however, have argued that attention should also be paid to the production and consumption of different meaning systems within mobility in addition to

flows and costs (Beckmann, 2000; Cresswell, 2006; Jensen, 2013; Urry, 2007). This is an approach that various mobility scholars have taken in order to critically reflect upon and supplement the conventional approach to transport studies through an interdisciplinary mobility perspective. With regard to supplementing the existing research within light rail mobilities it is argued that there is a need for a more interdisciplinary understanding of light rail mobilities, including an understanding of the social and spatial context in which these mobilities are embedded and the meaning systems that are linked to this mobility mode in different cities. As the review of the existing literature within the field of mobilities studies has shown, light rail mobilities have not yet been studied from this interdisciplinary mobility perspective, and this perspective can provide useful knowledge of the meanings behind such mobilities. In the following section the mobilities paradigm is elaborated along with relevant studies of urban transit systems, in order to understand the streams of thought within this interdisciplinary approach and extract the key ideas that will be the basis for the research design of the thesis.

2.3.1 The Mobilities Paradigm

In the year 2000 the English sociologist John Urry (2000) introduced a new theoretical way of perceiving mobility that differed from the conventional transport planning approach. He argued that the study of society should be understood through mobilities. Not just physical mobility, but also virtual and experienced mobilities and the relations that among between these many different forms of mobilities. His main point was that it is important to understand the close relations between society and mobility in order to understand the social basis of mobilities, including the cultural production of mobilities as well as the consumption of mobility. The new understanding of mobility has been called 'the new mobilities paradigm' or the 'mobilities turn' and further developed by other theorists (Urry, 2000; Urry, 2007; Kaufmann, 2002; Cresswell, 2006; Adey, 2010; Lassen & Jensen, 2006, Jensen, 2013). This theoretical understanding of mobility implies that transport projects should be investigated on a more interdisciplinary level, with emphasis on the social-science-oriented approach that addresses rationales related to the systems and the behavioural, practical, ideological and material implications of the systems, in addition to the cause-effect understanding of transport and mobility with quantifiable measures of environmental impact, traffic levels and economic benefits.

2.3.2 Socio-technical Approaches to Mobilities Reserach

Within the mobilities paradigm different socio-technical approaches have been taken to study the role that urban transit systems play in the city and how these mobilities are produced discursively and materially. The strength of this approach is that it also allows for the synthesis of why certain technical innovations in public transport occur and the potential impacts of these innovations. The multiplicity of understandings of the word 'system' or 'transport system' has been a strength of the socio-technical tradition (Beckman, 1994), providing an inclusive concept that brings together histories and analyses of diverse technological networks with a focus on the socio-technical dynamics that constitute them, rather than on quantitative measures of performance or coherence of such

systems. As argued by Callon (1986), the development of technical systems should be understood in their social contexts.

Mobility scholars have previously studied various modes of mobility through the notion of socio-technical mobility systems. Urry (2007) explains mobility systems thus: 'the focus upon objects combining with humans into various coupled relationships also implies the significance of systems that distribute people, activities and objects in and through time-space and are key in the metabolic relationship of human societies with nature (…) in the modern world auto mobility is by far the most powerful of such mobility systems, while other systems include the pedestrian system, the rail system and aero mobility' (Urry, 2007, p. 51). Urry (2004) analyses the 'System of Automobility' and refers to Slater (2001), arguing that: 'a car is not a car because of its physicality but because systems of provision and categories of things are "materialized" in a stable form, and this generates the distinct affordances that the car provides for the hybrid of the car driver' (Slater, 2001 in Urry, 2004, p. 6). Lassen has described long-distance work-related trips as a practice of 'Aeromobility', where the aeroplane is an important technology enabling increasing business travel (Lassen, 2006). Vannini (2012) studied the interaction between human and machine in his book 'Ferry Tales', in which he argues for a relational understanding of ferry mobilities. He conceptualises ferry mobility as a constellation of ocean routes, ships, passengers, scheduled sailings, fuel, islands and many more social and technical components. He argues that viewing mobility as constellations of humans-technology-policies-space-etc. allows us to better understand the patterns of movement that constitute them as political articulations of connection and disconnection (Vannini, 2012, p. 130). These are just a few examples of the increasing amount of literature within the socio-technical field of mobility studies. Various studies of public transport, in particular, have also applied a socio-technical perspective. The findings from some of these studies are elaborated in the following section.

2.3.3 Public Transport Systems and Infrastructures from a Socio-technical Perspective

There are various examples of public transport infrastructure as the centre of a narrative to illustrate the production of mobilities. Through the study of the 'killing' of the urban transit system 'Aramis' in Paris, Latour (1996) describes the socio-technical construction of the Aramis urban transit project. He in so doing this he turned the urban transit system into the main character in his narrative, placing emphasis on both the material and the social dimensions of the decision-making process. The study of Aramis proved that the failure was mainly caused by the fact that, though the political environment around the technology changed, the engineers did not adapt the technology to these societal changes; it stayed exactly the same throughout the entire process. Through this story Latour (1996) showed that the engineers' 'love of the technology' was so strong that they couldn't manage to fit it into the social arena, and therefore the project was never realised, since there was no political ownership of the project (Latour, 1996).

Inspired by Latour's story of Aramis, (Jensen, 2012) used the infrastructure project 'Alaskan Way Viaduct and Seawall' to foster understanding of how urban transport interventions can change our perception of space. This approach shows 'how infrastructures and mobility systems are both material and cultural artefacts that we need to understand very different from the utilitarian and instrumental perception guiding much urban planning and design today' (Jensen, 2012, p. 59). Here Jensen (2012) argues that we need a vocabulary to understand the complexity of infrastructure projects in which the infrastructure itself assembles multiple voices on how to understand place. In a paper concerning the cultural background of the 'Sky Train' in Bangkok, Jensen (2007) further explores the meanings behind this new infrastructure and the socially segregating effects that it has on mobility patterns in Bangkok. Jensen (2007) shows how this new infrastructure changed mobility practices in the city and how the potential for movement shifted in favour of the elite and tourists, as the Bangkok Sky Train acted as an icon of modernity. He thus shows that the Bangkok sky train is more than infrastructure to overcome traffic jams; it is also an expression of power and social exclusion in the city. Finally, Jensen (2008) described how everyday mobility is practised within the European Metroscapes of Copenhagen, Paris and London. Here Jensen (2008) emphasises that various top-down orchestrations of these Metroscapes - with regard to design, planning and operations framework, etc. - come together with the everyday live performances of real passengers. The socio-technical metro systems facilitate the meaningful and mobile engagement of system, objects, humans and the city with each other.

The socio-technical approach to studying the production of mobilities makes clear that the emergence of new mobility systems is not just a matter of creating capacity and reducing travel time. Much meaning is connected to these socio-technical systems. There seem to be important cultural implications and different rational bases for various actors to act upon in deciding on different transport technologies. Frederiksen (1996) illustrates the many rationalities at play in choosing a technology for what is today known as the Copenhagen Metro. The alternative technologies considered in the process were mini-metro, tramway and light railway. Though these three options seem to have many of the same characteristics, the decision-making process shows that very different rationalities were connected to each of these technologies. In the study, Frederiksen (1996) demonstrates how the choice of mini-metro technology involved a power struggle among the three transport planning rationalities a long time before there were any well-defined technological options. In this sense, the choice of a mini-metro has been a way to materialise the planning ideals and rationalities that went along with this mobility system. The thesis 'The Design of Large Technological Systems' by Pineda (2010) further analyses the material scripts behind the design of two large technological mobility systems: the Copenhagen Metro and the Transmilenio Bus Rapid Transport system in Bogotá. Through the analysis the visions, politics and materialities that constitute the mobility systems are traced in order to explain the complex socio-technical design processes behind these urban transit systems. The central point made by Pineda is that the material scripts for implementation of new public transport systems play a crucial role in the physical reorganisation of the

city and the everyday lives of the citizens. These material scripts, and the discourses linked to them, redefine space.

From a historical perspective, Thelle (2013) analyses the role that the old tram network in Copenhagen has played in the development of public spaces in the 'modern city'. His work is very central to the purpose of this thesis since he unfolds the historical and cultural role that a transport-technology, the old tram, has played in the production of the modern city. In the thesis, Thelle (2013) describes how the tram grew out of the problem of the need for more efficient transport modes caused by the expansion of the city. At this time the development of the tram network was not based on economic and technological rationales; rather, it developed in the interfaces between urban spaces, the users of the city and the conception of the 'modern city'. The tramlines became guides for urban and transport planning and an inseparable part of the Copenhagen morphology. Property values in the corridor rose, central activities such as restaurants and shops were placed the stations, the population in the tram corridors grew and many quarters in the city lobbied for the next tramline. All these elements were repeated with the new light rail lines. Thelle's (2013) description of the tram as a 'medium to negotiate for the urban space in the city' (p. 115) is still very central to the role that the modern light rail plays in the city today. The light rail is still a subject for aesthetic discussions of urban spaces and is often implemented as an unavoidable element of the cityscape, since one of the central ideas behind this technology is still that it runs on the front side of the city, integrated with the existing infrastructure corridors. However, today the materiality of the old tram has changed and enables new enactments of the urban environment that still make it a valuable tool in strategic urban development and the design of the city. In this sense, the tram was and the light rail is produced by the interactions it has with the city, and is at the same time affected by the physical restrictions of the city.

2.4 EPILOGUE

This chapter has established the basis for the thesis by unfolding the central themes that are relevant for light rail as the analytical object and the research question presented in chapter 1. Previous research on light rail mobility cites the irrationality that is linked to the decision-making process around light rail mobility in many cities, and provides an interesting paradox: light rail continues to be build eventhough it in an economic perspective is a irrational decision. This discussion is strongly related to a 'technology battle' or 'political momentum' that favours light rail transport technologies over other alternatives. A central question raised by this finding is, why this is so? The thesis will dig deeper into the production of these mobilities and the rationalities that govern the decision-making and planning processes.

Within the existing literature there are consistent insights into the indicators that influence the performance of light rail systems. Important performance indicators behind the success of light rail mobilities prove to be urban factors and urban form, supportive planning policies that link the light rail project with other strategic prioritisations, operating

policies and implementation of the system within the overall network, and supportive general urban policies that afford modal shifts in favour of public transport such as pedestrian zones, restrictions on car traffic, etc. Research in some contexts, however, also proves that many systems have not been successful in reaching a high level of patronage or in reducing car traffic. As the context seems to play such a crucial role in the performance of light rail, there is a need for research that addresses the societal and cultural production of light rail mobilities locally in order to unfold the constellation of light rail mobilities and to identify why these systems continue to be implemented.

No research regarding the socio-technical production of light rail mobilities has been produced so far. Research from this socio-technical mobilities perspective has primarily focused on the larger urban transit systems of capital cities, where the spatial and transport challenges are on a very different scale in terms of urban form, flows and politics (as in the case of the Copenhagen metro and the BRT system in Bogotá). With a strong emphasis on interdisciplinarity, mobilities studies in many ways links transport studies with urban studies, indicating that mobility is more than transport from A to B; it is also about production of new social and cultural practices of mobilities. Here the potential exists to fill the gap in the literature regarding the social and cultural production and material and spatial practice of light rail mobilities as a supplement to the more performance-oriented analysis previously conducted.

In this sense, the present thesis brings the existing themes within light rail research into a wider interdisciplinary mobility framework, where an in-depth approach is applied to understand the very different 'constellations' (Cresswell, 2006) of light rail mobilities in each city. Inspired by the work previously done on public transport systems from a socio-technical mobilities perspective, it is evident that light rail should not only be analysed through measurable cause-and-effect mechanisms from a conventional perspective; attention must also be paid to the socio-technical co-production of these systems and the city. The aim of this thesis is to produce a deeper socio-technical understanding of the rationales behind the political and cultural production of light rail mobilities and their material and spatial implications in addition to the more quantifiable environmental, economic and operational factors. Applying such an approach enables an understanding of the societal and political trends under which such systems are produced, as well as the ideologies and values that are associated with such systems in actual planning practice. The socio-technical approach furthermore provides a rich analytical framework to understand how mobilities and the city are co-produced by focusing on the various constellations of technologies, politics, space and culture that are unique for each light rail project. This implies that it is important to understand the meaning of light rail mobility in various practical realities and the history, culture and policies that have influenced the layout and design of the system. The reserach approach applied will be unfolded through the following chapters.

THEORETICAL APPROACH

3

3.THEORETICAL APPROACH

3.1 PROLOGUE

This chapter argues theoretically for a relational understanding of light rail mobilities as a way to operationalise qualitative knowledge around the socio-technical process of making light rail mobilities. The analytical approach is inspired by socio-technical approaches to mobilities studies (and Actor–Network Theory, ANT) (as argued in chapter 2) which provides a useful way to understand the relations between the social and the material dimensions of light rail mobilities. This provides the thesis with a theoretical insight into the social, political and cultural values embedded in light rail projects and how these projects affect society, politics, culture and space. The chapter furthermore argues for an analytical approach in which 'making light rail mobilities' is placed at the centre of the analysis. The purpose is to create an analytical framework to understand the discursive and institutional production and the material and spatial practices of light rail mobilities in the four cases analysed in chapter 6. The chapter is structured in the following way: firstly it argues the need for a relational understanding of light rail mobilities, which takes its point of departure from the new mobilities paradigm and further draws inspiration from the relational and post-structuralist understanding posited by actor–network theory. The chapter introduces the analytical model for understanding the production and practice of light rail mobilities in a discursive and institutional dimension as well as a material and spatial dimension. The analytical model draws mainly on discourse analysis to understand the political framing and institutional embeddedness of light rail mobilities and material, and the spatial analysis of light rail corridors, to understand how the discourses have materialised in the four cases.

QUOTE

'There are people who want to study the transformation of technological objects without worrying about the engineers, institutions, economies or populations involved in their development'
Latour, (1996), p. 24.

3.2 TOWARDS A RELATIONAL UNDERSTANDING OF LIGHT RAIL MOBILITIES

'Tomorrow is a big day for public transport. I am pleased for all of those who have fought for the light rail to Bern West, which now is a reality. A light rail is not just a light rail… it is also a successful neighbourhood. The light rail has many mothers and fathers, but also brothers and sisters. I am happy to see that we on our official opening of the new line have guests from other cities, regions and from Germany and France. There is representation from governments and transport companies who themselves are planning or already building new light rail lines; we stand together for the future of public transport. I hope, ladies and gentlemen, that the opening of the light rail to Bern West will bring inspiration to your own future projects.' (quote by Rytz, councillor of the city of Bern and director of public works, transport and city greening; opening speech, Bern light rail; see also chapter 6)

The above quote from the opening of the light rail project in Bern West, Switzerland exemplifies the complex material and social relations which light rail projects are made of. In the quote the light rail project is described as much more than a transport project;

it is also a neighbourhood and a vision for future public transport. Constellations of humans (politicians, planners, transport companies etc.) and non-humans (light rail vehicles, housing areas etc.) have enabled this light rail vision to become a reality. Metaphorically, the human actors that brought the project into being are the mothers, fathers, brothers and sisters of this project as they have been crucial in the creation and definition of the project. Guests from around the world visits Bern to witness the opening of the Bern West tram because the project brings inspiration to similar future projects in other cities and ideas about this urban transit mode thus travels from context to context (see also chapter 8 for further elaboration). In this sense, the light rail is associated with certain visions and strategies for the city and is a technological solution to the challenges many cities are facing today. The question may even be, if a light rail project is more a cultural project than a transport project? Light rail mobilities are multiple and performed in multiple ways around the world (Mol, 1999). Latour (1996) has argued that a technological project does not have a context - it brings a context, and complex relations constitute the system of light rail mobility. The technology, humans, codes, legislations, semiotics, objects, economics, powers and artefacts are assembled in a very unique constellation in each light rail project, facilitating certain practices and restricting others.

It is argued that a study of the production and practice of light rail mobilities requires a relational understanding of mobilities, since light rail is always positioned in relation to something or somebody, be it government, geography, passengers, legislation, organisations, etc. No technology or infrastructure is power neutral; it is a part of a strategic prioritisation (Latour, 2005; Adey, 2010; Jensen, 2013). Therefore, we must find analytical tools and methods that allow us to deal with the complexity inherent in light rail projects and focus on both the discursive and political production of such mobilities, as well as the spatial and material embeddedness of this infrastructure in the urban environment in order to describe the unique 'DNA' of light rail mobilities.

QUOTE

'In recent years, the social sciences have taken a 'mobilities turn'. There has been a developing realisation that mobilities do not 'just happen'. Mobilities are carefully and meticulously designed, planned and staged (from above) . However, they are equally importantly acted out, performed and lived as people are 'staging themselves' (from below). Jensen (2013) p. 0.

3.3 MOBILITY IS 'MORE THAN A TO B'

Transport planning and research has conventionally been conducted by engineers and treated as what can be called 'tame problems' (Rittel & Weber, 1973) in which the flow of people and objects is considered as a derived demand and thus understood by its cause-effect mechanisms in a very instrumental sense (Banister, 2008; Lahrmann & Leleur, 1994). As Pineda (2010) argues, transport engineers focus mainly on how to model an ideal flow system using mathematical models and methods, but a sense of how to integrate this knowledge with the social reality is lacking. The challenge may be that in the making of new transport systems the social and political aspects of engineering may be pushed aside (or be less articulated) (Downey, 2005). Striving for scientific or fact-based objectivity is part of what can be termed a 'just the facts ideology (Hildeband, 2008). This rational instrumental approach, which has been and still is governing much transport and city planning, can be useful in understanding flow, capacity and costs. However, it does not pay much attention to the complex nature of the production of mobilities and 'politics of place making' (Vannini, 2012, p. 156), which is not only a technical science but also a

social science. An urban transit system has to fit into a social context (as is also argued by (Latour, 1996)) and is often part of changing how mobilities are framed, produced and practised in the city. Furthermore, it changes the consumption of mobility and the production and meaning of place in the city when it becomes an integrated part of the city morphology (Cresswell, 2004; Thelle, 2013). This means that transport technologies should not only be understood by their ability to move people efficiently from A to B. It is also important to understand the rationalities that produce this movement, and, on a more general level, the plans and policies that are behind this (se also Jensen, 2013). Furthermore, these normative ideals and discourses materialise in the spatial layout of the corridors and change the urban environment; thus light rail technology is used to mediate certain values in this urban development and redevelopment process. As argued by (Cresswell, 2006), mobility without meaning is simply movement. There seems to be a need to provide a vocabulary to understand the production and practice of light rail mobilities and to describe the unique DNA of the light rail constellations in mid-sized European cities. Such an understanding is crucial for the development of sustainable practices for light rail projects from a future strategic planning perspective.

As mentioned in chapter 1 this thesis is grounded in the emerging interdisciplinary field of mobilities studies, which has also been framed as 'the new mobilities paradigm' and/or the 'mobilities turn' (Urry, 2000; Urry, 2007; Sheller & Urry, 2006; Lassen & Jensen, 2006; Cresswell, 2006; Kaufmann, 2002; Jensen, 2013). As a starting point for the research process, the theoretical understanding of light rail mobilities has been inspired by how the new mobilities paradigm forces us to attend to economic, social and cultural organisation of distance and not just the physical aspects of movement (Urry, 2007, p. 54). Urry (2007) has argued that there is too much transport in the study of travel and not enough society and thinking through the complex intersecting relations between society and transport (Urry, 2007, p. 20). The new mobilities paradigm has emerged as an interdisciplinary field that goes beyond the taken-for-grantedness of transport and mobility as a derived demand and a positive good (Urry, 2000; Oldrup, 2000). Within mobilities studies there has thus been an increasing interest in understanding the production and consumption of movement in addition to the more technical disciplines of transport planning that focus primarily on flow and costs of mobility.

By applying this interdisciplinary approach the process of making light rail mobilities is put in the centre of the analysis in order to understand the societal trends and context in which this transport mode is produced and practiced. This perspective underlines that there exists an 'ideology of movement' as it has been argued by (Urry, 2000, p. 18), which means that there is meaning behind the production of mobilities and behind mobile technologies (Vannini, Lucy, Jensen, Fisker, & Jirón, 2012). 'More than A-B' has practically become the mantra of mobility studies and is the central question that makes mobility studies different from transport studies, which can often be characterised as A-B studies. Looking through the mobility lens enables the social world to be theorised as a wide array of economic, social and political practices, infrastructures and ideologies that all involve,

entail and curtail various kinds of movement of people, ideas, information or objects (Urry, 2000, p. 18). This is the key to understanding the production and practice of light rail projects in a discursive, institutional, spatial and material sense, which is the primary focus of this thesis and is further elaborated in section 3.5.

Mobility should be understood in the plural since there are different practices and meanings linked to mobilities (Adey, 2010; Urry, 2007; Cresswell, 2006) (which are further elaborated in chapter 5). The phenomenon of mobilities is empirically diverse, and thus calls for theoretical and methodological diversity (Jensen, 2013). It calls for a theoretical and methodological approach that does not only represent the rational representations of mobilities, such as patronage and travel time, but also the actions which is beyond representation, such as qualitative values of light rail projects that are harder to measure. These are values such as aesthetics, quality of life, city branding, etc. The emphasis in this thesis is on the making of light rail mobilities and the discursive and spatial embeddedness of light rail and not on an aim to develop universal truths of light rail mobilities. Inspired by the new mobilities paradigm, the thesis provides new ways of understanding the 'sociology of light rail infrastructures' in not only a technical sense but also a political, cultural and spatial sense. The interest in how technologies and materialities have shaped mobilities of various sorts bears witness to a perspective that understands infrastructures as complex networks of artefacts that assemble human as well as non-human entities, which challenges our understanding of place (Vannini, Lucy, Jensen, Fisker, & Jirón, 2012). The analytical approach applied in this thesis is inspired by this socio-technical movement within mobilities studies, which, among other perspectives, has been inspired by the relational thinking applied in Actor–Network Theory (ANT) (Latour, 2005; Jensen, Lauritsen, & Olesen, 2007). In this sense, light rail mobilities is perceived as more than the movement of people from A to B; it is a constellation of strategic urban development policies, urban transformations, operating policies, technologies, etc. This is why it is argued that the deconstruction of these constellations of light rail mobility is central to the understanding of how light rail mobility is produced, reproduced and performed.

3.4 THEORETICAL INSPIRATION FROM ACTOR–NETWORK THEORY

Actor–Network Theory is an approach to social theory that originated in science studies. Bruno Latour founded the ANT approach when he studied the production of scientific facts in the laboratory of the Salk Institute in California (Latour & Woolgar, 1986). He observed that the practices of the researchers in the laboratory were not the only entity worth studying in order to understand laboratory work. He also studied the production of maps, graphs, etc. as representations of scientific facts, as well the use of machines and various techniques in the work that was carried out in the laboratory. On the basis of these observations he developed an analytical framework that allowed him to deconstruct the laboratory processes and understand how scientific knowledge is produced in the laboratory through the relations between humans (the researchers) and non-human entities (the maps, graphs, machines, etc.). Since then, the ANT method and theory has been applied to various fields within science and technology studies, including health,

architecture and transport studies, to study the complexity of socio-technical construction processes (Law & Hassard, 1999). Often the ANT approach is also described as a 'material-semiotic' method that maps relations that are simultaneously material and semiotic. This means that entities take form and acquire their attributes as a result of their relations with other entities, as is explained by (Law, 1999). In the process of assembling socio-technical constellations (such as light rail projects) in support of various interests, both human and non-human actants play roles. Law (1999) describes: 'It takes the semiotic insight, that of the relationship of entities, the notion that they are produced in relations, and applies this ruthlessly to all materials - and not simply those of linguistics' (Law, 1999, p. 49). Here Law (1999) argues that we must not attend to language alone in the study of these various socio-technical construction processes. The material does play a role in this process, and entities do achieve their form as a consequence of their relations - meaning that they are performed in, by and through these relations. Some of the general characteristics of the ANT approach are:

- It is an analytical tool to understand and deal with complexity.
- It is a post-structuralist, anti-foundational position that avoids essentialist explanations of events or innovations (Jensen, Lauritsen, & Olesen, 2007). Events are constellations of complex constellations that enable certain phenomena at certain points in time, or, as Latour (1988) puts it: 'everything happens only once, and at one place' (Latour, 1988, p. 162)
- Relations between entities do not hold fast by themselves; rather, they are performed, which means that the entities in a network are given meaning by their relations and the role they play in the Actor-Network.
- It operates with an ontology that considers both human and non-human actors (also referred to as actants) in socio-technical construction processes. This means that the material can also play a role in relation to human actors (Brinkmann, 2010). The gun is often used as an example to explain how the interaction between humans and artefacts creates relations and enables certain actions: a man and a gun can form a new entity when they are connected in a third entity: the gunman. Guns do not kill people, people with guns kill people. In this sense things or material artefacts are actors in complex processes and events.

As it has already been mentioned in chapter 2, previous studies of urban transit systems have applied a socio-technical perspective in order to show the role that infrastructure and transport technologies have played in redefining politics, culture, place and the everyday performance and practice of mobility. In different anthologies various researchers have unfolded this approach from an urban planning and mobility perspective (see among others (Farias & Bender, 2010) and (Vannini, Lucy, Jensen, Fisker, & Jirón, 2012)). ANT provides important analytical insight for analysing the research questions in the present thesis: it enables an understanding of the role that light rail has played in the creation of urban politics and spatial and mobility practices. Through the process of deconstruction the human and non-human entities that went into making light rail mobilities can be

identified along with the role that they played in their relational constellation. Central questions in the analysis of the cases will be the role of both materialities and language in the construction process. The relational and performative understanding provided by ANT will guide the development of the analytical framework for the thesis; it will however not be the key analytical approach to analysing the case studies since there is a need to apply more fixed categories of analysis to deal with the complexity inherent in the four case studies. One of the downsides and critiques of ANT is that it remains mainly a descriptive approach that provides few hands-on guidelines for how to analyse complexity besides the injunction to 'follow the actors' (Latour, 2005). The reason for this is that ANT seeks to avoid reductionism in its analytical approach and this makes it very hard to perform reasoning within the empirical material (for discussions of critiques of ANT see among others (Arnoldi, 2003) and (Law & Hassard, 1999)). The role that ANT plays in the thesis is to allow a focus on the 'objects' and 'materiality' of light rail projects. A purely discursive and policy-based analysis would have downplayed the role that the materiality of light rail has had in its interaction with the city and how the winning discourses of decision making have materialised in the city and created a very specific local configuration of light rail mobility. Light rail holds a symbolic character and is performed by both rational decision-making tools and models such as cost–benefit analysis and transport models, but also by strong normative statements, spatial visions and diagrammatic representations of the aesthetic and spatial values of such a project. In this sense light rail mobilities is 'staged' from above by politicians, planners, designers and other powerful actors (Jensen, 2013).

3.5 ANALYTICAL APPROACH

The process of 'making light rail mobilities' is placed at the centre of the study as the analytical object. The thesis explores both the political and cultural production of this technology as well as the spatial and material practice of light rail, and, most importantly, the interaction between these two dimensions. This analytical approach creates a holistic way of understanding both the political framing or 'language' and the spatial implications of the 'material' that these light rail projects are embedded in. In the following sections the theories applied analytically unfolding the discursive, institutional, spatial and material relations of the four light rail projects will be outlined. The analytical approach is summarised in a diagrammatic representation at the end of this chapter.

3.5.1 The Role of Discourse and Metaphors and their Institutional Embeddedness

Light rail projects are constituted by 'hardware' - trains, tracks, stations, masts, etc. - but the politics, discourses and metaphors - or 'software' - around these systems are equally important to understanding the production and practices of these mobilities. Ideas about light rail mobilities are assigned significance and meaning by the actors and institutions involved with such systems, be they planners, designers, engineers, politicians, economists, interest organisations, passengers, etc. These actors have various governing rationalities and emerging cultural practices that they take into the production and practice of

QUOTE
'Contemporary cities and urban spaces are defined by their connectivity and their relationships to other nodes in the global network'.
Jensen (2013) p. 19.

light rail mobilities. Light rail systems are thus not unambiguous technological solutions; they are marked by various normative interpretations of what such a technology can and cannot do for the city. Any intervention in the city is based upon a more or less explicitly articulated set of norms and values (Jensen, Wind, & Lanng, 2012).

Mol (2002) describes how objects are performed differently from practice to practice, and therefore the realities of these objects are multiple. Mol (2002) uses the case of the illness anaemia, which is performed in various different methodological ways depending on practice. Mol (2002) explains that there are clinical, statistical and pathophysiological ways of performing anaemia, meaning that the reality of anaemia takes various forms and there are thus co-existing realities of this illness. The same is the case with the performance of light rail mobilities, which is also carried out in the co-existence of various practical realities - those of economists, planners, politicians, etc. Language, explanations, reports, rhetoric and technologies are all important components of the enactment of the different realities of light rail mobilities as a concrete physical solution to mobility and urban issues. The realities of light rail mobilities are articulated through these various practices, which then manifest what light rail is (and is not) in each specific urban context, and what purpose this technology should fulfil compared to other technologies of mobility (Gad & Jensen, 2007). It is in the multiple understanding of light rail mobilities that we find complexity - the fact that there are many versions of light rail projects and light rail technology (see also chapter 1 and 6). The question is thus, how are these objects designed and assembled in practice? And can different versions of an object be mutually dependent? The multiple co-existing realities create tensions among the many conceptions of light rail by actors trying to explain light rail from completely different professional contexts and semiotic concepts - is it an urban development project, a city icon or an effective public transport system, and can it be all of these at the same time? One of the key concerns for the researcher should thus be to disentangle these many versions or concepts for light rail and the 'relational network' through the deconstruction process (Mol, 1999) not by looking at universal laws for light rail mobilities but rather by studying these mobilities 'in situ' (Jensen, 2013) - situated in their practical context. As argued by Jensen: 'Mobilities do not "just happen" or "simply take place". Mobilities are carefully and meticulously designed, planned and staged (from above). However, they are equally importantly acted out, performed and lived as people are 'staging themselves' (from below)' (Jensen, 2013, p. 4).

In the deconstruction of the language and materiality of light rail mobilities the thesis draws on central analytical concepts from discourse analysis and a narrative approach to studying planning practice (Hajer, 2006; Flyvbjerg, 1991) and metaphor analysis (Lakoff & Johnson, 2008). Hajer (2006) argues that: 'language has the capacity to make politics, to create signs and symbols that can shift power balances' (p. 67). Hajer (2006) defines discourse 'as an ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices' (p. 67). The purpose of examining discourses and meta-

phors analytically is not to establish that light rail is a social construct on an ontological level from a discourse theory perspective; rather it is to analytically show how different practices makes sense of light rail. This means that there is a division between discourse theory and discourse analysis, which is which is important to note in defining the scope of the thesis. By using discourse analysis as an analytical tool it is possible to deconstruct the political realities and different ways of interpreting a given phenomenon over time. In the decision-making process some discourses prove to be more powerful than others and materialise in physical imprints or frozen discourses in the city. In this sense discourses are interesting because they result in a concrete configuration or redesign of the urban environment.

QUOTE
'Language has the capacity to make politics, to create signs and symbols that can shift power balances' Hajer (2006) p. 67.

3.5.2 Analysis of the Discursive and Institutional Dimension

Analytically, central discourses and metaphors used in each case (see chapter 6) have been traced through some basic analytical steps inspired by (Hajer, 2013). The purpose was to understand the dominant rationalities behind the light rail projects in each case and the local policies and institutional settings in which these discourses are embedded and have developed over time. In the analysis of discourses the following steps were followed:

- 1. Accessing policy documents, media material, speeches and transcriptions of interviews in each case.
- 2. Identifying structuring concepts: storylines, metaphors, etc. used by the various actors in relation to their institutional position.
- 3. Identifying key events that led to the implementation of the light rail project (radical changes in society, policy changes, cultural influences, spatial implications, etc.). Whether there exist coalitions of discourses among certain actors and whether certain discourses and metaphors are consistently used in a specific institutional setting are analysed. Furthermore, whether there has been a shift in the use of discourse in the decision-making process and, finally, which discourses proved to be the most powerful and thus affected the material and spatial layout of the system are analysed.

Some practical analytical concepts were applied in the three steps described above:

A storyline is understood as a 'condensed form of narrative in which metaphors are employed, used by people as "shorthand" in discussions. Identifying storylines in, e.g., the acid rain controversy then brings out that people actual do something with acid rain when talking about it, not merely refer to a problem with a fixed identity' (Hajer, 2013). Storylines are used to impose views on reality to other actors, suggesting certain positions and practices. Storylines are often embedded in certain practices and institutional settings; it is thus important to address where these stories and realities come from. In the thesis storylines provide a specific way of interpreting how light rail mobility is understood in mid-sized European cities and these storylines are analytically related to the analytical

concept of metaphors.

Metaphors are understood as 'understanding and experiencing one kind of thing in terms of another' (Lakoff & Johnson, 2008, p. 5). Metaphors then become an emblem in terms of which a general understanding of a given problem is used in policy documents and certain practices or institutions (Hajer, 2006). Metaphors are, like storylines, simplified interpretations of a given problem that are helpful in raising awareness.

Discourse-coalition refers to a group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time' The important thing to notice here is that discourses should be understood in relation to where they are practised. Practice is in this sense embedded in professional routines or institutions and mutually understood rules and norms that provide coherence to social life (Hajer, 2006), e.g., the practice of transport engineers, the practice of architects, the practice of politicians or the practice of certain institutions. There are two criteria for a discourse coalition: first, central actors should accept the rhetorical power of a new discourse (discourse structuration); second, the new discourse should be reflected in the institutional practices of actual policy processes conducted according to the ideas of a given discourse (Hajer, 2006). When a discourse is institutionalised the discourse is being explicitly used as a foundation for policies and for institutional arrangements. A major point from (Hajer, 1995) is that a discourse does not have to be coherent to become institutionalised.

As it is described in chapter 8, the process of staging light rail mobilities is complex and involves several processes of 'translation' (Callon, 1986). Translation is a central notion in the ANT approach (Jensen, Lauritsen, & Olesen, 2007) and an alternative to the natural sciences notion of causality (Brinkmann, 2010). The notion of translation provides an analytical framework to study the role played by science and technology in structuring power relationships (Callon, 1986). The process of translation transforms the project in the making, when various actors pose their arguments in order to create alliances that secure their perception of the project: is the project a generator for urban development, an effective transport system or both? In this way light rail technology is an important actant in constructing an argument that advocates for issues such as attractive public transport or city branding. The network around the light rail solution stabilises when a certain network of allied actors is so insistent in their demands, knowledge, truth or facts that the cost of opposing this network is larger than the gain of joining the alliance or of keeping silent (Jensen, Lauritsen, & Olesen, 2007). Translation is thus the process of shaping the project, and this happens through constant negotiations and shifting power relations between actors, making light rail a dynamic and changeable project. Thus the translation may also sometimes fail if the actor network becomes unstable. In this process bringing in distant projects as arguments that shape the project - previous experiences of contractors, similar projects in other parts of the world or alternatives that have proven problematic elsewhere - can be of great importance (Hughes, 1998).

3.5.3 The Role of Materialities and Space

Technologies of mobilities and infrastructures can carry with them great symbolic and cultural value that go beyond the function of transport (see figure 3). As Vannini (2012) has explained, implementation of new infrastructure can change the configuration of the city and urban space: 'everything would change with a bridge, we'd become a suburb' (p. 79). Jensen (2013) has described how mobility is materialised in cultural artefacts or technologies, which in themselves have no pre-existing meaning. Certain places, cultures and societies can give particular kinds of mobility particular kinds of meaning, meanings that may even cross cultures (Adey, 2010). Analytically, the link between meaning, materiality and spatiality is central to the analysis of the cases in chapter 6. Mobilities are cultural, ideological and embedded in local political discourses (Jensen, 2013). The physical settings of infrastructure are encouraging as well as discouraging particular mobile practices (Jensen, 2013). The infrastructural moorings are a very important actant in light rail projects, creating immobile sights and corridors of mobilities (see article 2). The immobility that the light rail tracks provides is a highly valued attribute from an investor's and user's perspective, since an investment in light rail physically manifests as a stable, long-lasting public transport solution (Hass-Klau, Crampton, & Benjari, 2004) and is also a powerful strategic tool in urban development. Among decision makers, light rail is often perceived as the 'technical fix' to several urban problems, but light rail mobilities can be assembled in such various ways that it does not provide one answer to the problems of cities, but many, and also sometimes none. This is the multiplicity linked to the production and practice of light rail mobilities (Mol, 2002). The choice of route can be based on objectives to optimise the speed of the system or the light rail can be a tool in urban regeneration processes. In practice this means that it may prove to provide a very different passenger experience than if the route was made to create a scenic experience of the core activities in the city or provide a fast transport mode transporting passengers efficiently from A to B. Routing and the corridor are thus important material and spatial actants in the light rail assemblage (see figure 4+5). Some routes favour some users over others as the production and consumption of mobility is associated with stratification and patterns of exclusion. Through the notion of 'power geometries' (Massey, 2005) describes these socially differentiating mobilities and power in relation to the flows and movement.

Light rail has, as exemplified in the cases (see chapter 6), become a symbol of 'the future-oriented and modern city', and many decision makers consider this technology to hold a cultural value, as does an opera house or new harbour front. Thus light rail is considered much more than transport in many urban contexts; it is also a strategic urban project (Andersen, 2013). Therefore, in many cases, infrastructure design is in some way rethought from being a 'non-place' (Augé, 1995) or a transit space without any specific identity to being a cultural and experimental urban corridor with new urban spaces and a brand for the city. This trend is especially evident in French cities (as argued in chapter 1) where the vehicle and tracks hold iconic status and communicate the history and culture of the city. No light rail system in France has the same colour scheme; each vehicle has been designed with a unique character, and everything from the front to the seats and

Figure 3: From Prague, Czech Republic: Nostalgic paintings of Prague are sold at the riverside, and many of these depict the scene of the old trams in the city as a cultural image that is an important part of the history of the city. (Photo by author, 2012)

Figure 4+5: The various assemblages of light rail mobilities provide very different passenger experiences and impacts in urban environments. Left, Angers: the light rail in the core urban areas driving in the 'foreground of the city; and right, Nottingham: the light rail on existing rail tracks affording a higher speed, but driving in the 'background of the city' (Source: Left, Photo by Author 2012. Right: www.lightrailnow.org)

the ceiling has a unique character.

The corridors, and all the relations that constitute them, also contain many material actants. The stations are placed in relation to core urban destinations such as universities, hospitals, shopping facilities, city centres, new urban developments, etc. The stations can also express various cultural values in their design. Some stations are created using local materials such as shale (Angers) or are designed with a 'Nordic touch' with straight lines and simplicity (as in Bergen). The tracks do not only afford mobility; they can also become an immobile visual image in the city. Green grass tracks, especially, have been appreciated among many planners and architects for their aesthetic value and at the same time criticised for their autonomy, especially from car traffic, and for their high maintenance costs. The tracks can be a very visible element in the city or blend into existing infrastructure by integration on roads or old railway tracks (examples drawn from chapter 6).

One of the large costs when investing in light rail infrastructure is the depot where vehicles are maintained and stored and the operation of the system is managed from the control tower. In some cases the construction of the depot is kept at a low cost, and in other cases it is part of communicating the iconic status of the system, as is the case in Angers (see chapter 6). In Angers the depot is located at an old airport site and therefore the building is shaped like the wing of an aeroplane to materialise the history of the site and create a relationship between the site and the materiality. However, not all light rail systems hold material iconic status. In countries such as Germany, where few new light rail projects have been introduced, but several old systems kept, there is not the same focus on design as in France (see chapter 6). In Freiburg, Germany, where the trams hold iconic status in historical terms more than in design terms, the vehicles are often used as advertising pillars and thus show a more standard type of vehicle design. Here the vehicles and tracks play a different role in the interaction with the urban environment than in the French cases. In the German context the design of the technological systems does not play the same aesthetic role.

The light rail as an urban project potentially creates new attractive spaces in the corridor and, from decision makers' and investors' points of view, there are expectations that this attractiveness will raise the housing prices in the corridor (Hass-Klau, Crampton, & Benjari, 2004) due to strategic transit-oriented development. Light rail as an urban project and new development thus become important actants in support of the light rail solution. Decisions to build such systems are often based on normative values rather than results from rational decision-making models such as cost–benefit analysis. Thus, many new light rail projects, especially in smaller cities without capacity needs, frame their projects as urban development projects, as a supplement to the main purpose of upgrading public transport, underlining the aesthetic and strategic value of such projects. The light rail system is used as a strategic urban development tool in relation to other strategic prioritisation made in the city, which adds strategic value to other urban projects, objectives that go beyond transport.

Light rail has furthermore become a symbol of the effort to change the mobility hierarchies in the city (see chapter 8 and 9). Regulation of car traffic is in many cities a politically sensitive subject, and the lack of space to accommodate the increasing levels of car traffic makes it necessary to optimise the use of infrastructure. In many mid-sized cities especially, public transport ridership is low and it takes some political muscle to initiate new solutions to shift modal splits in favour of public transport. Here the light rail proves to have an important 'political rail factor' (as elaborated in chapter 2) in many cities due to its material attributes, which symbolise new and forward-looking technology. These enable mid-sized cities to establish a public transport system that can be considered equivalent to larger cities' metros and bolster the mid-sized cities' image as vibrant cities. As also argued in chapter 2 many decision makers do not associate the same attributes with the bus, even though bus systems can facilitate the same transport solution if its design similar to light rail, with dedicated tracks. By implementing a rail-born system small cities can move up into the big city league (see also chapter 6 and 9).

3.5.4 Analysis of the Material and Spatial Dimension

To understand the material and spatial layout of light rail projects the notion of scripts and 'scapes' are helpful theoretical framings. The term 'script' defines the visions that have been incorporated into an object; the design and planning of infrastructure triggers certain ways of enacting the social world (Yaneva, 2009). A light rail holds a 'vision of the world' that is inscribed in its material and spatial construction; a specific script can be the colour of the light rail vehicles, or the segregation of the tracks, the placing and design of stations - all elements that are important to the way this infrastructure interacts with the city and its users. Somewhat similarly to the notion of scripts, (Jensen, 2013) has described the socio-technical constellations of metro systems as 'Metroscapes'. In his work on European Metroscapes he analyses how metro systems in three different European cities - Copenhagen, Paris and London - are assembled from various elements such as signs, kerbs, automatic doors, rules, etc. He defines the Metroscapes as landscapes of mobility consisting of all the software and hardware that together create a Metroscape. Through the analysis of the material design of the Copenhagen Metroscape he shows how the design practice used in this Metroscape has been guided by the principle of staging the mobility experience as generic and independent of specific place identities. In this sense, the Copenhagen metro is design as a 'flow machine' rather than an urban space. Marling (2013) has worked with the notion of 'Bikescapes', where she defines Bikescapes as a new urban architectural typology that represents a design approach to studying spaces of mobility, such as pedestrian and cycling lanes. She describes how these Bikescapes offer many different 'urban programmes' and possibilities for new urban spaces in this corridor. The urban integration of this mobility system offers new aesthetical qualities with regard to rhythms, changing pavements, spatiality, scales and materials. These theoretical and analytical inspirations have been central to the spatial and material analysis and mapping of the light rail corridors in the four cases.

The spatial embeddedness and 'frozen discourses' (Dovey, 2008) of light rail mobilities are mapped by the use of Lynch's (1959) understanding of the city image and its elements in order to analyse how a certain image and vision of the space are enacted by the implementation of a 'light rail scape'. Lynch (1959) has argued that 'moving elements in a city, and in particular the people and their activities, are as important as the stationary physical parts' (p. 2), indicating that the mobile artefacts are also important in our understanding of space. As Lynch (1959) argues, analysis of the city image 'limits itself to the effects of physical, perceptible objects. There are other influences on imageability, such as the social meaning of an area, its function, its history, or even its name. These will be glossed over since the objective here is to uncover the role from itself. It is taken for granted that in actual design form should be used to reinforce meaning and not to negate it' (p. 46). The spatial framework provided by Lynch is thus very much of form an not so much of meaning. Seen in relation to the analytical framework in this thesis, form will be analysed in relation to the framework provided by Lynch, whereas the extra layer of meaning is provided by the discursive and institutional dimension drawing on discourse and metaphor analysis inspired by Hajer (2006). By paying attention to both dimensions it is possible to see how planning practices frame places both discursively and spatially (inspired by (Dovey, 2008) and (Andersen, 2013)).

QUOTE
'moving elements in a city, and in particular the people and their activities, are as important as the stationary physical parts' Lynch (1959) (p. 2).

It is important to be aware that Lynch (1959) developed his framework in order to understand the mental image of the city as it is held by its citizens on an individual level. Applying this approach as an analytical tool provides some central categories of urban form through which the mapping of the material and spatial layout of the light rail corridor is performed. By doing so the thesis draws on Jensen (2013), who argues that attention should be paid to the physical setting, materials, spaces and design as well as the social interaction and embodied performances that are practices in the individual performance of mobilities. In the spatial analysis applied in this thesis I have delimited the analysis to concern the staging from above by examining the discursive and institutional framing and how traces of these discursive framings materialise in the urban environment and 'stage' certain urban environments. While I acknowledge that the staging from below by citizens and passengers is equally important, the analysis has been delimited due to the scope of the thesis.

Lynch (1959) categorises physical form of city image into five types of elements: paths, edges, districts, nodes and landmark. These elements should not be seen in isolation but in relation to one another in order to create the full image of the urban environment. In table 1 Lynch's definition is included and operationalised in order to apply it to the spatial and material analysis of the light rail corridor. Lynch defines each element in the following sense (Lynch, 1959, p. 47), see figure 6. The concrete methodological performance of the material and spatial registration of the light rail corridor is described in chapter 4.

ELEMENT	DEFINITION BY LYNCH	ANALYTICAL OPERATIONALISATION
Path	Paths are the channels along which the observer customarily, occasionally, or potentially moves. They may be streets, walkways, transit lines, canals, railroads. For many people, these are the predominant elements in their image. People observe the city while moving through it, and along these paths the other environmental elements are arranged and related.	Analytically light rail alignment is placed in the centre of the spatial analysis as the path along which space in the corridor is transformed. How the path is designed and how it integrates with the street environment are analysed. Which role does this path play in the visual navigation of the city and how are other urban elements arranged in relation to the path? To what extent has the path been thought to perform identity?
Edge	Edges are the linear elements not used or considered as paths by the observer. They are the boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of developments, walls. They are lateral references rather than coordinate axes. Such edges may be barriers, more or less penetrable, which close one region off from another; or they may be seams, lines along which two regions are related and joined together. These edge elements, although probably not as dominant as paths, are for many people important organising features, particularly in the role of holding together generalised areas, as in the outline of a city by water or wall.	The analysis focuses on the edges and seams that the light rail creates in the urban environment. How the light rail corridor is assembled in relation to the creation of boundaries or front and back sides in the city is analysed. Which districts does this light rail line hold together and what role does the light rail corridor play in the overall urban development structure and mobility system in the city?
Districts	Districts are the medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters 'inside of' and which are recognizable as having some common identifying character. Always identifiable from the inside, they are also used for exterior reference if visible from the outside. Most people structure their city to some extent in this way, with individual differences as to whether paths or districts are the dominant elements. It seems to depend not only upon the individual but also upon the given city.	What characterises the main district connected along the light rail line, and what role does light rail play in different district? How has it been 'staged' to fit the urban environment and fit or create a certain environment or urban program in certain districts?

Figure 6: Analytical approach to analysing the spatial and material dimension of light rail mobilities. (The table draws on Lynch (1959)).

ELEMENT	DEFINITION BY LYNCH	ANALYTICAL OPERATIONALISATION
Nodes	Nodes are points, the strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is travelling. They may be primarily junctions, places of break in transportation, a crossing or convergence of paths, moments and shifts from one structure to another. Or the nodes may be simply connections, which gain their importance from being the condensation of some use or physical character, as a street corner hangout or an enclosed square. Some of these concentration nodes are the focus and epitome of a district, over which their influence radiates and of which they stand as a symbol. They may be called cores. Many nodes, of course, partake of the nature of both junctions and concentrations. The concept of node is related to the concept of path, since junctions are typically the convergence of paths, events on the journey. It is similarly related to the concept of district, since cores are typically the intensive foci of districts, their polarizing centre. In any event, some nodal points are to be found in almost every image, and in certain cases they may be the dominant feature.	Nodes are used as a reference to the stops along the route. How are these stops placed and at what distance? What role does the stop play in the nearby environment? To what extent has the physical character and design of the stop been fitted to the surrounding environment and what role does the stop play in the urban environment? Besides working as a nodal point impacting the immediate urban environment, how are these nodes connected to other mobility connections in the city? Do they work as a symbol, and how has this symbol been staged?
Landmarks	Landmarks are another type of point-reference, but in this case the observer does not enter within them, they are external. They are usually a rather simply defined physical object: building, sign, store, or mountain. Their use involves the singling out of one element from a host of possibilities. Some landmarks are distant ones, typically seen from many angles and distances, over the top of smaller elements, and used as radial references. They may be within the city or at such a distance that for all practical purposes they symbolize a constant direction. Such are isolated towers, golden domes, great hills. Even a mobile point, like the sun, whose motion is sufficiently slow and regular, may be employed. Other landmarks are primarily local, being visible only in restricted localities and from certain approaches. These are the innumerable signs, storefronts, trees, doorknobs, and other urban detail, which fill in the image of most observers. They are frequently clues of identity and even of structure, and seem to be increasingly relied upon as a journey becomes more and more familiar.	Focusing particularly on the material scripts of ight rail technology, the extent to which light rail works as a landmark in the city and how this point reference is staged materially and spatially in the different cases are analysed. What are the characteristics? What identity is mediated through the design of the vehicle and the technological system in general? To what extent does the political framing of the project materialise in the city? Light rail has both mobile and immobile elements that have implications for the image of the city. The vehicles work as mobile landmarks that momentarily affect the urban environment, whereas the tracks, the stations and the depot are immobile infrastructure that is constantly present in the urban environment.

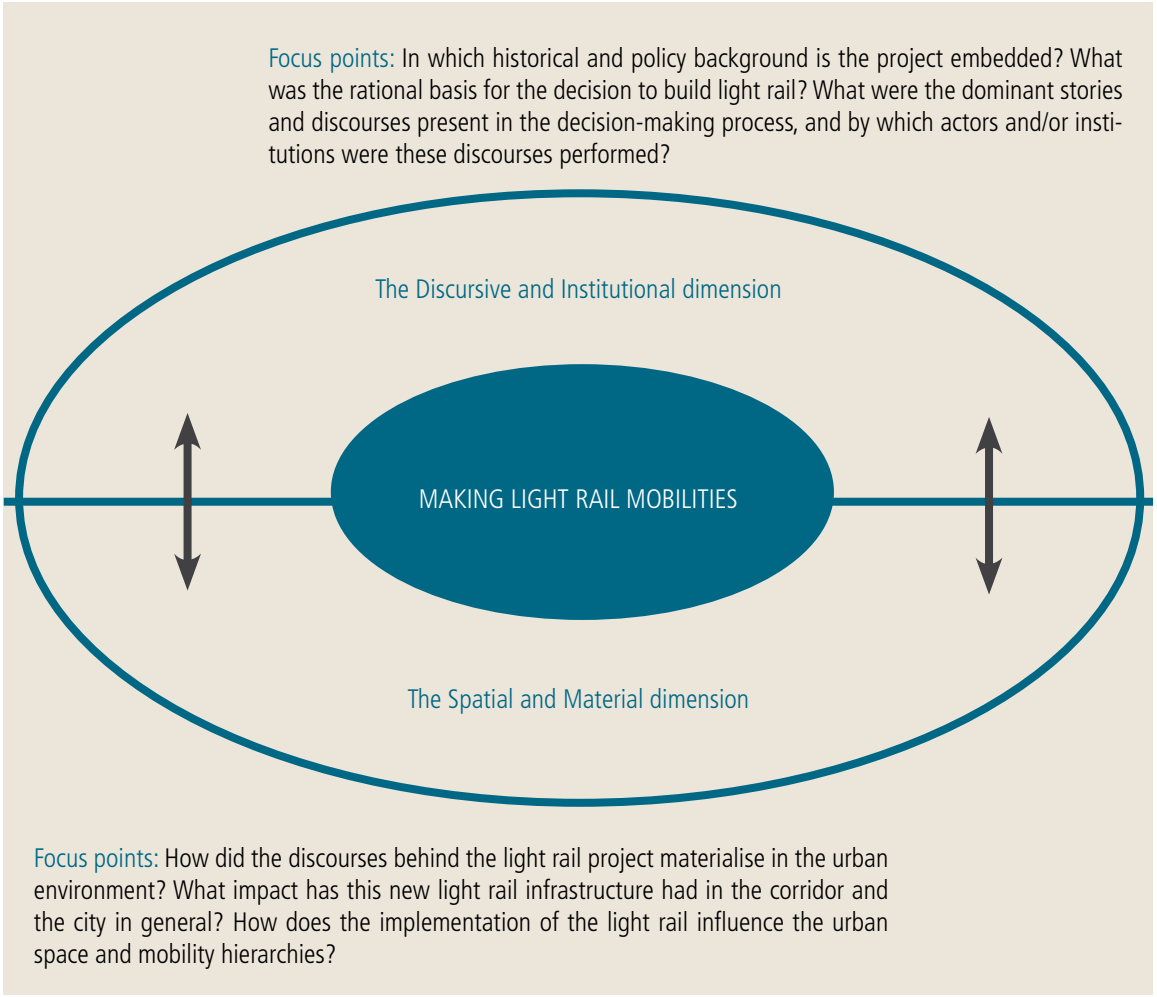


Figure 7: Diagrammatic representation of the analytical approach, with focus points used as references to each of the two dimensions.

3.6 Analytical Framework

The analytical approach places 'making light rail mobilities' at the centre of the project in order to analyse how light rail mobilities are politically and culturally produced and materially and spatially practised in mid-sized European cities. The analytical approach is thus based on two primary dimensions: the discursive and institutional dimension and the spatial and material dimension. This means that making light rail mobilities happens in the interplay between discursive battles in the decision-making process in which different actors, discourses and rationalities compete in order to define the objectives of the project. Some of these discourses then 'translate' into the later stages of the project when alliances agree on a certain rationality and objective and 'win' the discursive battle. The winning discourses institutionalise in planning and policy documents and become the 'main language' of the project. The implementation of light rail in the city 'freezes' the discourses into the urban environment and the material layout of the system mediates the objectives behind the project. Furthermore, the materiality of the infrastructure interacts with urban spaces and is part of both creating new and reorganising existing urban districts and mobility hierarchies according to this new and central 'light rail scape'. The analytical framework is represented diagrammatically in figure 7. In the following chapter the methodological setup behind the theoretical and analytical framing of the project is outlined.

3.7 Epilogue

In this chapter the theoretical framing of the thesis was introduced. It was argued that there is a need for a relational understanding of light rail mobilities in order to understand the production and practices of such mobilities in relation to both the human and non-human actors of these complex strategic urban projects. It was argued that a light rail project is a complex constellation of policies, urban transformations, operating policies, technologies, etc., and the making of light rail mobilities should thus not be approached using a rational instrumental approach. Light rail projects mediate certain values and views of the world that can be understood as the strategic qualitative values and perspectives supporting the more technical elements of such mobilities. Applying a socio-technical mobility approach enables the analysis to operate between the intersecting relations of society and transport technologies. Analytically this is enabled by a framework that puts the 'making of light rail mobility' at the centre of the discursive-institutional and spatial-material production and practice of light rail mobilities. Analysing both materiality and language has been central in order to disentangle the many realities of light rail mobility.

CASE STUDY DESIGN

4

4. CASE STUDY DESIGN

4.1 PROLOGUE

In the previous chapter it was argued that the production and practice of light rail mobilities happen through complex decision-making processes that are not rational and instrumental. Light rail projects are strategic urban projects, which in this thesis are approached analytically as being between discursive–institutional and material–spatial practices. This chapter outlines the case study design that has been used to deconstruct the complex human and non-human constellations that constitute light rail projects. The chapter argues that light rail projects should be approached in their concrete context in order to understand the meaning behind these mobilitity systems. A multiple case study design has been applied in which it is argued that the force of the good example has been underestimated, and a qualitative in-depth method is crucial when the aim is to analyse how light rail mobilities are politically and culturally produced and materially and spatially practised in mid-sized European cities. The criteria for case selection are described in the chapter. Maximal variety has been the main objective for the case selection. The rationale for this design has been to show similarities and differences across very different contexts and practices of making light rail mobilities. Completely new lines and extensions of existing systems have been chosen to analyse the discursive–institutional and material–spatial practices in the four cases. The methods applied in the data collection have been combined in order to extract the many viewpoints and narratives in which light rail mobilities are embedded. The methods have also involved a mapping of the material and spatial dimensions in order to analyse how the winning discourses have materialised in each light rail project and reorganised urban space in the corridor and in the city.

4.2 MULTIPLE CASES OF LIGHT RAIL MOBILITIES

QUOTE

'The way to re-enact the world…is to stick to the concrete'
Richard Rorty, cited in (Flyvbjerg, 2004, p. 283).

An analysis of the political and spatial production and complexity of light rail projects requires proximity to practice since light rail projects are performed through planning practice. Applying a case study design can provide proximity to the practical realities of different light rail projects and allows a focus on the context in which light rail mobilities are produced and practised. As it has been argued by (Flyvbjerg, 1991; Flyvbjerg, 2006), the case study is a way to study the social phenomenon in its concrete practical context, and through this approach context-dependent practical knowledge and experience can be derived. Furthermore, cases studies are strongly related to a narrative phonetic approach to planning research (Flyvbjerg, 2004), which is central to uncovering the hows and whys of light rail mobilities. The aim of this case study approach is also inspired by (Flyvbjerg, 1998, p. 1), who argues that findings presented as a narrative can help readers move about in the case material and provide them with the basis to form their own judgements about the case and its implications. The phronetic methodological approach is about deliberation of values in relation to praxis and analysing pragmatic, context-dependent knowledge that is oriented towards future action (Flyvbjerg, 2004, p. 287). Flyvbjerg (2004) outlines four central questions that can be guiding for phronetic

research: where are we going with planning? Who gains and who loses, and by which mechanisms of power? Is this development desirable? What, if anything, should we do about it? (Flyvbjerg, 2004, p. 290). There are no universal answers to these questions; however, Flyvbjerg (2004) argues that the plausible answers to these questions should be seen as inputs to the on-going debate about the problem investigated. As inspired by this phronetic approach, case studies enable proximity to the reality of planning practice as 'a way of gaining a better understanding of the nature and difference of conflict and generating ideas and propositions which can more adequately inform planning practice than much current planning theory and research' (Flyvbjerg, 2004, p. 297). In order to understand the dynamics of practice we must ask 'how' questions; asking 'how' and doing narrative analysis are closely linked activities. The narrative approach has inspired the case analysis to develop rich descriptions and interpretations of light rail planning from the different actors involved in this process.

The thesis is based on a multiple case study with practical examples of light rail projects in four different mid-sized European cities. The experiences and knowledge from practice in the four light rail projects studied provide valuable insight into the planning process and implications of these mobilities in various local contexts. Despite the small sample studied, the insight into how different light rail projects have been framed, evaluated and materialised can provide a basis for some analytical generalisations (Flyvbjerg, 1991) about the process of making light rail projects and the potential outcomes that these projects hold. An analytical generalisation is enabled by strategic case selection, where it should be possible to ask, 'If the thesis could be proved false in the favourable case, then it would most likely be false for intermediate cases' (Flyvbjerg, 2006, p. 226). Furthermore, Flyvbjerg (2006) argues that 'formal generalisation is only one of many ways by which people gain and accumulate knowledge. That knowledge cannot be formally generalised does not mean that it cannot enter into the collective process of knowledge accumulation in a given field or in a society' (p. 227). By abductive reasoning (see also chapter 5) in the analysis of the empirical data there may be certain factors in each case that could be subjects for analytical generalisation and could be useful lessons learnt for practice. As Flyvbjerg argues (2006), the force of the good example has been underestimated.

The choice of cases studies as the research design enables an interpretive approach to data, and it makes it possible to study 'things' within their contexts (Yin, 2009) and consider the subjective meanings that people bring to their situation. The strategy is to study the problem in its totality by its in-depth and actor-oriented focus (Flyvbjerg, 1991). The analytical focus has been on analysing the connections that are being made and remade between the discursive–institutional and material–spatial dimensions in each case study (see also chapter 3, 6 and 7). The aim is to create an understanding of how these projects are assembled discursively and materially and what implications they have had in various cities. Deconstructing the relations and 'multiple realities' (Mol, 2002) that light rail technology is part of can be supported by various different qualitative methods of data collection, which will be elaborated in section 4.3 in this chapter.

STRATEGY	CATEGORIES
1. Extreme cases	To gain information on unusual cases, this could be cases that are particularly problematic or successful in regards to specific factors.
2. Maximum variation of cases	To gain information on the importance of specific circumstances for the structure of the case, e.g., three to four cases that are significantly different in terms of one dimension: size, organisation, localisation, budget, etc.
3. Critical cases	To gain information that enables logical reasoning in the sense of 'if it is (not) true for this case, then it is true for all (or none) of the cases'
4. Paradigmatic cases	Cases that work as metaphor for best practice or set the fashion for the field that the case concerns

Figure 8: Strategies for case selection, as referenced in (Flyvbjerg, 1991); own translation.

Besides the study of practice, the case studies have been a way to acquire new knowledge and skills through the research process. As Flyvbjerg (2006) puts it, 'for researchers, the closeness of the case study to real-life situations and its multiple wealth of details are important in two respects. First, it is important for the development of a nuanced view of reality, including the view that human behaviour cannot be meaningfully understood as simply the rule-governed acts found at the lowest levels of the learning process and in much theory. Second, cases are important for researchers' own learning processes in developing the skills needed to do good research' (Flyvbjerg, 2006, p. 223). The case study approach thus enables the researcher to develop skills and knowledge of the process of making light rail mobilities. The case design has been developed and adjusted throughout the process with feedback loops and adjustments to the research design. The cases proved to show many more different aspects than expected, and some of the pre-given assumptions could be falsified. After each case study, the approach has been adjusted due to findings in previous case studies. The theoretical and analytical approach of the thesis does not suppose a priori that 'the world out there' has any kind of predefined structure or geography. Rather, it is argued that the form of what becomes 'out there' emerges from the dynamics of multiple gatherings (Law, 2004). This means that there is no one fixed model for understanding the production of light rail mobilities. Methodologically, this requires a creative approach were several methods are combined in order to show the dynamics at play in the process of making light rail projects.

QUOTE

'for researchers, the closeness of the case study to real-life situations and its multiple wealth of details are important in two respects. First, it is important for the development of a nuanced view of reality, including the view that human behaviour cannot be meaningfully understood as simply the rule-governed acts found at the lowest levels of the learning process and in much theory. Second, cases are important for researchers' own learning processes in developing the skills needed to do good research' (Flyvbjerg, 2006, p. 223).

4.1.1 Case Study Design and Case Selection

Practically, the study of light rail mobilities is conducted through the use of a multiple case study design in which it is possible to analyse light rail in relation to various local contexts (Antoft & Houlberg, 2007). Flyvbjerg (1991) describes the maximum variation as useful when the aim is to gain information on the importance of specific circumstances for the structure of the case, e.g., three to four cases that are significantly different in terms of one dimension: size, organisation, localisation, budget, etc. (see also figure 7). The use of a single case design would not allow for a study of the similarities and differences between the multiple national practices and realities of light rail mobilities. The purpose of the case studies is thus to derive findings from each case that can be subject to analytical generalisation in order to explain the dynamics in the production and practice of light rail mobilities. Furthermore, these analytical generalisations are useful inputs to future decision-making processes as structuring guidelines to handle the complexity that is often inherent in light rail projects. To show the variety in the production and practice of light rail mobilities, the cases are selected using the criteria of maximum variation of cases (Flyvbjerg, 1991). The basis for this strategy is an information-oriented selection where the purpose is to maximise the information that each case contains. The cases are selected on the basis of expectations as to the amount of information in the case, existing data on the case and judgement from key persons and researchers in the field. The cases should provide the maximum contribution of new information in relation to the research question and the existing literature on the subject.

Figure 7 is used as a strategic tool in the selection and description of cases. The considerations for the different types of cases do not eliminate each other. A case can be considered both critical, extreme and pragmatic within different aspects of the case, and different conclusions can be derived depending on the perspective from which the case is approached (Flyvbjerg, 1991). The criteria for selection of cases in this thesis is thus based on the aim to achieve maximum variation of cases, while the more specific argument for the selection of cases can be grounded in the wish to include a critical, extreme or paradigmatic case to provide varied insight into the research question.

The case studies have been selected using the following criteria:

- 1. Western European context: Since the thesis originates from the Danish context, the analytical scope of the thesis has been limited to light rail systems in European cities, as this context has been the major reference for Danish light rail projects. This means that the analysis excludes cases outside the Western European context.
- 2. Mid-sized cities: The cases are limited to cities with a conurbation of between 100.000 and 350.000 inhabitants. This criterion is stipulated with the aim of studying light rail mobilities in medium-sized European cities. In such cities the patronage is often lower than in major cities where a metro is often a prioritised solution. As in the basis for the first limitation, light rail projects in a Danish context are often considered in smaller cities that do not have the same ridership on public transport as the major capitals. Thus the objectives for implementing light rail schemes are based on very different logics and rationales than just capacity and transport flows in cities of this size.
- 3. Location: the cases represent light rail systems in four different national contexts in order to study the variation in national and local light rail practices and realities.
- 4. Variation in age of the systems: extensions to old networks and implementation of completely new networks. The cases were selected to show cities where light rail has been embedded in the political, cultural, material and spatial practices for a longer period, as well as cites where light rail has just recently been implemented in the urban environment. The aim is to show both the long-term and short-term implications of light rail systems in relation to urban policies, mobility practices and urban structures.

The number of cases is based on a desire to create a suitable variation of cases to provide a basis for analysing the factors of importance to the research question. At the same time, the number of cases analysed is based on limited resources and acceptance of the time consuming task it is to create an overview of four different national contexts, conduct field visits, perform interviews with a sufficient number of actors and do extensive document analysis. The language barrier has also had a major impact on the breadth of cases and the depth of the analysis of each case. In the French and German cases the number of actors available for interview was limited due to the challenges of finding respondents that were able and willing to give an interview in English. Furthermore, it has been a

challenging task to gather material in a foreign language and create a comprehensive analysis of all relevant policy documents, actors involved and other relations. There are also different rules for right of access to documents, and the amount of available material on the Internet, depending on the national context studied. These are all important methodological limitations of the project.

4.1.2 Justification of the Selected Cases

Based on the above strategies for selecting relevant cases, the empirical evidence comes from four main cases: the light rail projects in Freiburg, Germany; Bern, Switzerland; Bergen, Norway and Angers, France. These cases are selected because they are examples of old and new networks implemented in mid-sized western European cities and different national contexts. The cases are significantly different with regard to history, legislation, culture, policies, localisation and budget. This creates complexity in comparisons and in carrying out the case studies, since it is a time-consuming task to analyse all the complex relations in the light rail projects. The case study evidence showed that light rail is reluctant to be bound to one specific situation or one particular category; the implementation of this technology has multiple realities (Mol, 2002) (see also chapter 5). When technologies prove to be effective in various associations it is because they are active participants in the transformation of reality (Jensen, 2010).

The cases of Bern and Freiburg are examples of existing tram networks where the extension of new light rail lines is central in the case analysis. Both of these cities are in practice considered to be best practice examples or paradigmatic cases of public transport and transit-oriented development, and the tram is an integrated part of the urban morphology. Freiburg is acknowledged for its integrated urban development and public transport system and consistent sustainable transport policies over decades. Bern, and Switzerland in general, is known for its integrated public transport mobility systems and its public transport culture. More specifically, the extension of the old Bern tram network to Bern West has been based on objectives of urban development and regeneration, which places this project in an interplay between a transport project and an urban project. The fact that these two cases have a longer history with regard to preserving the old tram network means that the cases enable a study of the relations in the design processes that created a successful outcome in these two best practice cases. It furthermore creates an opportunity to see how the city has developed along with the network and how the light rail vision has been integrated into practices and policies for a longer time period. Finally, it is possible to analyse the design and framing of new extensions in relation to existing policies. Both cities have a high modal share of public transport and have succeeded in the creation of an attractive and popular light rail system. In both cities light rail has been used strategically as a tool in urban development.

The cases of Bergen and Angers are examples of completely new light rail systems implemented in 2010 and 2011, respectively. Angers is an extreme case in terms of the French redesign vision - Angers was one of the most expensive light rail project implemented in

CASE	LIGHT RAIL	CHARACTERISTICS	INTERVIEWEES BY CATEGORY
Bergen, Norway 260.000 inhabitants Municipal area 465.56 km^2	First LRT line built in 2010. The first LRT in Norway	Extreme case with regard to the political decision-making processes and enactment of the light rail vision in a new social and spatial context	• Municipal planner • Chief engineer–light rail project • Politician–left wing • Public transport operator • Head of business • Researcher, Bergen University
Freiburg, Germany 220.000 inhabitants Municipal area (Stadtkreis) 153.07 km^2	Old tram system. New LRT extensions have been made to the network since 1970.	Paradigmatic case and often used as 'best practice' example of integrated urban and transport planning.	• Transport engineer–municipality • Politician–left wing (the Green Party 'Die grünen, Bündnis 90 ') • Researcher–geography department at Freiburg University *Presenters at seminar* • Traffic planner–municipality • Public transport operator • Regional transport planner
Bern, Switzerland 130.000 inhabitants (Bern Municipality) (Note 6) Municipal area 51.62 km^2	Old tram system. First new LRT extensions to Bern West in 2011.	Paradigmatic case/best practice example in integrated mobility systems and public transport culture. Extreme case with regard to decision-making process for new LRT extension.	• Municipal transport authority • Regional transport planner • Public transport operator • Public transport NGO • Researcher, Bern University
Angers, France 156.000 inhabitants (Municipal area) (Note 7) Municipal area 42.70 km^2	New system built in 2011	Extreme case with regard to the French redesign vision. The most expensive LRT project in France due to the design and urban renewals in the light rail corridor. A light rail project that is based on very different objectives than transport efficiency	• Traffic planner–municipality • Public transport operator • Consultant–light rail in France

Figure 9: Characteristics of the selected cases

France. The visual design and the redevelopment along the tracks have changed urban areas remarkably, and light rail has also served as the backbone in a new urban development. Furthermore, Angers is a case of a light rail system that is based on very different rationalities and objectives than that of transport efficiency. Bergen is an extreme case with regard to the political process since the project was discussed for more than fifteen years and was a controversial political subject. Bergen is the first light rail scheme in Norway, and provides insight into the policy development and change associated with the implementation of this new technology. The project managed to keep on schedule and on budget and was awarded Worldwide Project of the Year by the Light Rail Awards in 2011 (Note 3), where the light rail project in Angers was one of the other finalists. One of the main objectives behind Bergen's light rail is the urban development objectives that were crucial in the decision to create the system. These two cases give insight into the framing of new light rail projects through policies and planning documents. The design processes are here more extreme because a new technology has to be fitted into existing urban and mobility patterns and strategic policies for future urban development. Both cities have focused on using light rail to curb the use of cars in the city centre and on using light rail as an integrated urban development tool. The implementation of light rail can be seen as a policy innovation in these local contexts.

NOTE 3
For more information see: http://research.lctr.org/TRBLRT/news/Worldwide%20Project%20of%20the%20Year%20by%20the%20Light%20Rail%20Awards%202011.pdf

The depth of analysis is greater in some cases than in others. The Bergen case has been studied in greater depth than the rest of the cases. This is due to the amount of data accessible and the richness of the case. Bergen was also the first pilot case study conducted, and it was part of the learning process in order to grasp the many complex relations that such projects are made of. Altogether, six interviews were conducted in Bergen, which is the largest group of interviews in the cases. Due to the language barrier, the number of interviews in the remaining cases is smaller. This is due to the fact that many of the local policy and planning documents in Freiburg, Bern and Angers were in German and French, as well as to the challenges of finding potential respondents willing to give interviews in English. In figure 9, the cases and the interviewees are briefly summarised, and in chapter 6, Case Analysis, more detailed presentations of the interviewees and their roles in relation to the light rail project are provided.

4.3 COLLECTING DATA: METHODS

4.3.1 Document Analysis

The departure point for each case study was document analysis of available written resources from the four light rail projects studied. Document analysis has been used to identify processes that lead to the establishment of a political agenda, development of norms, and practices within certain organisations (Lynggaard, 2010). By the use of document analysis, key events that led to the establishment of the light rail project are identified at both the national and the local level, answering questions such as: what were the trends in society that encouraged the adoption of light rail? Who were the main actors involved in the decision-making process? And, which realities and rationales governed

NOTE 6+7
Bern agglomeration, which includes 43 municipalities, has a population of 356,000 inhabitants

The Angers Loire Métropole is made up of 33 communes covering 540 km² with 287,000 inhabitants.

their perspectives over various periods of time? Which policies supported the light rail vision, and what were the dominant discourses related to the specific light rail practice that was constructed? As described in chapter 3, discourse analysis has been used to analyse the emerging discourses and rationales in the documents assessed. Through this approach it is possible to identify structuring concepts in the documents as well as in the interviews - storylines, metaphors, etc. used by the various actors in relation to their institutional position. Besides the written word, the document analysis also included visual representations such as maps, diagrams, posters, etc. that were used in the decision-making process as spatial and material representations of the system. These resources are valuable in addressing the many realities and meanings that have been enacted in light rail practice, and maps and diagrams are the visual representations of the discursive framings performed in the projects (se also Dovey, 2008).

Different sources have been assessed through document analysis. The webpages of each light rail project mainly provide insight into the operation of the systems today, and not many resources are available that explain the process of creating the system. Information on the technical operation of the system can provide important information on the translation of policy frames into the technical project. The frequency, number of stops and travel time in the system can provide information for understanding the physical integration of the system - whether it was conceived of as a fast transport mode or as an urban development tool with frequent stops and slow travel speeds. The policy and planning documents behind the project have been assessed and provide insight into the governing rationales and discursive frames behind the projects as well as the choices for spatial integration of the system. The policy documents are, however, the official representation of the project, and thus do not provide insight into the complexity of the decision-making process. To address this facet, other sources such as public hearings, power point presentations, technical studies and, local newspapers have been have been consulted. Furthermore, expert interviews with practitioners in each case are the key empirical sources (see section 4.2.3). In summary, the following types of written resources have been reviewed:

- Policy and planning documents: vision statements, planning reports, non-technical resumes, maps, diagrams, official speeches, meeting minutes etc.
- Consultant reports: technical assessments, design guidelines etc.
- Marketing materials: posters, webpages, public hearings, etc.
- Relevant webpages: local authorities, public transport operators, Facebook groups, interest groups
- Previous studies of the case
- Local media

4.2.2 Field Studies

This thesis has argued that the production and practice of light rail mobilities should be studied 'in situ' (as argued by Jensen, 2013), and this approach also has implications for

the methodological approach applied. The physical surroundings and the social affect each other (Hastrup, 2010); this implies that the thesis deals with both discursive–institutional and material and spatial practices of light rail mobilities. Field studies have been conducted in each case city. This was done in order to conduct interviews face to face with practitioners, but also to study the situated mobilities in their places, be close to the field and see the specific characteristics of spaces and material scripts in the light rail corridor. The spatial and material analysis and mapping of the corridor were performed using a walk-along, ride-along approach (inspired by Dovey, 2008 and (Büscher, Urry, & Witchger, 2011) in which the different urban programs and material layouts in the corridor were registered and mapped (using the theoretical approach elaborated in chapter 3). The materiality and the spatiality of the different urban programs in the corridor were registered using photos, and maps were used to register how light rail was intended to integrate with the urban environment in different parts of the city. With regard to this mapping it is important to note that the spatial analysis was only performed by the researcher and thus represents my professional perspective and the analytical image I created of the corridor. The mapping exercise was furthermore supplemented with available on-line tools such as Google Street View and YouTube in order to register parts of the corridor where central photos were missing from the fieldtrips. The mapping exercise can be seen as a phenomenological registration of urban space as a method, where my own embodied experience of riding and walking along the corridor has been used as the medium to perform the analysis of the material and spatial implications of the light rail system. More concretely, the registration of the corridors and the design and materialities of the systems were made by paying attention to the visual categories that Lynch (1959) uses to describe the individual image of the city, as elaborated in chapter 3. This methodological exercise is a visual examination of the materiality and spatiality of the 'light rail scape' to detect the main technological and material features such as the vehicles, interiors, stations, tracks, depot, power supply, tunnels, bridges, etc. Field studies also enabled investigation of the corridors to see the spatial impacts that the system has had in the city and on urban space in the corridor. In order to document these registrations, different methods were used: photos, notebook registrations, riding along and walking along the tracks to examine the corridors, visits to the depot and the maintenance areas. Photos and maps of the corridors are available in the case study analysis in chapter 6.

4.2.3 Qualitative Expert Interviews

Qualitative expert interviews have been an important method for uncovering the process of making light rail mobilities through insight into the professional life worlds of practitioners in each case. The exploratory interview is a method for uncovering the tacit knowledge that is often embedded in certain practices and is therefore often not explicitly represented in official policy and planning documents. In the interviews the respondents talked about their professional life worlds (Kvale & Brinkmann, 2009) on the basis of the institutions they represented, but also the logics and ways of reasoning embedded in their professional and personal backgrounds.

Flyvbjerg (1991) describes the characteristics of the expert and the way she/he acts thus: 'The competent practitioner performs on the basis of exhaustive experiences from various situations, situations that all involve the same goal and the same perspectives, but that requires different tactical decisions.… Virtuoso football players perceive the moment for dribbling or the opportunity to score using the entire visual situation in front of them, and this bodily intuition triggers memories of past situations in which they succeeded in dribbling or scoring. Nothing suggests that the football player makes his decisions based on general rules in combination with facts of his own and his competitor's position, movement, speed, etc. Intuitive, holistic and synchronic action is the centre of attention' (Flyvbjerg, 1991, p. 31, based on own translation).

Through this example of non-rational practical knowledge, Flyvbjerg (1991) argues that the study of this intuitive decision-making process compared to the rational decision-making process has often been left out in the practice of Western science, where analytical, rational methods have dominated. It is, however, important to understand that experts often act based on a holistic and extensive understanding of their field and previous experience, and that this action is often intuitive. These actions and practices have become a bodily and tacit extension of the competent practitioner, and she/he is often no longer aware that these actions are part of their tacit knowledge. Thus it is important to know which institutional and professional position the interviewee holds - architect, economist, engineer or politician - in order to understand the reality from which they approach and speak about the subject discussed. The experts interviewed are presented more extensively in each case analysis (chapter 6) to illustrate the perspective that these respondents provided on the light rail project, as well as from which institutional context these respondents speak. Experts were often interviewed who had to defend their own or their institution's viewpoints and realities. They sometimes had certain messages or views of reality that they wanted to communicate through the interview. The central characteristics of the knowledge produced through these interviews are therefore that it is produced, relational, based on dialogue, contextual, lingual, narrative and pragmatic (Kvale & Brinkmann, 2009). The knowledge derived from interview is thus always dependent on the context and is not a way to mirror the world, but rather to reveal the multiple social realities that exist for given subjects. The strategic selection of relevant persons to interview was based on three simple criteria for collecting knowledge based on different views on the light rail project:

- Interviews with independent/critical local sources (such as representatives from the university or local media)
- Interviews with central actors in the planning, implementation and operation of the system
- Interviews with political actors or civil servants involved in the decision-making process and visionary phases of the project.

Performing expert interview required specific skills as an interviewer. The case studies

and the expert interviews are not only a source of information, but also a learning process for the researcher in order to advance from being a 'novice' in light rail planning to being an 'expert' (inspired by Dreyfus model for the human learning process as cited in (Flyvbjerg, 1991, p. 35)). The aim is to master the technical and professional terms used in practice around light rail. In order to understand the institutional context from which the case study and the interviews were approached. Prior to each interview desk research concerning the genesis of the systems, the urban context, the mobility cultures, the political influences, etc. was prepared. Also prior to the interview, review of existing literature on light rail and engagement with practice in a Danish setting enabled a development of skills in order to create a dialogue and a technical language that moved from the descriptive to the reflective level (Launsø & Rieper, 2000). An interviewer who can demonstrate that she/he has a good grasp of the subject of the interview can be an interesting conversational partner, and thus the interview can develop more as a symmetrical narrative dialogue than a strictly structured set of questions and answers (Kvale & Brinkmann, 2009). The situation placed large demands on personal skills to master the many relations and complexities inherent in these light rail projects in order make sense of the many interests and realities at stake.

Expert interviews are important because they reveal what has been left out of the documents reviewed: the process of making these written representations. In addition to the opportunity to see the material design and spatial implications of the system through the field studies, interviews were conducted with actors face to face. This enabled the actors interviewed to show various reports, documents and maps during the interview and provided better insight into the design process and the actors involved. Planners, engineers, operators and politicians were interviewed about the process of designing the main features of their systems and evaluation of the implications. For the most part, the interviews were unstructured and open, based on dialogue. Before each interview, an outline of some of the central themes of the interview was sent to the respondent in order for her/him to prepare for the interview (see interview guide and central themes in Appendices). The themes and some specific questions for clarification for each case provided the basic structure of the interview, but the unstructured design also allowed the respondents to talk about different aspects of the process that were central for them and the case. Through this approach the respondent's stories about the relations in each case were derived and the perspectives and rationalities from each respondent towards the light rail project were unfolded. The interview material was handled as a hybrid of a factual and a narrative interview (Kvale & Brinkmann, 2009, p. 171-173) in which many different stories unfolded through the process. This means that the interviews have not been coded into specific categories, but are seen as individual reflections from the interviewees on their views on and experiences of the decision-making process. In a similar vein Flyvbjerg (2001) states that 'narratives are perhaps our most fundamental form of making sense of experience' (p. 137).

QUOTE
'narratives are perhaps our most fundamental form of making sense of experience' Flyvbjerg, 2001 (p. 137).

4.1.3 Engaging with Practice

In a position as a business Ph.D. student I have been deeply involved in Danish light rail planning practice through various tasks on Danish light rail projects at the consultancy company COWI. Furthermore involvement in the Danish context has happened through conferences, networks, meetings, etc. This means that Danish light rail practice has played a crucial role in the research process, providing practical knowledge inputs to the structure of central themes in the case studies. Through participation in practical tasks concerning the Danish projects, insight was gained into the design processes and the politics of making light rail mobilities. In this sense, the Danish cases serve as reference cases in the study of European light rail mobilities. Below is a list of the tasks I have been associated with on Danish light rail projects that are of relevance for the empirical basis of this thesis:

- Preliminary analysis of phase two for Aarhus light rail
- Feasibility studies for Odense light rail
- Preliminary studies for Aalborg light rail
- Development of qualitative decision-making tools supplementary to socio-economic analysis of light rail (see also chapter 10)

4.4 REFLECTION ON ETHICS AND VALIDATION OF FINDINGS

Using interview material and interpreting and generalising the findings also involve ethical questions and considerations as to how to use and validate the knowledge produced in the research process. Firstly, since there has been extensive complexity present throughout the research process it has been important to find methods to validate the findings or at least reflect upon the knowledge produced by the methods applied. As has been argued, there are many relationships to uncover in light rail projects and it is a complex process to present the multiple realities that are linked to the light rail as the analytical object. The choice to work with case studies in multiple national contexts to show the variety of practices and the different political and spatial framings of light rail has not decreased this complexity. In dealing with different planning traditions, foreign languages, other cultural practices, historical backgrounds and urban contexts, it has been a challenging and time-consuming task to establish the validity and the correct interpretation of the findings. A timeline with the interpretation of the main events and policy phases that led to the implementation of the light rail project in each case was sent to one of the local respondents to validate the findings and see if central elements were missing. Furthermore, the national setting of each case was discussed with a reference person with a professional planning background who was not directly involved in the light rail project. This enabled further validation and clarification of the findings and the conclusions about the context of each case.

Since the interview process worked as a dialogue between the respondent and the researcher, some of the interviews ended up being quite extensive. All interviews were recorded, and the most important interviews were transcribed completely, while only short-

er sections of the other interviews were transcribed. All respondents were asked whether the interview could be used actively in the analysis by quoting central statements and referring to them personally. All respondents agreed to these terms. As to the inclusion of important quotes in the case analysis, it is important to note that these quotes are part of a wider context and that the meanings presented for these quotes are based on my interpretations.

4.5 EPILOGUE

In this chapter the case study design and the methodological basis for the thesis was introduced. The qualitative in-depth case study design has been central to analytically deconstructing the process of making light rail mobilities and the many human and non-human actors present in this process. Field studies and engagement directly with the practice studied have been central to the outcome of the thesis. The interviews, document analysis and material and spatial mapping of the light rail corridor have provided important angles from which the research question has been approached, and the combination of these methods has fit directly into the analytical framework that was presented in chapter 3. The chapter has also provided a new methodological starting point for studying the meaning of light rail mobilities - a qualitative, narrative starting point - which is an important contribution to new ways of analysing light rail mobilities as more than a transport project.

POSITION OF THESIS WITHIN THEORIES OF SCIENCE

5

5. POSITION OF THESIS WITHIN THEORIES OF SCIENCE

5.1 PROLOGUE

This chapter positions the thesis within theories of science and is thus central to the understanding of the meta-theoretical starting point from which this research has been conducted. Most importantly, the chapter positions the knowledge contribution in relation to the interdisciplinary mobility approach explained in chapters 2 and 3. This chapter argues for a pragmatic approach to light rail mobilities in which the criteria of practical relevance to the on-going debate has been central for the research design explained in chapters 3 and 4. A pragmatic approach takes its point of departure in a concrete problem or situation, claiming that knowledge and experience should be derived from concrete practical situations and problems. This approach acknowledges that there is not one foundational truth about the world and that the research process is not value neutral. The researcher is not passive, but in interaction with the world and the research field. As was introduced in chapter 1, there are multiple realities of light rail mobilities, which often cause debate as to the usefulness and relevance of such systems. This chapter will more deeply explain how and why these multiple realities can and should be unfolded in order to make these various views on the world more open for discussion, both in the thesis from a perspective of looking to the future. The pragmatist position is furthermore an expression of an urge to interact with the world through the findings in the thesis, and the thesis therefore has an action-oriented perspective providing guidelines on how to include the knowledge produced in future practices in the cross-disciplinary field of making light rail mobilities (which are included in chapter 7).

5.2 DERIVING KNOWLEDGE FROM PRACTICE

The background for this thesis was the urge to understand why light rail as a modernisation of trams is a popular tool in public transport and urban planning and, more importantly, which challenges and potentials exist in implementing such systems in a Danish context. In the 1960s and '70s many of the old tram systems were abandoned in European cities in favour of the automobile. Why is this technology resumed and modernised, what role does it play in cities today and what meaning is attached to the production of light rail mobilities? How can we understand the process of building light rail projects, and what implications does this process potentially have on the outcomes of the project? Why has this mobile technology become a controversial subject between different disciplines, and why are such systems built even though they may seem irrational from an socio economic perspective? Indeed, these are practical questions that it requires assessment of planning practice to answer. In the Danish context there is no pre-existing experience with light rail systems, and learning from experience in other light rail cities provides valuable knowledge that can be integrated in all phases of the decision making and implementation process.

The thesis has been inspired by the practice orientation that exists within the philosophical position of pragmatism. As (Gimmler, 2012) describes, in pragmatism practices are described as collections of practices in which different forms of action are considered as connected to actors as well as routines. A practical inquiry always starts with a puzzled feeling and an indeterminate situation. We inquire when we question (Dewey, 1986). Some of the questions mentioned in the paragraph above may seem naive, since various research and practical reports already exist that provide plausible answers to some of the questions in the light rail debate. I will however argue that following the puzzled feeling provides analytical strength when studying implementation of 'new' technologies since it enables a more in-depth understanding of the meanings behind these technologies. The study of implementation of new technologies demands particular theoretical and methodological considerations that are related to the question of limiting the scope of the study, since light rail mobilities in itself is unstable and consists of multiple realities (Mol, 2002). Through the practical experience of working with light rail it is obvious that the outcome of these projects is dependent on such complex factors as the cultural and geographical contexts, different political objectives, different societal and organisational schemes, different urban structures, etc. Even within different practical disciplines there seem to be co-existing understandings of the reality of light rail technology. Each stakeholder - engineers, architects, politicians, transport operators, passengers, etc. - perceives light rail through her/his own particular skills, habits and histories, and in this sense each view of the world is very different. It is thus arguable that light rail mobilities are performed in very different ways.

One of the best ways to illustrate the multiple co-existing performances and realities of light rail mobilities is by referring to the parable of the blind man and the elephant, which was devised by John Godfrey Saxe in the 19th century. Briefly explained, the story is about a group of blind men who touch an elephant to learn what it is like and describe its characteristics. Each man feels a different part of the elephant, but only one part: the leg, the ear, the trunk. They then compare notes and learn that they are in complete disagreement as to what the animal is, since they have each described the elephant from their own experience in engaging with only part of the animal. Based on their own experience, they have a very clear understanding of some characteristics of an elephant, but they do not share the same reality. This small story is a good metaphor for the multiple realities that can exist around the same object based on the experiences and practices of those who describe this object. The story can be used to illustrate the multiple co-existing realities of light rail mobilities, and, in an ironic sense, we can also adapt this parable into the story of 'the blind man and light rail' (see figure 10).

In accordance with (Mol, 2002) it is thus argued that reality does not have a universal character; instead reality is historically, culturally and materially located. In practice new ways of doing reality are crafted and objects such as light rail can carry new ontologies with them (inspired by (Mol, 2002, p. 75)). This is also why light rail mobilities must be studied in their concrete practical context in order to deal with and understand the com-

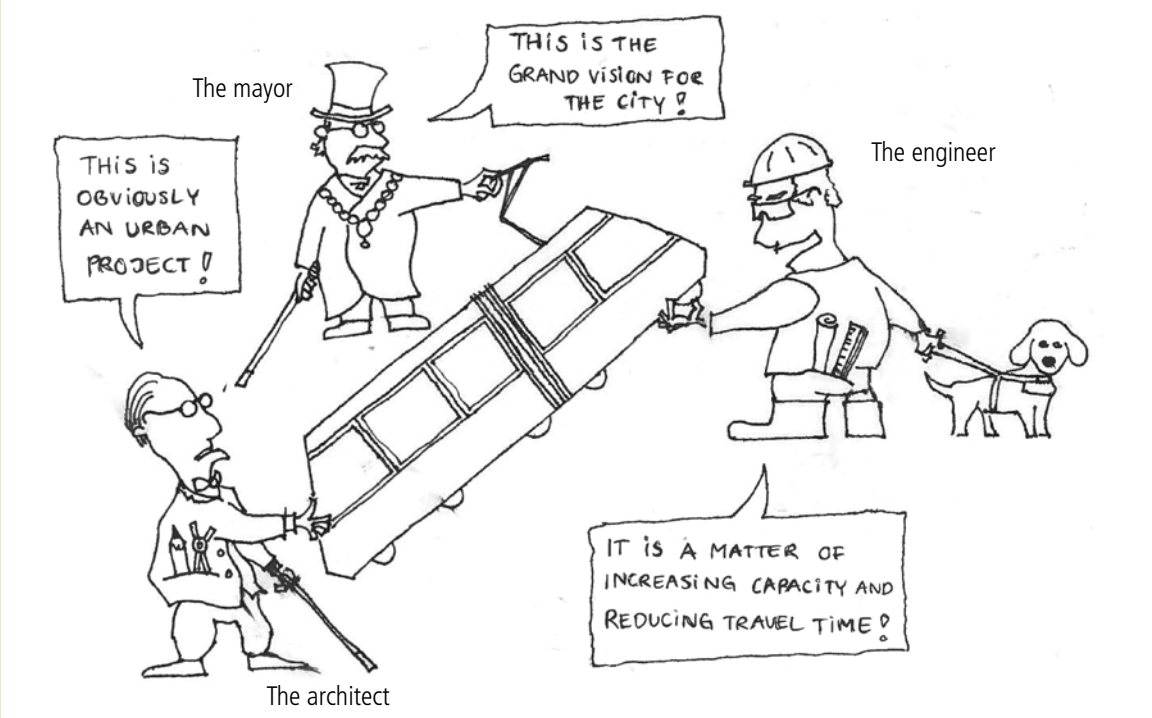


Figure 10: 'The blind man and the light rail' - Multiple co-existing realities of light rail mobilities, here illustrated in caricature by the understandings of the (from left): architect, politician and engineer. Inspired by the parable of the blind man and the elephant. Drawing: Hans Bruun.

plexities of these multiple realities.

Dewey and James (as referred to in Gimmler, 2005) have both argued that inquiry should not be made with the purpose of creating one single description of the world, meaning that although 'absolute truth' and 'real reality' are helpful in scientific investigations, there is a need for alternatives to such a rational scientific approach, as also argued by (Flyvbjerg, 1991). Inquiry goes beyond the facts, implying that it is impossible to push normative values of the study object aside; rather, these normative values should be used as a mean to enrich the definition of the problem. The act of pragmatic inquiry should, however, also be understood as beyond the distinction between the social and natural sciences, meaning that the creative and pluralistic pragmatic approach is more concerned with the problem than with which are the 'right' methods to choose; the methods depend on the problem to solve. A problem could require both causal explanations and normative understandings; the methods to choose should be those that will help solve the problem (as has been argued by (Law, 2004)). However, this pluralistic approach does not mean that anything goes. For doing pragmatic inquiry, Dewey introduces the pattern of inquiry (Dewey, 1991). Dewey's notion of inquiry is understood as a systematic gathering of experiences that takes its point of departure in indeterminate and unstable situations or what has been framed as 'wicked problems' (Rittel & Weber, 1973). Through the act of inquiry, the attempt is made to transform these intermediate situations into determinate and stable entities (Brinkmann, 2006). The definition of inquiry as formulated by Dewey reads: 'Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole' (Dewey, 1986, p. 104).

QUOTE
'Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole'. Dewey, 1986 (p. 104).

Knowledge produced through inquiry should not be understood as 'fixed and complete in itself, in isolation from an act of inquiry' (Dewey, 1998 in Neubert, 2001). As it is indirectly given in the research question (see chapter 1), the hypothesis of the thesis is that in order to understand the production, practice and potential implications of light rail there is a need to approach the practical contextual knowledge around the making of these systems. It is assumed that there is a link between the actual impacts of the light rail systems and the objectives and rationales that were originally used to justify the decision to implement light rail. By applying a 'more than the facts' ideology the thesis acknowledges that light rail as the study object should be understood as a socio-technical assemblage (Urry, 2007; Farias & Bender, 2010; Latour, 1996) of various human and non-human elements that influence the potential impacts such as culture, technology, legislation, politics, actors, discourses, materialities, etc., rather than just a technology and causal mechanism. Some of the key elements in the research question (see chapter 1) can be elaborated to explain the knowledge produced through the approach applied:

- Production and practice is the specific socio-technical constellation of light rail projects in different cities. Which rationalities and policies has been part of framing the light rail projects studied and how has this discursive framing influenced the material

and spatial layout and the implications of the system?

- Light rail Systems should be understood in the sense that technologies are based on socio-technical relations and thus are constellations that link together different human and non-human actors. The socio-technical assemblage consists of culture, technology, legislation, politics, actors, discourses, materialities, etc. that create the basis for our understanding of the implications of these systems in each local context.
- Knowledge is not an objective reflection of reality; knowledge is context dependent and should be derived from practice. Through the thesis questions are asked concerning what is reality and for whom? This is done by departing from concrete practical cases and local know-how, thereby paying much attention to the empirical data collected through policy analysis, field studies and interviews with local practitioners.
- Future decision-making processes indicate that the research produced has an application-oriented focus. The knowledge produced should be operationalised and applied in practice in future decision-making processes.

Instead of answering the 'what happens' question or the 'knowing what' (Bohman, 2002, p. 501), I apply a pragmatic approach in which I will seek to answer the why and how or 'knowing how' (Bohman, 2002, p. 501). This is based on questions of the practical experiences 'out there' in the practical reality.

5.3 ABDUCTIVE REASONING - LEARNING FROM PRACTICE

QUOTE
'all ideas of science come to it by way of abduction. Abduction consists in studying facts and devising theory to explain them'. Peirce, 1997 (p. 218).

Abduction is used as the preferred mode of pragmatic inquiry as reasoning in the collection of new knowledge. This is knowledge 'out there' or know-how in the practical reality that has not yet been defined in completely clear concepts. Where deduction proves that something must be and induction shows that something actually is, abduction merely suggests that something may be (Kirkeby, 1990). Retroduction from critical realism is often considered in association with abduction or abductive reasoning, and the two terms are often used interchangeably. Abduction and retroduction offer ways to describe the mechanisms that may enable social phenomena such as light rail mobilities - these could be sustainable urban policies, regulations, passengers, dedicated infrastructure, stops, vehicles, congestion, the need to move, lack of space in the city, etc. According to Sayer (1992), retroduction is a 'mode of inference in which events are explained by postulating (and identifying) mechanisms which are capable of producing them' (p. 107), and this means that the question of 'What makes this phenomenon possible?' is central to the inquiry. Likewise, abduction is an approach to collecting 'unknown knowledge', or tacit knowledge, which has not yet been described (Kirkeby, 1990). An abductive approach consists in describing empirical facts and allows these facts to suggest relevant theory to describe them; therefore, practices are prior to theories, and the creation of hypotheses and new ideas is the central function of abduction (Peirce, Hartshorne, Weiss, & Burks, 1974). This is what Dewey referred to as 'instrumental pragmatism' (Gimmler, 2005). Peirce (1997) states, 'all ideas of science come to it by way of abduction. Abduction consists in studying facts and devising theory to explain them' (p. 218). Furthermore, it is important to recognise that reasoning always starts with a situation, and the aim of

abductive reasoning is to give a probable explanation for an otherwise not explicable and disturbing fact (Gimmler, 2005). In this thesis this implies looking into the likely dynamics of relations that determine the implications of a light rail project. Abductive reasoning about light rail projects could suggest that it would be likely that the light rail would be considered as more of an 'urban project' than an 'infrastructure project'. However, there would be no claim that all light rail projects are then 'urban projects'. Being an urban project may be a reasonable fact in some cases, where this reasoning proves to be true. This reasoning then has implications for how we should interpret the outcome of such systems and how we should assess success in reaching these objectives.

5.4 NORMATIVITY IN RESEARCH

As stated in the quote (to the right), normativity is unavoidable in the act of inquiry. This is true both in relation to the normative position of the researcher as well as in the normative ideals held by the actors, which are a part of the problem defined in the inquiry. However, in the act of inquiry there is a need to aim for objectivity, transparency, repeatability, systematicness and validity in the way that the data are collected and analysed (Hildeband, 2008). Using collective intelligence - collaborating with people trained in other discipline - brings more perspective to the subject and provides creativity in both qualitative and quantitative ways of approaching the problem (Bohman, 1999). The inquiry posed in this regard places a strong emphasis on the necessity to include a variety of practical experiences and perspectives in order to understand the production and practice of light rail projects. Actors actively shape the ways technologies are used and implemented. Knowledge is a product of processes that cannot merely be described methodologically, but must also be understood as tacit practical knowledge.

QUOTE

'Inquiry is, in fact always done from particular concrete and value-laden perspectives. Each of us brings a "bias" to analysis because we cannot divorce ourselves from the cares and concerns that make us who we are. At the same time, each has the ability (however imperfect) to acknowledge and compensate for the influence our perspective may exercise on our analysis'
Hildeband, 2008 (p. 225).

Dewey understands experience and thereby knowledge as being experienced through something; in this regard, tacit knowledge and aesthetic elements play a huge role (Polanyi, 1958). Experience is layered in three ways: in the tool, in the product and in the performer and it is in the interaction with the material that tacit knowledge is realised (Gimmler, 2005, p. 19). In the planning of light rail systems, many normative ideals are evoked by actors that take part in forming/defining such an object and the problem it is set to solve. These actors bring in different professions and perspectives as it has previously been described in section 5.2. This means that there can be technical performances of light rail mobilities based on routines of engineers, such as technical system design and performance, cost optimisation, construction, etc. Aesthetical performances of light rail mobilities are based on routines of architects and designers such as design of urban space and coherence with architecture and the urban environment, and political performances of light rail are often based on performances such as city image and future visions for urban development. And these performances are not separated; they are related and are intertwined in complex constellations. It is important to uncover these practical performances of light rail mobilities in order to learn from the local experiences gained from different light rail projects. Furthermore, this knowledge is a qualitative contribution to supplement the more specific knowledge of how to model the system, how to consider

specific effects, how the technology works under different conditions, etc. As (Pineda, 2010) has previously argued, there is a missing point in the design of technological systems. This is that there is often little instruction on how to integrate technical knowledge og these system into the development of a project in practice. In order to develop knowledge that can overcome this missing point, this thesis seeks to uncover local tacit knowledge around design and impact of light rails by conducting case studies of four practical examples of light rail projects in European cities and interviewing local actors that possess tacit knowledge of implementing light rail projects. Because of the relatively small sample size and the context-dependent knowledge derived from the cases studies, the outcome of the thesis will be subject to analytical generalisation rather than statistical (as elaborated on in chapter 4).

The research produced in this thesis is grounded in light rail planning practice in many ways: as has been explained, the research questions are approached through practical, context-dependent case studies of light rail planning practice in a European context. At the same time, the thesis is also the outcome of the Danish Business Ph.D. programme where the empirical data derived from this thesis are grounded in Danish light rail planning practice. Here my own normativity as a researcher also plays a role in the research process and the knowledge derived from this thesis. Educated as an urban planner, I bring my own professional skills, habits and worldview into the research process, all of which influence the perspectives from which light rail mobilities are studied as a strategic urban project in this thesis. I have approached the study of light rail mobility by focusing on the complex relations of the city and its mobilities systems. I have had a specific interest in studying the 'how and why' of light rail mobilities. This interest is based on more than the technical and physical features of the city; it is also an interest in the political and cultural production of mobilities. This means that light rail mobilities have been approached from a qualitative perspective with the aim of analysing and understanding the production and practices of such systems.

Furthermore, my position as a business Ph.D. has meant that I have been involved in the practical challenges related to the planning process for Danish light rail projects, which has been inspirational for the problem definition of the thesis and for themes analysed though the case studies. The knowledge produced in the project has been tested and integrated in practice throughout the Ph.D. process. Along with the empirical case studies in European light rail cities, practical experience from the process of implementing Danish light rail projects has been part of shaping the arguments in the thesis (as argued in chapter 4). The knowledge of Danish projects should be considered an important empirical source in the project. The knowledge gained through practice was used to guide the design of the empirical investigations of European light rail projects. This has been an important source for uncovering planning processes and knowledge around implications of light rail systems. Furthermore the knowledge produced though the research process has been used actively in the Danish decision-making process, and this knowledge is thus not a neutral outcome to just describe reality; it is a part of changing reality and practice.

A reality and practice where I have been an actor due to my position as a business Ph.D. and engagement in the Danish light rail planning (see also chapter 8 for future methods to use in planning practice based on the findings in the thesis).

The Danish light rail systems are all in the preliminary stages of the process. Therefore I have primarily been involved in the process of framing and evaluating the projects and have been less a part of the materialisation and operation of the systems. Through empirical investigations it has been possible to gain experience with materialisation and operation. Since light rail is a highly political subject, it is a challenging and complex research topic that can be approached from many viewpoints. By studying light rail mobilities in its concrete situation, it is thus possible to see light rail in relation to the city, its mobilities systems, politics, cultural practices and spatial dynamics. In this way it is possible to discuss the practical outcomes instead of the qualities of the specific technology. By creating a qualitative framework to understand the relations that constitute light rail projects, decision makers are able to understand the relations that have been a crucial part of creating successful or unsuccessful systems. More importantly, they can be better informed in order to define the criteria of success for the system and design the systems in such a way that they will accomplish these goals.

5.5 THE ONTOLOGICAL AND EPISTEMOLOGICAL ORIENTATIONS OF THE PROJECT

The thesis is, as described above, inspired by pragmatist thinking and especially by Dewey's understanding of nature as 'events' rather than foundational truths (Brinkmann, 2006). This means that reality should be understood as ever-changing dynamic processes and practices. In relation to the thesis, this means that light rail mobilities should be understood as a relational and dynamic analytical object. There is not one solution to building light rail mobilities, but multiple, as has been previously argued (see also chapter 3). This means that knowledge is acquired through interaction with the world, through social practices in specific contexts where practical knowledge emerges from specific situations (Jones, 2008). A central claim of pragmatist theories of knowledge is that epistemic claims are embedded in a practical context with practical problems or challenges, which, to a large extend, determine relevant standards of justification and conditions of success. This can also be referred to as the 'practical turn' of epistemology (Bohman, 2002, p. 499). John Dewey (1948) advocated judging an idea by its consequences, bearing in mind that this does not imply only assessing concepts or theories in terms of usefulness or instrumental value. It rather means to see these within a normative context and acknowledging that knowledge is normative and that it aims at helping us to realise normative ideals. A pragmatic approach is applied in order to analyse the practical relations and implications of light rail. In this regard it is possible to analyse how light rail systems were framed, which normative ideals were involved, how they materialised and how they influenced the urban environments and mobility systems in the context in which they were implemented. The future-orientation of the pragmatic approach (Gimmler, 2005) is the very core of the results presented, where the qualitative knowledge produced around the

system of light rail mobility should be put into future political and planning frameworks for light rail systems. The concepts derived are thus not only results of past experiences with light rail projects; they should also be recipes for further action.

5.5.1 Ontology

Actions are always embedded in a web of experience. This makes it necessary to conceptualise everyday life from a viewpoint of actions, communicative as well as instrumental (Gimmler, 2005); this means that knowledge is contextual and deeply embedded in practical experience. In a pragmatic sense there is no ontological truth: 'truth claims are forced to be tentative and revisable' (Thayer-Bacon, 2002). The ontological notion of symmetry introduced in Actor Network Theory (ANT) describes the need to break with the ontological differentiation between the social and the material, what has also been called a flat ontology (Brinkmann, 2010) (see also chapter 3). The flat ontology in the ANT approach has been criticised for adding the same value to both humans and non-humans (Ingold, 2008). This should however not be considered as humans and non-humans are completely equal on an ontological level. Gimmler (2005) frames it as the 'material turn' in social sciences and the acknowledgement of the social importance of artefacts in our everyday lives (Gimmler, 2005). The relations constituted between human and non-human actants enable the stabilisation of given phenomena in a given period of time, as is the case with light rail projects. Light rail as a non-human actant has become a powerful tool to develop the normative ideal of 'the good life in the city' and in many ways materialises the many current discourses related to this ideal. In order to understand the subject of light rail mobility ontologically I will argue that social, material and spatial relations are equally important and that this involves a wider understanding than just the technical sides of such systems. The distinction between subject and object is, however, not only to be understood as ontological but also as epistemological and methodological, meaning that pragmatists acknowledge these two spheres differently and this affects the ways that science is done.

5.5.2 Epistemology

Technical knowledge of light rail mobilities is valuable in 'knowing that' (Bohman, 2002) there are different capacity standards, curve standards and power supply systems. These could be considered the general technical standards of light rail. Practical knowledge - 'knowing how' (Bohman, 2002) - of the process of implementing such systems in a city can provide insight into the political, cultural and spatial challenges of implementing such systems. These could be considered as the contextual factors of implementing light rail. Due to the different assemblages of political, cultural and spatial relations in each city, it is harder to standardise this practical knowledge; however, practical knowledge is valuable in understanding how light rail mobilities are produced and practised in various contexts. In pragmatism the traditional representationalist way of understanding knowledge and experience as representing something in the world or representing a particular foundational structure of the world is criticised, and a non-representationalist approach is offered. The representationalist epistemologies, such as the empirical analytical sciences,

are systematically devaluing the practical 'know-how' in favour of a privileged and fundamental 'know that' (Bohman, 2002; Gimmler, 2005). Through the pragmatic approach it is claimed that there are no a priori foundations for knowledge and inquiry as there are no fixed truths, objectives and universal laws or facts. Foundations for our knowledge go beyond this, and are also referred to as non-foundational (Gimmler, 2012). This entails that theory and methods are not objective representations of reality; we use them because they may be useful practical tools in investigating our research questions. Theories are narrative tools that can be used to work with the richness of the unfurling world: 'theories are tools, metaphors to be used if we feel they are useful to us. They are not tools for revealing the world but for intervening in it' (Jones, 2008, p. 1601). The schemes we have, our language and thoughts determine the way we analyse the world. This means that there is a plurality and creativity in the available theories and methods used to answer the research question. Thus the value of theories and methods is to be understood in their practical implication (Bohman, 2002). There is thus no a priori superiority of one method over another (Gimmler, 2005). The epistemological stance in pragmatism is thus to focus on practices and not on the discovery of scientific laws. This thesis does not aim for any objective universal truth of light rail mobility; it contributes to practical methodologies for understanding light rail mobility qualitatively from a strategic perspective that has its point of departure in the concrete practical situation (Jones, 2008). Furthermore, it has an orientation towards interacting with practice through application. Four different cases of light rail projects form the empirical basis for the thesis, acknowledging that this practical knowledge about light rail systems is non-foundational. It should thus be understood in the concrete situation and be subject to an objective that is relativistic, meaning it adheres to no standards beyond human activity (Hildeband, 2008).

QUOTE
'theories are tools, metaphors to be used if we feel they are useful to us. They are not tools for revealing the world but for intervening in it' Jones, 2008 (p. 1601).

5.6 EPILOGUE

This chapter has argued for a pragmatist position of the thesis within theories of science that goes beyond the distinction between natural and social sciences. There is a need for normative values to enrich the problem defined, and the aim of objectivity is neither possible nor ideal. Applying a pragmatist approach entails that problem definition is prior to 'the right' theories and methods to choose. Theories and methods are simply tools that provide possible explanations to experience. It was argued that light rail mobilities are performed through multiple co-existing realities and that these realities are central to understanding how actors shape the ways light rail technologies are used and implemented in various contexts. Therefore, it has also been argued that reality is historically, culturally and materially performed and contextual knowledge is central to the understanding of making light rail mobilities. The production and practice of light rail mobilities should therefore not be studied from a distance; it should be studied in concrete contextual situations. Finally, this chapter argued that abductive reasoning has been central in the research process - not arguing that something is true, but that something may be true under certain given circumstances. In this sense, an abductive approach was applied to understand the mechanisms that enable certain phenomena such as light rail projects.

CASE ANALYSIS

6


9 Wabern
654
BAUHAUS
www.bauhaus.ch
BAUHAUS
www.bauhaus.ch

6. CASE ANALYSIS

READING GUIDE

This chapter contains the analysis of the four cases, which form the empirical backbone of the thesis. The cases are chosen to represent a variety of contexts and practices of light rail mobilities, as elaborated in chapter 4. The cases are analysed in the following order:

- Case A: The Bergen light rail project - Norway.
- Case B: The Angers light rail project - France.
- Case C: The Bern West light rail project - Switzerland.
- Case D: The Freiburg light rail project - Germany.

At the beginning of each chapter, the interviewees' names and professions can be found. Furthermore, each case analysis begins with a narrative describing the arrival scene in the city to provide a mental picture of the case. With the exception of the quotes from the interviews in Freiburg, Bern and Angers, citations used in the case analysis are translated into English from the French, Norwegian and German. The case analysis is structured according to the analytical model introduced in chapter 3. This means that the cases are first analysed with regard to the discursive and institutional dimension, focusing on the genesis of, the vision for, and the policies and plans behind the projects. More specifically, the focus is on the discursive production and 'meaning' of each light rail project and the dominating discourses that have guided the decision-making process and been institutionalised in the later planning and implementation of the project. Visual representations of the project are also included in this part. Furthermore, timelines with the key events that led to the implementation of the light rail project are provided in order to illuminate the historical and cultural conditions under which the project was produced and how the dominating discourses might have changed during the process.

Secondly, the cases are analysed with regard to their material and spatial dimension, focusing on the planning and design concept behind the system. The focus in this part is on analysing how the central discourses have materialised in the conceptual approach to the system, as well as how the light rail integrates with different districts in the city. The implications of the light rail in the city are described through a spatial analysis using pictures and maps to illustrate some of the central design concepts as well as the material and spatial layout of the system in the city. At the end of each case analysis, a summary of the central findings can be found. Cross-case comparisons are found in chapter 7. Figures included in the case analysis is consecutively numbered in each case, and does thus not related to the numbering in the remaining chapters.

FIGURE:

Ligh rail station in Bern city centre, with a glass roof connecting the train station and the light rail stop (Photo by author).

CASE ANALYSIS
BERGEN LIGHT RAIL

6A

FIGURE 1+2: First impressions of Bergen light rail. Above: the city located in between the mountains. Below: the Station Byparken in the city centre (Photos by Author).

BEST IN THE WORLD

PROLOGUE

I arrived in Bergen on a rainy day in May. From the plane I could see the mountains between which the city is located; the city has developed in a radial urban structure due to this location. Many large infrastructure elements - bridges and highways - are present in the landscape, reminding me of the man-made attempts to access these natural environments and creating possibilities for the city to sprawl. Smaller paths lead to houses in the middle of no-where, in the most beautiful location towards the fjord. I can understand why people want to live in such a remote place with so much natural beauty. From the airport I boarded the bus, which took me directly to the city centre. I remembered that the light rail is intended to run between the city centre and the airport in its third phase, providing a new corridor from the city to this international node. After settling in at the hotel I went directly out to find the famous new light rail. I looked at my map to find 'Byparken', which is the final destination of the light rail corridor connecting the suburb of Nesttun with the city centre. Walking towards Byparken I noticed the overhead wires that provide the power supply for the trolley bus lines. They reminded me of Bergen's history as a tram city. The overhead wires indicated that not all elements of the tram system were scrapped when the old tram was closed in the 1960s. The Bergensers are used to the visual impact that these wires make in the urban environment since it has become a part of the scene. I made a left turn and was suddenly there, at the end station for the light rail. The stop 'Byparken' is next to a beautiful park full of flowers and a fountain. I could see that the street environment is fresh and new. The light rail trace is paved with cobblestones to fit the atmosphere of the old city centre and the station has a Nordic design with straight lines and visual simplicity. The visually identifying characteristic of the light rail vehicles, their dark orange colour, is also integrated into the station, creating a landmark for this new central node between the city and the suburb. The name Bybanen is placed on top of the station, indicating that this is an urban transport mode and city project. (See figure 1 and 2 for first impressions, and figure 3 for map of the light rail corridor).

As argued in chapter 1, the political and spatial embeddedness of light rail mobilities is important to understanding the strategic perspective of such projects. Seen in relation to the research question stated in chapter 1, Bybanen in Bergen is a case of the highly controversial political topic of how to develop the city with a future-oriented perspective. The analysis of Bergen light rail presents a case of two choices for future urban development: business as usual, where the rational choice is to predict future demand for traffic and provide the necessary and cost-optimised solution, or moving in a totally different direction and focusing on transit-oriented development by reintroducing a light rail system. As will be shown in the case analysis, Bergen light rail started as an environmental project intended to compete with car traffic in travel speed by providing fast access to the city centre and few stops. But before it was accepted politically it was transformed into an urban development project providing new corridors between the city centre and the sub-

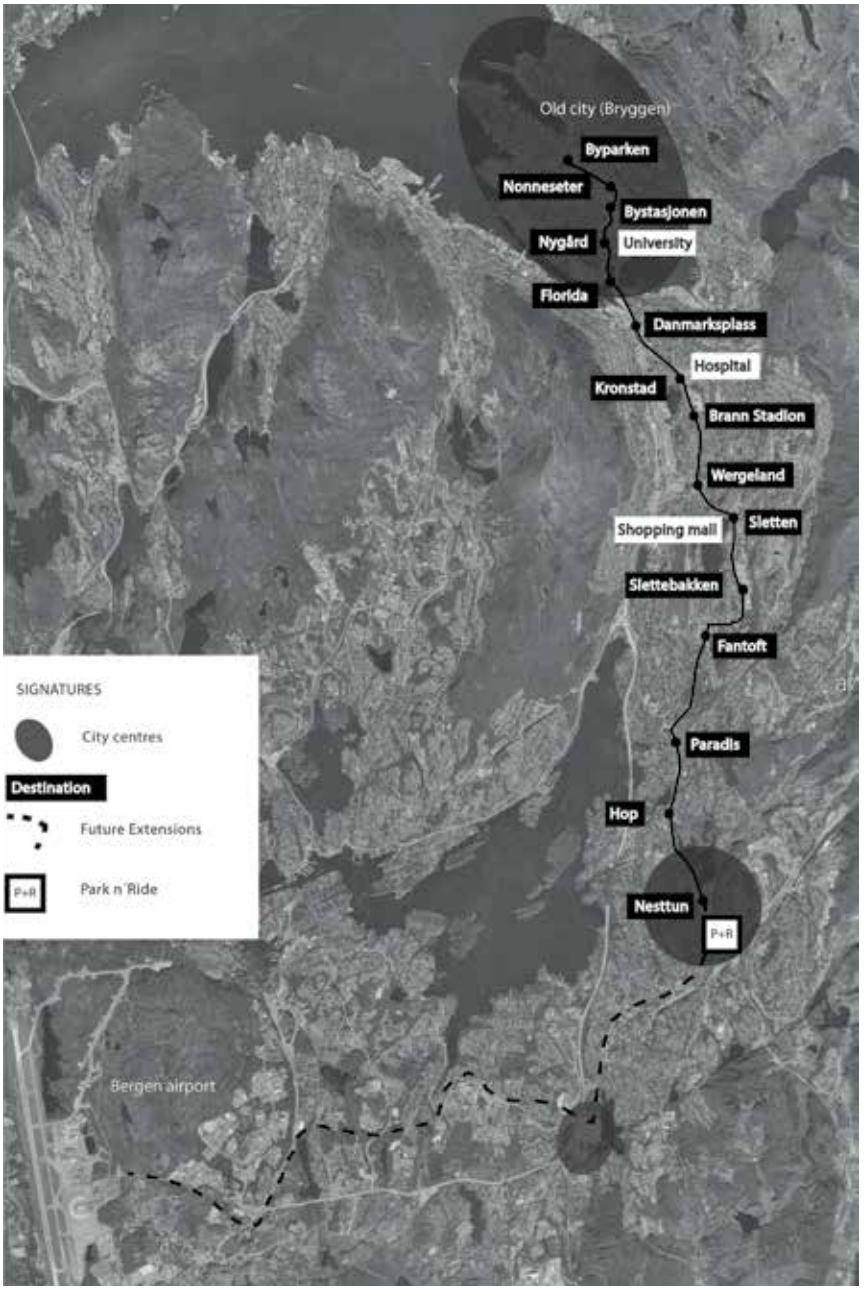


FIGURE 3: MAP OF LIGHT RAIL CORRIDOR

The light rail corridor from Bergen city centre to the Suburb Nesttun - included are indications of further extensions towards Bergen Airport (Background map Google).

urbs and a new brand for the city. This meant that accessibility to core urban destinations and integration with the urban environment were prioritised over fast travel speeds. This point is important to understanding why the spatial and material layout of the system is built as it is today. The case analysis will provide examples of the political and cultural production of Bergen light rail and the many competing rationales and realities that influenced the decision-making process. Furthermore, it explains how the final decisions on implementation of the light rail as an urban development project is reflected in the material and spatial layout of the system today. The main findings of the discursive-institutional and the material-spatial dimensions, as well as reflections on the process, are summarised at the end of the analysis using the dimensions of the analytical model that was introduced in chapter 3.

QUOTE:
"this is a project for generations to come whatever it might cost".
Gunnar Staalesen, in Vollset (2007).

THE DISCURSIVE AND INSTITUTIONAL DIMENSION

Bergen was the first city in Norway to implement a modern light rail system. It opened in June 2010. Being a pioneer implies not only having to fit this new infrastructure into the physical surroundings but also having to frame it politically and discursively and fit it into policies and the minds of decision makers. This may also explain why this is a case of a politically controversial subject of two very different rationalities and realities: the economic and technical rationale and the urban and aesthetic rationale. The case analysis is thus especially centred around unfolding the many conflicting discourses and realities produced in the decision-making process, since this is one of the central findings of this case. This discursive and institutional dimension is followed by an analysis of how the winning discourses have materialised in the spatial layout of the system and provide a framework for understanding the central implications of the material and spatial concept for the light rail project.

Interviewees in Bergen were selected according to the criteria introduced in chapter 4. The interviewees were identified and contacted through a snowball sampling method and were chosen to represent a variety of perspectives on the project. Arne Sortevik from the conservative party, Fremskridtspartiet, was not available for interview. However, since he was one of the major opponents of the project, his perspective is important, and a review of newspaper articles in which he states his position is used to represent his perspective. As explained in chapter 4, Bergen is also the case that has been studied to the greatest depth, and therefore the number of interviews is greater than in the other cases.

The people interviewed in relation to the Bergen case were:

- Thomas Potter: Chief Engineer of the light rail project, previously employed in an engineering company, Taugbøl and Øverland, where he took part in one of the initial proposals for a light rail project in Bergen in 1989. He was a central figure in the genesis of the program, in shepherding it through the controversial decision-making phase.
- Håkon Rasmussen: municipal planner, responsible for the spatial integration of the light rail project; also part of the municipal light rail office, which was a taskforce

PROJECT OVERVIEW (FIRST LINE - BYPARKEN - NESTTUN)

OPENING : June 2010

LENGTH: 9,5 km

STOPS : 15

AVERAGE SPEED: 28 km/h

TRAVELTIME: 21 Minutes

MAJOR DESTINATIONS:

PUBLIC TRANSPORT SHARE: 18% (2012)

FREQUENCY: Every 5 minutes during peak hours

PASSENGER LEVELS: Estimate 26,000 pas. /day (actual 2013 is 31.000 pas/day)

PRICE: Around 270 mio. euro (2007 prices) 27 mio euro/km

Paradis: 100 homes + offices and retail space. **Fantoft:** renewal of student housing from the 1970s + 77 new homes. **Wergeland:** redevelopment 400 new homes + 14,000 m2 offices and 8.500 m2 retail space. **Bystasjonen:** new housing and offices. **Kronstad:** Educational facilities 4.400 students and 570 employees. **Nygård:** 17,000 m2 retail space + businesses. **Florida:** the largest construction site to be developed until 2020 branded as 'the good life in the city'. **Danmarksplass:** new hospital 11,000 m2 + 3,500 new workplaces (50,000m2) + retail space. **Nesttun:** new cultural centre with smaller shops + 450 new homes under the concept of 'Plus Living', with services, community activities, and safety systems. Nesttunhagen: a project with 19 new homes.

FIGURE 4: Overview of key figures of Bergen light rail project.

FIGURE 5:
Bryggen in Bergen. Old wooden houses on the UNESCO world heritage list. There are plans for future extensions of the light rail along Bryggen (Photo by Author).

assembled to implement and coordinate the plans for the light rail project.

- Gunn-Vivian Eide: politician for Hordaland Venstre, head of the urban planning department of the local government from 1995-1999; a principal player in getting the light rail project 'back on track' when she created the initial model for financing the project through road tolls.
- Karl Inge Nygård: planner at the public transport authority SKYSS, responsible for operation of and marketing/communication for the system; provider of knowledge about the operation of the system today.
- Magnus Vollset: historian, Bergen University, author of the book 'På sporet av Bybanen in Bergen', an historical piece on the development of the public transport system in Bergen and the political process behind the Bergen light rail project.
- Marit Warncke: managing director at the Bergen business council; an institution whose position on the light rail project transformed from that of sceptic to strong lobbyist for it.

The Genesis of the Project: A Controversial Theme

The light rail was the most heavily discussed project in Bergen in a fifteen-year period (Vollset, 2007) (see figure 6 for timeline with key events). The political process was so interesting that it was documented in the book 'On the Track of Bergen Light Rail', written by the historian Magnus Vollset of Bergen University. A famous local writer, Gunnar Staalesen, wrote the preface of the book, which captures the societal trends that influenced the project and the various realities enacted through the decision-making process. He writes:

'This is a project for generations to come, whatever it might cost. In the 1970s the politicians didn't dare to take the big decision. The plans for a light rail were abandoned. Instead, the city was left to the cars. We see the result today: massive air pollution and endless car queues during rush hour. A new generation of politicians - or at least most of them - have realised that the ideas from the 1970s weren't so bad after all. A few years ago something started to happen. In the heavily discussed 'Bergensprogrammet', the light rail has a very central part and is a crucial factor in the solution... in the next ten years the light rail should be extended in all directions.… This is a future-oriented politic. I would dare to say that future generations will thank us for this. This book tells the history of the project that is now finally starting. This is old wisdom: to know the past is the best prerequisite to build on in the future'. (Vollset, 2007, p. 5) .

Gunnar Staalesen is an obvious proponent of the light rail. He describes the light rail as a project for the future. In this way he places the project in a much broader context than a simple transport system, making it a resource for future generations - a discourse that was central to the entire decision-making process. The text from the preface provides a good picture of how the project has been framed and reframed throughout the process and how the discussion around the project has shifted from different transport solutions to the liveability of the city for future generations. In the epilogue the author, Magnus Vollset, concludes:

'The Bergensers care for their city; therefore they care for the light rail. No other project has caused as much debate. Some claim that the car has come to stay, and hence conclude that the solution is more roads that can be used by both cars and busses. Others claim that there is no space left in the city for more roads, and the light rail is the only public transport system that in the future will be able to compete with the car. The battle is between asphalt and rail. Very conveniently, the politicians chose the compromise with both provides a ring road, and the start of the light rail project'. (Vollset, 2007, p. 148).

QUOTE:
'There is a problem with the term light rail, and we try to use it because we don't want to use tram, because there is a lot of historical opposition to it (Reserach interview Thomas Potter).

Both the preface and the epilogue set the scene for the genesis of Bergen light rail, which was an ideological struggle between very different visions for the future development of the city. As explained in chapter 3, the case analysis explores how different rationalities were enacted through this political process, which values were considered the most important in the political process, and which discourses finally got the project moving.

In June 2010 the Queen of Norway opened the first light rail line in Bergen. It was a symbolic day, since proponents of the light rail had worked long and hard to reach to this point (Vollset, 2007). Bergen is the second-largest city in Norway, with approximately 260.000 inhabitants (Bergen Kommune, 2013). With the opening of the first line, a stretch of 9.8 km with 15 stops connecting the city centre with the suburb of Nesttun, it became the first Norwegian city to introduce a completely new light rail network. The second stage of the light rail, running to the shopping centre Lagunen, was opened in 2013, and the last stage, to the airport, is planned. There were also on-going discussions in 2013 about integrating the light rail further to the north of the city, directly through the most sensitive old part of the city, Bryggen, which is a UNESCO world heritage site (see figure 5). These discussions continue with the same opposing viewpoints as existed in the planning of the first line: is it an urban project that should be integrated into the street environment in Bryggen, or is it purely a transport project that can run in tunnels under Bryggen? It has been described in the local newspaper as a battle of symbols, history and beliefs (Kvile, 2013). Like many other cities, Bergen closed its tramlines in the 1960s due to the introduction of the automobile. The old tram took its last trip in Bergen on New Year's Eve in 1965, and on the 14th of January, 1966 the tram was dumped in the fjord in order to attest to the beginning of a new era (Vollset, 2007; Research Interview, Håkon Rasmussen). Since then, proponents of rail-borne urban transport have argued for the need for a new rail-borne transit system. The chief engineer Thomas Potter explains this process, and the issues that the history of trams carries:

'(…) there is a problem with the term light rail, and we try to use it because we don't want to use tram, because there is a lot of historical opposition to it(…)all these projects, all the new light rail projects or new tram projects, over the entire world, are built 40 years after the original systems was closed. And there is a real interesting reason for that. It is because the people who were empowered and made the decision to close down are no longer relevant", they might still be alive...but they are not in power and their friends are not in power (…) they also had loyalty to the people who made that decision, so there was an awful lot of opposition and you had to wait for that opposition to die - Literally!

And to fade away, because when you come with a project like this, the people who were behind closing it (red. the old tram system) down, they take it as an insult. Like: "Oh you are saying we should not burst it down". No, forget that time, maybe that was the right decision. But they take it personally. So we had an awful lot of opposition from people who worked for former mayors (…)' (Research interview Thomas Potter).

The project is indeed inscribed in the history and culture of the city and mobilises many emotions. It is a hard historical load to carry, especially in a changing society wherein new transport priorities are replacing old ones. Since the last tram was deactivated and dumped in the fjord in Bergen in 1965 (see figure 7), the need for the establishment of a new urban rail borne transport system has been problematized politically and publicly, and many different alternative public transport solutions have been presented (Vollset, 2007). The various dominating discourses are analysed by theme in the following sections.

The Environmental Discourse

In the 1970s and 1980s, increasing automobile traffic began causing problems in the city, such as congested roads, lack of accessibility, environmental hazards, and time delays (Vollset, 2007). For the environmental movement in Bergen this prompted the discussion of 'the liveable city': How should the city develop in the future, and how should space be prioritised? (Research Interview Håkon Rasmussen). In 1981 Bergen introduced the urban strategy of 'Gatebruksplanen,' a way of dealing with inadequate space. Its argument was that car-oriented planning had ignored public transport, cyclists and pedestrians, and that it was necessary to change this focus. In 1989 the Environmental Union in Bergen proposed the idea of re-establishing a rail borne solution in Bergen. The rationale behind the light rail idea was supported by the environmental discourse that was particularly strong in Bergen, where an important meeting in the Brundtland Commission was being held concurrently with the launch of the light rail idea (Vollset, 2007). The light rail idea was presented in the report 'Bybanehøringen 89', which introduced ideas and experiences from light rail projects in both Europe and the USA as a possible solution for Bergen. International experiences were important to the project since they served as practical experiences and created alliances for the light rail solution. As a reference point, the first reintroduction of modern trams in Europe happened in Nantes in 1985 (Groneck, 2003). This had a great influence on the tram renaissance in Europe in general, and particularly illuminated tram vision as a solution to the problems Bergen was facing (see chapters 1 and 2).

QUOTE:
Right about that time Grenoble (France) had opened. And that was a tremendous success, not just as a transport project, but as a city development project, because it was really pretty. It had a very little, nice amenities in the centre of town, bicycle paths and artwork and fountains and all those things. So, some people had seen that, and we used that to try to sell the system (…)' (Research interview Thomas Potter).

The arguments introduced in 'Bybanehøringen' were based on international experience showing that a light rail solution would be cheaper than a suburban train or metro and would also result in environmental benefits, as well as a more regular and reliable transport system not affected by car traffic. Furthermore, the light rail would save space in the city. The main rationale behind this report was to show that the solution to the problems facing the city was not to build more roads but to look for more efficient alternatives that made it more difficult to use the car in the city (Vollset, 2007). The report, and its timing,

FIGURE 6: Timeline with key events that led to the implementation of Bergen Light Rail.

was a major factor in putting the light rail back on the political agenda in Bergen. Thomas Potter the chief engineer of the light rail project has been a recurring actor in the process. At the time Bybanehøringen was launched, he worked as a consultant at the engineering company, Taugbøl and Øverland and made the proposal to the Environmental Union. He describes how the initial project was formed:
'(…) the modern Bybane, the last one, the one that actually went through started in about 1987-1988. That was when the first project was launched. In Norway that time it was difficult time for consultants, we had a little bit of recession here. So I worked for a consultant company (…) and we put together a brochure, which I have some place, trying to push the idea of light rail systems. Just, while we certainly believed in it, but is was more to get consulting work (…) but then the city became interested. The city council; we sent the brochure to all the members of the city council, and some of them thought this might be an interesting idea and we saw... Right about that time Grenoble (France) had opened. And that was a tremendous success, not just as a transport project, but as a city development project, because it was really pretty. It had a very little, nice amenities in the centre of town, bicycle paths and artwork and fountains and all those things. So, some people had seen that, and we used that to try to sell the system (…)' (Reserach interview Thomas Potter).

The consultant company managed to present a project that received support from the city's politicians. Political support made the idea of a rail-borne transport system a realistic project for Bergen, more realistic than any of the alternatives that were previously suggested. The spatial referent in Grenoble, France was a physical manifestation of what the tram might to do for the city; thus these urban development effects (visual expression, reduction of car traffic, new public spaces) greatly influenced the framing of the project later on. It was not only a transport project but also an urban development project. This had an impact on the name of the system; instead of light rail, which was used in many other spheres, the system was called By (Urban) Rail, which characterised the system as something beyond transportation. The Environmental Union was not pleased with the shift to the urban focus in the discussions since this meant that the light rail would have more stops, slower travel speeds and run in the most urbanised corridors (Vollset, 2007). The rational of the Environmental Union was that light rail should provide an efficient public transport network that could serve as an attractive alternative to the car, i.e., getting people from A to B as fast as possible. Therefore it was important that the location of the tracks would provide high speed for commuters by using direct lines. The light rail should therefore have a limited number of stops to be able to compete time wise with private cars. This argumentation did not fit with the views of many planners at the municipality, who argued that the light rail should be an urban project. They thought it most important for the light rail to integrate the system into the urban environment and allow frequent stops at the relevant urban destinations (Vollset, 2007).

Even though the conceptual approach behind the light rail project shifted from involving mostly environmental concerns in the 1980s to having a wider focus on urban develop-

ment, the environmental considerations still influenced the decision-making process in the later periods. Bergen's location between seven mountains and its proximity to the sea has, in some years, allowed the smog to lie as an unsavoury duvet; a visual reminder of the downside of increasing personal car traffic (Research interview Håkon Rasmussen). The picture found in figure 7 was used in the political process and became an important argument for the need to shift planning towards more sustainable modes, including the possibility of constructing a light rail. The environmental discourse was however not the main rationale behind the light rail project; the primary argument was to use the light rail as a strategic tool in urban development and facilitate a higher use of public transport in the dense urban corridor. Thomas Potter explains the ideas behind the perspectives that were adapted:

'(…) to be honest here, we never thought that the Bybane (read Light Rail) was going to solve environmental problems in the short term. I worked on a plan, a strategy. It was called a Strategic Plan for the County and for Public Transport. And at that time we came up with this concept of you can't get public transport to everybody. Because there are people in Bergen who want to live in distant valleys and they want to work in distant places. (…) So you actually have to pick the areas where you are going to have a good public transport system. So basically we divided the city into 3 zones. Where you had an area where public transport could provide all of the transportation services throughout the week. And that we called the 'collective city'. And basically it's the centre of town and certain access (…) so if you live in those areas you should expect that you have public transport available to use throughout the day. And that means you can buy an apartment or house, whatever, and, it assumes of course that you have a job that is in the same area, and give up your car (…) the second area would be the area where you take the car to work. And that could be either that you have feeding busses, or you would have park and ride, so people can drive to a terminal (…) public transport could replace your second car (…) And then we have the outsider, where the only public transport was basically for socially welfare (…) it's more about modal shift. That's the major rational (…) if you evaluated the first ten kilometres it properly would not look so good on paper. But it's the long term and the next stage of Bybanen that will make more sense (…)'. (Reserach interview Thomas Potter).

In this statement Thomas Potter the chief engineer of the light rail project articulates the importance of a network in order to get the full benefit of the new public transport system. Many of the actors in the process talk about light rail being 'the backbone' of the public transportation system. Marit Warncke managing director at Bergen Business Council describes how the light rail is the 'backbone' of the network:

"The discussions around the decision to build the light rail in Bergen were very much based on the economic basis of the project. Should you use so much money on a rail system with a dedicated routing compared to what you could get for the similar amount of money through other solutions, but now the decision has been that this should be the backbone of the public transport network". (Reserach interview Marit Warncke).

The backbone metaphor is important to understand the role that the rail infrastructure has played in the decision making process and the choice of a light rail system. It is also institutionalised in many planning documents amongst others in the municipal plan, the design guidelines, technical reports, power point presentations etc. It has furthermore been supported by the 'string of pearls' metaphor which connects new urban development projects to this backbone (see figure 21).

Economical Profitability - Choosing the Right Technology

One dominant discourse in the decision-making process was linked to the economic profitability of the project, which created a debate of how to value transportation and get the most transportation for one´s money (Hartmann, Lampe, Monsen, & Prestmo, 2006). The debate also included whether or not the light rail was the best technical solution to fit the needs and problems of the city, and whether it was a good value for the money from a socio-economic perspective (Hartmann, Lampe, Monsen, & Prestmo, 2006). The Highway Department, which is a regionally located national authority (Statens Vegvesen, 2013), and the right wing party 'Fremskridtspartiet' were especially involved in this debate and, became dominant actants that managed to mobilise public and political support against the light rail project. Håkon Rasmussen planner at the municipality describes the major obstacles in the path of the project:

'(…) it has been a tough battle to carry the project out. There were two main arguments that were used, one was that there was no need for a light rail system because a bus could solve the problem. The other argument was the financing and the fact that it was not popular that money collected through tolls should be used on public transport(...)'(Reserach interview Håkon Rasmussen).

Thomas Potter Chief Engineer of the rail project describes his view of this conflict:

'(…) people who want roads always argue for busses, not because they want busses, but because they want roads and busses go on roads. So build a nice highway network and everybody benefits (…) Road toll it's properly the biggest negative to why people are against the project, because the highway users are the ones that are paying (…) the right wing wanted roads and left wing wanted public transport. Ultimately, they said "We'll compromise: 50% roads 50% public transport". That's what the Bergens' program is. And it's, it's both its strength and its weakness. So the conservatives had to accept the light rail, in order to get their roads, and the left wing had to accept roads in order to get the public transport. And that's the only thing that really kept the thing going because the people in power, the person who now is the leader of the city council in Bergen she….if our project had disappeared or if she could find a good reason to kill it, she would be very happy to have done it. But because of this political compromise she really couldn't attack it. She couldn't do anything active. She could sit there and wait passively for it to kill itself, but she couldn't do anything to attack it (…)'(Reserach interview Thomas Potter).

QUOTE:
Then we must use municipal resources to cover the operational deficit of the light rail; this means that there will be less money for schools and hospitals. Experiences from other countries show that it is difficult to operate such transport systems without a deficit' (Sortevik in Bentzen, 2008).

Based on traffic model calculations the Highway Department argued that the light rail project could not cope with the increasing congestion; new roads had to be built to meet the future demands and likewise socio-economic calculations showed that the light rail project was far too expensive. They viewed the most cost effective solution as introducing more busses when new roads were built (Vollset, 2007). Furthermore a main reason for opposing the decision to build a light rail was that the proponents of the light rail system proposed financing the light rail project through transferring revenue collection from road tolls to a public transport project (Research Interview Thomas Potter). Arne Sortevik from Fremskridts Partiet was a dominant actor in opposing the light rail system, which he saw mainly as a prestige project and argued:
'Both the Highway Department and the Research Institution TØI has made objections which have been neglected. There are furthermore elements that have not been included in the calculations of costs (…) the responsibility for operation is placed in the Municipality. Then we must use municipal resources to cover the operational deficit of the light rail; this means that there will be less money for schools and hospitals. Experiences from other countries show that it is difficult to operate such transport systems without a deficit'(Sortevik in Bentzen, 2008).

This coalition of actors argued that congestion should be solved by building a new roadway infrastructure, and primarily proposed Ulrikstunnel, a tunnel that bypassed the city. Originally the intention of the road toll in Bergen was to finance a road infrastructure project, making it controversial when proponents of the light rail project in the 1990s suggested that some of these funds be allocated to public transport. It was, however, necessary to secure financing of the light rail project locally since the state was reluctant to support the light rail idea financially.

Financing for the light rail project was secured by a political agreement in 2000 called 'Bergens Programmet'. The agreement allocates 12.7 billion N.kr to road and light rail in Bergen between 2002-2025 (Statens Vegvesen; Bergen Kommune; Hordalands Fylkeskommune, 2013) and was a compromise in which the new road projects, the light rail, and public transport as well as pedestrian and bicycle initiatives were prioritised. Different political prioritisations of road and public transport were mobilised through the process, and therefore, the finance package ended up as a compromise between public transport and road infrastructure, which exemplifies the competing rationales in the decision-making process. In the end, road tolls are partly financing 'Bergensprogrammet' (Research Interview Gunn Vivian Eide).

It is obvious that the Highway Department played a central role in the debate on light rail in Bergen. Their rationale was rooted in traffic modelling with time savings and construction costs as the most important factors to evaluate the socio-economic benefits of the infrastructure project; a perspective from which the light rail project did not make much sense. However it proved that many politicians did not share this view and that some parties were concerned with the redistribution of resources from road to public

transport such that the money coming from restrictions on car traffic and road tolls was more important than the actual price of constructing the system. Thomas Potter describes his viewpoint on the political process:
'(…) they (read. the politicians) didn't really care how much it cost to build, but they didn't want it to cost more than the busses to operate(…)they have a lot of money, so nobody really cares about the cost, they care about where the money is coming from. And so the fact that the car drivers are paying for this, they don't like that (…). The Bybane (read. light rail) actually makes money. It should anyway; in my calculations (…) I don't sit on the books anymore. But, this is the main bus route in Bergen if you will (…) this is where, if you can't make money on this route, you can't make it anywhere (…)'(Research interview Thomas Potter).

However as stated in the quote above, from a political perspective, the big investments in infrastructure do not seem to be a major barrier to the construction of the system. The issue is whether or not the costs of operation will prove to be neutral or not negative when compared to the use of busses.

Researchers from the Norwegian Research Institute (TØI) questioned how the alternatives to the light rail solution were evaluated. In their view insufficient studies of alternative public transport solutions, such as Bus Rapid Transit, had been studied. An evaluation performed by the institute shows that operation costs for the light rail system would be considerably more expensive (approximately 51 million N.kr/year) than a metro bus solution (26-29 million N.kr./Year), and in the worst case the extra money would be pulled from the resources used to cover existing public transport offers in Bergen. In the Norwegian Journal Plan they write:
'The light rail will offer a capacity that is way over the dimensioned patronage levels and sky-high above the passenger levels that can be expected the rest of the day - this is an obvious waste of resources (…) the big focus that is made in Bergen in regards to Public Transport can paradoxical lead to a downgrading of the existing public transport service or an increase in ticket prices (…) Whatever the end result turns out to be, the planning process for evaluating alternatives has been poorly implemented. As we see it this has been a weakness in the debate, but for sure the right strategy to use to advocate for the light rail'. (Johansen & Strand, 2005)

It was differing views on economic aspects that created the two main 'alliances' or 'strategic coalitions' to the project in the 1990s. Even within the same political party there was disagreement over how to finance the project. The Highway Department and the parties Høyre, Fremskridts Partiet and Kristelig Folkeparti constituted an alliance that looked at the project from a cost-benefit perspective—trying to get the most transportation for the least money. This alliance was against the use of road tolls to finance the light rail project. The other alliance made up of Arbejderpartiet, Socialistisk Venstre Parti, Center Partiet, Venstre and representatives from Kristelig Folkeparti as well as non-political actors, saw the project as a dynamic urban development project which had wider effects than solely

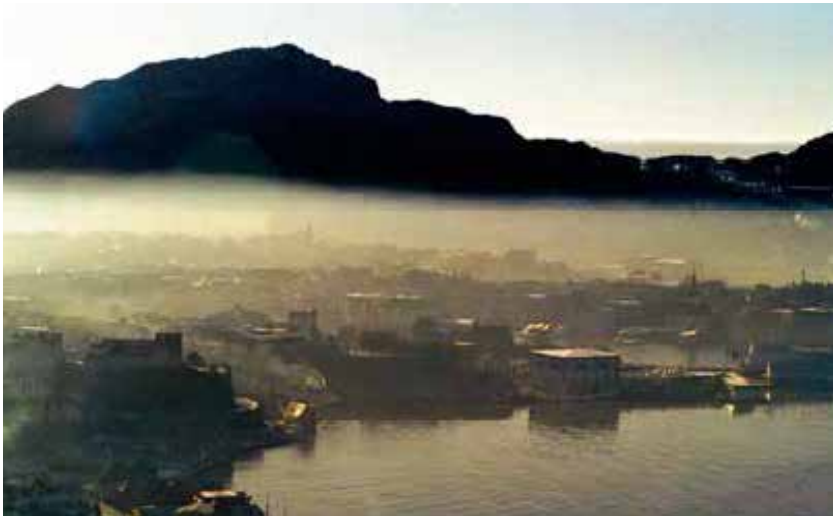


FIGURE: 7+8+9+10

Above left: Visual representation of smog over Bergen - used in the decisionmaking process to underline the environmental and health impacts of increasing car traffic. Above right: busses in que in the city centre, days of poor accessibility. Below left, the last light rail is dumped in the fjord - a symbol of a new era. Below right: the light rail swalloing millions - a representation of the economic discourse from Bergens Tidende the local newaper. Sources: Mette Svanes, Bergen Kommune and Bergens Tidende.no

the infrastructure and transport functions. This alliance discussed a 'light rail effect' (as also described in chapter 2) indicating that the mental attraction was higher towards rail than bus; furthermore, the light rail system would afford urban development and increase land values. This alliance perceived light rail as an urban development project and not just a transport solution (Research interview Magnus Vollset).

The Light Rail as a City Project - Multiple Realities Cooperating

The public transport network in the city had been de-emphasised by the Region responsible for public transport for a long time, and the need for strengthening the public transport network in the city now became a problem. In 2001, the responsibility for public transport in the city was handed over from the Region to the Municipality for a trial period of four years. In this period, a 'light rail office' was established under the chief of planning in the Municipality. The chief of planning was instrumental in implementing the light rail system as an urban project rather than a fast alternative to the car and (Research Interview, Thomas Potter). Chief Engineer for the light rail project at the time, Thomas Potter, describes the strategy implemented by the light rail office in order to cooperate with the Highway Department and get the light rail project moving:

'(…) the light rail office started in the planning department in the city. We were sectioned underneath the chief planner. The first thing we did on 2001-2002 was to do quality control. To go through all the documents that we had done with respect to operation costs, construction costs, passenger ridership, technical feasibility, and technical specifications. We tried to establish a dialogue with the Highway Department. Before the decision to build this was made, there was tremendous antagonism between the city and the Highway Department. The Highway Department was absolutely100% opposed to this project. And they used everything they could to try to kill it. (…)Historically, they had a lot of power. The Highway Department, the head of the Highway Department was called Kejser Josef and he got to decide how everything was done. And he distributed the money. (…) Because he was sitting at a high level throughout the whole county, he could use the distribution of money to get what he wanted: "If you don't want to take the money I'll give it to this county or I'll give it to other cities". He was a very powerful person. But he left the office right about that time I think. So there was a little bit of a vacuum. But anyway, we were instructed to begin a dialogue with him, and we asked him to come to different seminars where we went through the plans. And eventually actually we, at a lower level with the technicians with the Highway Department we established a very good working relationship. They started to understand what we were trying to do. But on a political level there was still the same antagonism with the Highway Department (…)'(Research interview Thomas Potter).

Håkon Rasmussen who was also a part of the light rail office describes the role of the light rail office:

'(…) we were almost like an action-group, but we were public employees; we had support from the Health Minister Anne Grethe Strøm Eriksen. She was a leader of the city council at that time, and she said "now that it is has been passed, it will be made". Every

QUOTE:
'We were almost like an action-group, but we were public employees; we had support from the Health Minister Anne Grethe Strøm Eriksen. She was a leader of the city council at that time'
(Research Interview Håkon Rasmussen).

time we ran into problems with this office (the municipality) it was sent to the top. It has been the local politicians who have seen this project through (…)'.(Research interview Håkon Rasmussen).

Under the support of the municipal light rail office, the light rail project was framed as an 'urban project' and integrated with plans for urban development and densification in the light rail corridor. Their leadership and the cooperation they managed to gain from the technicians in the Highway Department were crucial in moving the project forwards— in this sense the two realities of the project began merging—the project was now considered both a transport project and an urban project. The municipal rationale behind the light rail system was that it should be aligned so that it offered the most accessibility for working residents, and the light rail project was metaphorically framed as the 'backbone' to urban development since it was close to where people lived and worked. Håkon Rasmussen, a municipal planner, describes how the project fitted with the municipal strategies and also changed planning practices to focus on transit-oriented development. He also describes how the light rail project has worked as a catalyst for urban life along the corridor and a tool in the municipal densification strategy (Bergen Kommune, 2008):

'(…) there is a strong strategy for densification in the municipal plan since the city, over so many years, has spread out so now there is a wish to get the city back to the central corridors (…) Urban development effects show that there are many projects that are concentrated on the stops and there has been a change in attitude; people want to live close by (the stops)'. (Research Interview, Håkon Rasmussen) .

Bergen light rail has also had a strategic role in creating an image for the city and the region. In the design guide for the project it is stated that:

'The City of Bergen seeks to make the light rail transit system a truly iconic structure and the pride of the city (…) the light rail must be developed and built in a way which clearly communicates its characteristic identity.' (City of Bergen , 2005)

Politically the light rail system has been perceived as a symbol of a future-oriented city and an important landmark and brand for the city. Gunn Vivian Eide, a local politician who has advocated strongly for the implementation of the light rail project and a remodelling of the mobility hierarchy in the city, describes how she perceives the light rail as a catalyst for a new urban lifestyle:

'It is more than transportation (…) being the first city with light rail means a great deal'. (Research Interview, Gunn Vivian Eide)

As stated, she articulates a city hierarchy where she finds it natural that the second largest city in Norway is the first to upgrade the public transport network, and then the smaller cities can learn and follow in their footsteps. This touches upon the issue of urban competitiveness and the visionary element of the big city image that the light rail mediates as a material actant in the process.

Looking to the World - Gaining Experience from Elsewhere

Perspectives from various international experts were brought into the decision-making process to underline and envision the successful outcomes that the light rail project had facilitated in other countries (this perspective and the notion of 'travelling ideas' in spatial planning inspired by Tait and Jensen (2007) is further elaborated in article 1 chapter 8). These international experiences were important in order to provide spatial referents in the planning process of the Bergen light rail system and to anticipate many of the softer qualitative values of the project that was not part of the more rational decision making tools such as traffic models and economic analysis. External references were an important part in identifying alternative realities to the purely technical and economic ones. Politicians and planners went on study tours to gain inspiration. Experiences from these trips were important in order to visualise the more abstract values such as urban competitiveness and urban qualities in the project. Municipal planner Håkon Rasmussen describes how international inspiration was incorporated into the planning process:

'We usually say that we have tried to reach German precision and French design, so the contractor [of the vehicles] is German, but we have tried to think of the design like the French, and we have visited Montpellier many times (…) When we started our project they had some good experiences and have had incredible success. They have removed the cars from the city (…) It is a very impressive and elegant system (…)' (Research interview Håkon Rasmussen).

QUOTE:
We usually say that we have tried to reach German precision and French design, (Research interview Thomas Potter).

Contrary to the enthusiasm about the light rail, a bus solution is described somewhat differently:

'(…)If you want to ensure accessibility you might as well just put down the rails and increase the capacity and attractiveness [of the city] instead of a bus solution which is only in South America and maybe in North America but hard to find in European cities. There were some who tried to sell the idea of a bus solution here, but it never had an impact and it would also have been expensive if you didn't just use existing roads and remove car traffic (…)' (Research Interview Thomas Potter).

The argument of perceiving the light rail project as more than a transport project became important in the political process, especially since this argument was a valuable counter reasoning to the Highway Department which used traffic models and the technical and economic practice of using transport models and cost benefit analysis. Magnus Vollset describes a very influential outside opinion that came in the 1980s in his book about Bergen light rail:

'(…) especially important was Vukan R. Vuchic with this work on public transport systems. The Yugoslavian-American professor came to Bergen twice to give lectures. After having compared public transport systems in different cities he had the following message: There is no use in building more highways to deal with the problems. More capacity leads to more traffic. If a city should be able to grow there is a need to prioritise public transport (…)' (Vollset, 2007, s. 90)

QUOTE:
"Bybanen has become a lifestyle for me" says the Bergen-American who has worked with the light rail project i more than 20 years"
Thomas Potter Quoted in Finn (2012) article from Bergens Tidende 14/2/12.

This point of view became very influential in discussions with many engineers who agreed that public transport needed to be upgraded to make it more comfortable and attractive for the users. At the same time architects saw a light rail system as a tool to control urban development. Some argued that the indirect benefits that the light rail project could have in structuring urban development and increasing property values in the corridor was overlooked (Research Interview Håkon Rasmussen). The discussions therefore became a principal question of how infrastructure benefits and disadvantage could and should be valued. Not only did Bergen gain experience from other light rail cities, but Bybanen in Bergen has also been subject to much international attention, and many have visited Bergen to learn from their experience. Marit Warncke, Managing Director at Bergen Business Council, comments on the interest derived from the light rail project in Bergen which is a positive asset for the branding of the city:
'(…) we see interest from all over Europe to come and learn from the experiences we have had in Bergen, which is quite positive (…)'(Research interview Marit Warncke).

On the 5 October 2011 Bergen light rail received the prize of "World-wide Light Rail Project of the Year" at the Light Rail Awards in London. The project competed against light rail projects from the Gold Coast in Australia, Dallas in the USA and Angers in France. It was stated that the project in Bergen was 'a model for light rail projects all over the world'. In the newspaper article the light rail system is presented as a visiting card for the city (Aadland, 2011). Furthermore in 2012, the light rail project was awarded the local Norwegian prize 'Vakre Vegers Pris' which is awarded by the Highway Department (Statens Vegvesen, 2012). The award panel stated that:
'Design and the use of materials have been important in the light rail project. The winning proposal from an international tendered design competition has been the foundation for the physical design of the light rail system (…) The design project has provided a holistic design for the project, and has involved many professional disciplines such as landscape architects, industrial designers, graphical design, and textile design. User-friendly solutions with universal design have been one of the most important prerequisite in this process'. (Statens Vegvesen, 2012)

Not only is this a prestigious prize for infrastructure with good aesthetical qualities, but it is also an acknowledgement of the value of the project from the Highway Department, which had been sceptical towards its impact and the economics of the project. The commercial aspects and the identity created through the project has also provided important benefits in urban competitiveness and branding of the city as a future-oriented community. Not only has the light rail project caused physical changes to the city, but many former opponents now support it. Among these opponents turned supporters is the business community in Bergen. Marit Warncke, Managing Director at Bergen Business Council states:
"(…) there has been a shift and everybody see that we need to have a better public transport system. Before we had problems about congestion in Bergen (…) this has meant big challenges in relation to growth and the location of housing in relation to workplaces (…)" (Research interview Marit Warncke).

It would be fair to say that the period immediately following the opening day of the light rail system in June 2010 was somewhat different than the period leading up to the implementation of the project. Following the system's opening, a shift in the discussions surrounding the project occurred. It is a very popular project now and the opponents are not opponents of the project anymore; instead they are pushing for state financing for further extensions of the network since the issue of spending toll money on public transport is still unpopular with some political parties.

Central Discourses and Metaphors in the Decision-making Process

Summarising the analysis of the political and cultural production of the light rail project in Bergen shows the central discourses and metaphors in the planning process are (based on the analytical model introduced in chapter 3):

- Environmental discourse: The need for attractive and fast alternative public transport modes due to the smog covering Bergen. The city's struggle for space.
- Economic discourse: Economic arguments supported and opposed the light rail project; the light rail system focused on obtaining the most transport for the money or on value in a wider strategic regional development perspective, including the strategic indirect values that are not measurable.
- Technology discourse: This discourse concentrates on alternatives that have not been evaluated sufficiently, such as bus solutions that could solve transport related issues.
- Accessibility discourse: The arguments that car traffic should be restricted in the city centre and that road tolls should not be transferred into public transport spending. The idea that accessibility to the city centre by car should be limited.
- Urban development discourse: The light rail system as an urban project that has central stops and supports densification along the corridor. This places emphasis on softer transport modes and includes the 'backbone' metaphor of the public transport system and the urban network. The 'string of pearls' metaphor is linked to the idea of the light rail as a backbone, where the pearls represent the stops and the new urban characteristics and spaces along the corridor. The light rail is also considered to have an important strategic role of because of the large investments in dedicated rail infrastructure.
- Liveability and future-oriented city discourse: The light rail system as a symbol of modernity and a sustainable city vision.
- Urban competitiveness discourse: The claim that being the first city with a light rail system makes a difference. Having a 'big city vision' to the world and creating an 'identity' or image of mobility which contributes to the light rail system brand of the city and a symbol of change. The light rail system is seen as the beginning of a new era in urban development.
- The 'mother of the tram' metaphor: This metaphor underlines the importance of leadership as well as the emotional side of light rail infrastructure, which is deeply embedded with emotions, passion and ideology.

As summarised in the final bullet point, political leadership has played a key role in the process of Bergen light rail development. Many of the key political actors behind the light rail project are woman and are thus often referred to as 'the mothers of the light rail' in the articles reviewed. Some of the most central women in the process have been:

- Anna Elisa Tryti, representative from "Arbeiderpartiet", Norway's largest social-democratic political party, councillor for urban planning in Bergen from 1991 to 1995. She picked up the ball from Sissel Phil Haugen (see below) and took the first initiatives to create a county plan for public transport in Bergen with light rail transport as the backbone.
- Gunn Vivian Eide, representative from "Venstre", a centre-liberal political party, councillor for urban planning in Bergen from 1995 to 1999. She was instrumental in getting the light rail 'on track' and in creating the initial model for financing it through toll roads.
- Anne-Grete Strøm-Erichsen, representative from "Arbeiderpartiet", governing mayor of Bergen from 1999 to 2003. She was a proponent of the light rail system.

To continue the metaphor it can be said that the light rail project was 'born' as an urban project in the Bergen Municipality and realised under the political leadership of the women above. This history is central to the understanding of the final project and the urban consideration which required the light rail system to run at slower speeds than what was initially suggested by the Environmental Union in Bergen. Besides the 'mothers of the light rail', there were also other central actors who greatly influenced the project:

- Sissel Phil Haugen, representative from 'Venstre', a centre-liberal political party. In 1992 she successfully advocate for two million Norwegian kr. to be put aside for a study on public transport in Bergen which included an assessment of light rail.
- Martin Smith-Sivertsen, representative from 'Høyre', a right-liberal political party, councillor for urban planning from 1999 to 2003. He was one of the few proponents of the light rail system from the political 'right'. "Høyre" was negative in the 1990s to the light rail proposal, claiming it was inflexible and expensive. Smith-Sivertsen was crucial player in changing this point of view.
- Tom Knudsen and Monica Mæland from Høyre created the political compromise that secured funding for the light rail system.
- Thomas Potter, Former Chief Engineer of the light rail project, has played a major role in the entire process. He was part of the consultancy group that first proposed the plan for a light rail system and has followed the project ever since as a public servant and later as the chief engineer for the light rail project.

The dominating discourses have evolved during the light rail process in Bergen. The initial 'Bybanehøring' was created under a strong environmental discourse in the 1980s. Later, the economic discourse and the urban development discourse were the competing rationales in the project's development. . Two main 'alliances' developed during the

1990s had very different ideologies towards the project. The Highway Department and the parties Høyre, Fremskridts Partiet and Kristelig Folkeparti comprised an alliance that looked at the project from a cost-benefit perspective—trying to get the most transport for the least money. This alliance was against the use of toll roads to finance the light rail project and saw the light rail project as too expensive. Cheaper bus solutions would afford the same mobility in their perspective. The other alliance Arbejderpartiet, Socialistisk Venstre Parti, Center Partiet, Venstre and representatives from Kristelig Folkeparti as well as non-political actors, saw the project as a dynamic and strategic urban development project which had broader effects than the infrastructure and transport function itself. This alliance talked about a 'light rail effect' indicating that the mental attraction was higher towards rail than bus. Furthermore the light rail system would afford urban development and increase property values. The urban development discourse was institutionalised in the municipality and proved to be a successful argument in carrying the project out. The light rail system as an urban project was accepted across political parties, and the experiences of the strategic urban effects in other European cities made a significant difference in bringing about this reality.

In the following sections, how the vision and dominating discourses of the light rail system as an urban project has materialised and changes the corridor it runs through, will be analysed.

AN URBAN LANDMARK

QUOTE: *"Bergens new light rail has in no time become a landmark" Kontrapunkt, designers of Bergen light rail*

FIGURE 11+12+13: Left top: The light rail logo. New ticket machines re-designed with the light rail. Below: the city station Byparken. (Photos by author).

FIGURE 14+15+16+17+18
AN ORANGE IDENTITY: Right top: neon lights over the doors indicates exit. Green go, red stop. Right bottom: Local art in the cealing. Orange interior, and wide space for standing on shorter distances in the light rail vehicles. (Photos by author).

PRISLØFT: Bybanen i Bergen, her fra Kronstadparken har gitt et sterkt oppsving i prisene langs traseen.

FOTO: SIMRA LEKVE

Tilgang til infrastruktur øker boligprisene:

Nærhet til bybanen «verdt» 300.000 kroner

Proximity to the light rail is 'worth' 300.000 n.kr.
Source: Bergens Tidende Lekve (2013)

Stadig flere vil bo langs Bybanen

Still more people wants to live close to Bybanen
Source: Glatved-Prahl (2010)

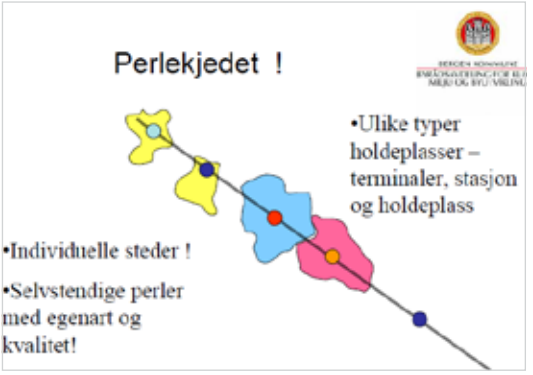


FIGURE 19+20+21+22: Above: Newspaper articles concerning the increasing popularity of the light rail corridor. Right: Slide from Planning chief Mette Svanes - representation of the densification strategy with stations as 'Pearls on a string'. Each stop should have its own individual character. Below: Identity along the route, the 'student city' Fantoft decorated with 'young' art. (Photo by Author).

THE MATERIAL AND SPATIAL DIMENSION

A Spatial Vision

The Spatial vision behind the light rail was that it should encourage urban development in the corridor. Bergen light rail has played a role in creating an image for the city and the region. In the design guide for the project it is stated that:
'The City of Bergen seeks to make the light rail transit system a truly iconic structure and the pride of the city (…) The ambition is for Bergen's light rail service to become a consistent product based on a coherent plan which seeks to create functional and visual connectivity between all elements. The light rail must be developed and built in a way which clearly communicates its characteristic identity' (City of Bergen, 2005).

This design vision was supported by a municipal plan that affords densification and transit-oriented development along the light rail corridor and stops. Mette Svanes chief of planning underscores this strategy:
'The light rail should be the backbone of the future public transport system, and it is thus important to allocate areas for the future network. The light rail should be continued to all parts of the city and the aim should be to further extend the network to neighbouring municipalities (…)' (Svanes, 2008).

Mette Svanes furthermore describes the light rail corridor as a 'string of pearls' with the stops as individual places with their own quality and distinctive character (Svanes, 2008). The densification strategy is a reaction towards the sprawl tendency in the urban development in Bergen. Håkon Rasmussen municipal planner describes the rationale behind the densification strategy:
'(…) there is a strong strategy for densification in the municipal plan since the city in so many years has spread out, now there is a wish to get the city back to the central corridors (…) The urban development effects show that there are many projects that are concentrated around the stops and there has been a change in attitude; people want to live close by. There has also been an increased value of the property, however it has not been thoroughly examined, but I definitely believe that there has been' (Research Interview Håkon Rasmussen).

The light rail corridor is slated for densification and transformation, 60% of new developments should happen in this corridor. In the municipal plan it is written:
'The goal is to maintain and strengthen the quality of the central urban area, and follow the traditions of densification in the urban quarters and in the light rail corridor (…) The light rail corridor will be attractive for job intensive businesses and functions orientated towards a wider audience (…) It is not until we have established a public transport system with enough capacity that we will make restrictions for car traffic (…) The light rail must be the backbone of a future public transport system and this is why it is important to reserve land for a future light rail network (…) The system today has 61.000 homes

DEVELOPMENT IN PASSENGERS ON BYBANEN 2010-2013

FIGURE 23: Graph based actual passenger levels from August 2010-2013 the daily average on a yearly basis is estimated to be 31.000 pas./day. (Source SKYSS, 2013).

EXTRACT FROM THE LOCAL NEWS-PAPER FANAPOSTEN REGARDING CAR TRAFFIC

'The measurement of traffic for 2010 showed a slight increase in traffic from the year before (...) at the road toll station in Fjøsangervegen it increased in average from 41.785 cars/day to 42.540 cars/day. It is an increase on 755 cars/day. "There is a slight increae in car traffic towards the city centre and that is expected. It is an increase that corresponds to the general increase in the Fylke" says section manager in the Highway department Olav Finne.

In June the light rail opened and many thought that this would mean less traffic on the roads towards the city, but that has not happend "the light rail has attracted passengers from the bus which is positive. But car drivers has to a lesser degree been tempted to shift to the light rail, this was what we expected says Finne (Nilsen, 2011).

FIGURE 24+25: The busses has been redesigned to fit the new organge image of the light rail. This provides a general identity for the entire system. (Photo by Author).

within 800 meter from a light rail stop. It has been calculated that 42.000 new homes can be built around the light rail stops. Today there are 102.000 workplaces in walking distance to a light rail stop. Calculations show that 50.000 new work places can be established within walking distance to the light rail stop (…)' (Bergen Kommune, 2008).

The light rail service has become a strategic value in the municipal plan and the municipality has used the corridor actively in their urban development, which has been important in creating a future foundation for passengers in this corridor. This proves to have been a successful strategy since the first indications show an increase of attractively and rising economic affluence in the corridor, according to real-estate agents who are reporting an increase in housing prices along the corridor. A three-room apartment in proximity to the light rail system is estimated to have increased its value by 200.000-300.000 N.kr. compared to an apartment elsewhere in the city (Lekve, 2013). However, the added attraction to the corridor could also show some potential social downsides. Housing prices have risen remarkably in the corridor (7% from May 2012 to 2013 (Buanes, 2013) and a gentrification process is traceable.

Mobility Implications

Passenger levels have proved to fit those projected in the forecast. The forecast for the first line to Nesttun was 26.000 daily passengers and the ridership as of August 2013 shows that there are 25.125 daily passengers (Tjeldflåt, 2013). SKYSS the transport operator estimates the average ridership in 2013 was 31.000 daily passengers (Mail correspondence with Ingrid Dreyer. Communication in SKYSS, 28/11 2013). When the light rail opened, many bus lines were shortened in order to feed the light rail line in Nesttun. Experience has shown, however, that the light rail capacity was too low and express bus lines have since been added in order to meet demand and afford faster travel speeds for those who travel directly to the city centre from Nesttun. Park and-ride facilities have been installed at the end station in Nesttun in order to afford for modal shift. Experience however proved this has not afforded modal shifts and the park-n'-ride facility is mainly used by car-drivers who work in Nesttun and find this cheap parking facility opportune (Research Interview Håkon Rasmussen).

One of the practical challenges of the light rail project in Bergen has been the lack of political will to restrict car access to the city of Bergen (Research Interview, Håkon Rasmussen) and, hence, the traffic levels and congestion have not radically changed (Nilsen, 2011). Many of the new homes and workplaces established along the corridor also have private parking facilities that support car ownership. Discouraging car usage was one of the original rationales behind the re-implementation of the light rail vision in 1989. The light rail has provided more mobility in the public transport system which is positive from a business perspective; however, it has been harder to reduce car traffic by only providing a public transport upgrade and not using restrictive policies for car traffic.

FIGURE 26+27: Above: Byparken station at the city centre Below: The adjacent city park (Photos by Author).

Spatial Analysis

The spatial analysis was performed by a phenomenological registration of urban space, where my own personal experience of riding and walking along the corridor has been used as the medium to perform the analysis of the material and spatial implications of the light rail system. The trip along the corridor starts in the northern part of the line in the centre of Bergen and ends at Nesttun. This is the first part of the light rail line. The second phase, which opened in 2013, has not been included in this analysis. It is important to notice that the analysis was performed in May 2011 only one year after the opening of the line and many of the current urban development projects had not been implemented at this time. The analysis will be supplemented with pictures and illustrations of the planned developments to provide an impression of the planned transformation of this central pathway through the city.

District: Bergen City Centre (figure 26+27)

The stop Byparken is the central node of the light rail line towards the city. The light rail system has not yet entered the very core of the old historical city 'Bryggen' where the architecture and the urban spaces are more sensitive towards implementation of new infrastructures. I am reminded that I have read that this has been and continues to be a bone of contention in the decision-making process. At Byparken passengers can transfer to busses and move into other parts of the city and it is placed on the edge to the historical part of the city. The light rail stop is between the old telegraph building which is a four-story red brick building and wide green park area where you can see red tulips and large, old trees. The light rail tracé is paved with cobblestone with fits in to the historical atmosphere of the city centre and the stations are paved with granite. The colour theme of the interior design is dark orange and grey. It has a simple design and straight lines that give it a Nordic touch. The orange identity of the sides of the station creates a landmark that makes it clear to me that I am at the transit corridor. The logo of Bybanen is placed on top of the orange sides of the stations. Moving away from Byparken the train moves along Kaigaten where there are buildings facing the street on the left side and a view of a trimmed lake with large, old trees facing the light rail tracé. The tracé is paved with asphalt and there are tracks in both directions. The light rail stops in front of an old building which historically used to be a nunnery. The stop is called Nonneseter. There are orange stoplights up the old, grey-stone building in the background. The stop is shared with bus traffic and it is possible to change to local and regional trains at nearby Bergen station, making this stop a central node. West of the stop is the public library and a large shopping centre is within view. The light rail crosses under a glass-covered pedestrian walkway. The passway connects the shopping centre and a huge parking facility with the station and the library. Taking a slight right turn I experience a shift in the spatial character of the area. Here everything opens up and I can see one of the mountainsides to the left, which is covered in green. Many houses are placed on this edge and they must have a beautiful view over the city. In sharp contrast to the green mountains the area around the train station is filled with parking facilities and the light rail crosses under a big parking garage. This place is a node in the 'traffic machine' where train, light rail and car traffic meet.

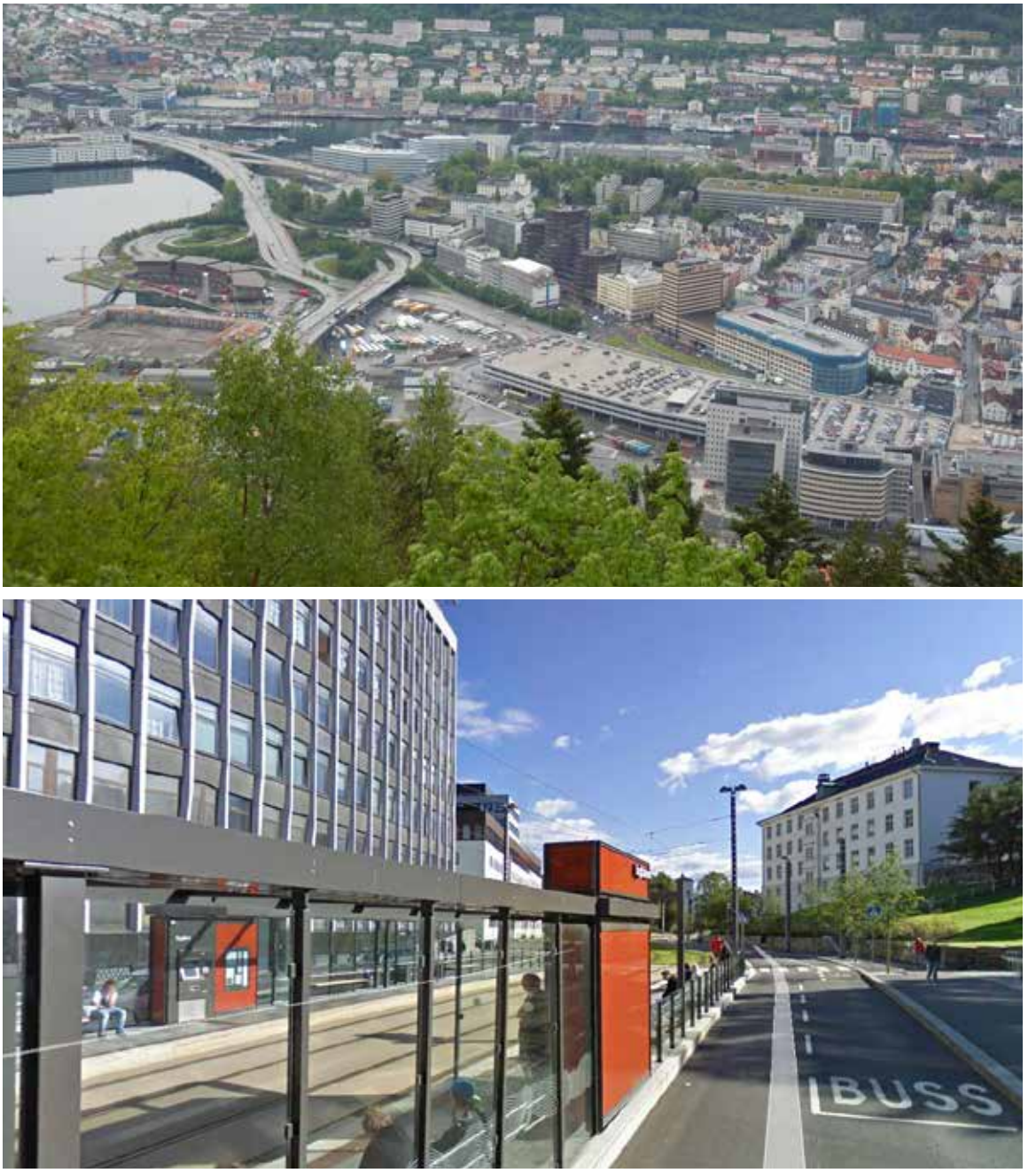


FIGURE 28+29: Above: Fjøsangerveien or the 'Spaghetti junction' as it has also been called, seen from the mountain side (Photo by author) Below: The stop at Nygård with the old university building to the left (Google street view).

District: Fjøsangerveien (figure 28)
Moving out from the parking garage the light rail crosses a main road artery 'Fjøsangerveien' that has three lanes of traffic in each direction. This is a traffic machine and the environment is dominated by asphalt and large-scale modern buildings in grey and brown. The light rail crosses the wide street and enters its own dedicated tracé which does not interfere with the road traffic. The light rail crossing is marked by red pavement and grass has been planted in the side of the road. This is not a pleasant place to be a pedestrian; the street is designed for faster moving traffic and was one of the major 'streets break through' that were made in the 1960s or 70s.

District: the University and Marineholmen (figure 29)
The light rail turns right where it passes the main regional administration office called the Fylkes Kommune. The building environment again completely shifts character, and I see a small old church and older four-story apartment buildings. The light rail continues along Lars Hillesgate where large modern buildings face the street on the left side of the corridor;, the same buildings also have a facade towards Fjøsangerveien. There are up to 12 floors. On the right side I see a brown field area under redevelopment. Double tracks for the light rail are placed in the right side of the road and on the left side is one lane for one-way traffic. Bike paths run in both directions. Nygård station is located at a large, modern seven-story concrete building. This building houses the engineering education of Bergen University. To the right of the stop are other buildings that also belonging to the university; this is a central node many students must pass on a daily basis. Again the orange sign of the light rail stop creates a very visual marker in the city environment and the presence of the tracks makes the light rail a central and integrated path in this urban environment. Moving out from the stop at Nygård, the light rail runs on a green tracé in the centre of the street—the grass pavement offers visibility of the tracks and a nice green element. One lane of car traffic goes in each direction and the street also has a bike path. The overhead power supply for the light rail is hung from masts on each side of the road. The area opens up again as the light rail moves on to Florida stop , which is the last stop in the urban quarter 'Bergenhus'—t he quarter that covers the old centre of town. The Florida node has views of the water, the mountainside and a highway bridge. On the left and right there is a massive building with a glass and steel façade facing the street, called 'Høyteknologi centeret', which is a technology business cluster. Altogether 2.000 workplaces are located close to this node. Continuing from here the light rail crosses under a highway bridge.

District: Fjøsangerveien (figure 30+31)
The light rail now runs in its own tracé without any contact with other modes. The colour of the pavement is now yellow, indicating a shift in character of the tracé. The tracé is often red at intersections with other modes to call attention to it. The light rail is green in central urban environments where it supports other existing green structures, and the yellow colour now indicates that it runs in its own tracé. It is the colour coding that gives me some kind of mental guidance. Small street corners have been slightly revitalised with

FIGURE 30+31: Above: Fjøsangerveien under the construction of the light rail (Google Street view) Below: Illustration from the architectural company SNØHETTA - with suggestion for development along Fjøsangerveien - the ligth rail runs in the left side of the picture as an integrated element in this new urban development proposed along Fjøsangerveien (Mette Svanes, Bergen Kommune).

trees and bushes and you can see the light rail has caused a restructuring of the street environment. A high kerb separates the light rail tracé from a one-lane traffic street. To the left there is a high, rock wall and if I look up I can see an old one-family home facing the tracé. Moving slightly further on, the light rail tracé is now running alongside the major street Fjøsangerveien. This wide streetscape has three lanes for cars in each direction and many large-scale business building are facing the road on the right hand side. A crash barrier separates the highway from the light rail. From the light rail I notice a cyclist riding in the light rail tracé. The architecture that surrounds the light rail is fitted for high speeds, and at this part of the path the light rail also speeds up. The light rail stops at the node/ station Danmarks Plass close to a cinema, a school and other places of interest. The placement of the stop is different from other places. The platform is placed between the tracks to prevent passengers from waiting too close to the fast moving traffic on Fjøsangerveien.

District: Kronstad and the Suburb (figure 32-36)

The light rail takes a slight left away from Fjøsangerveien. It now enters a more compact environment containing more narrow streets. It is still running in its own yellow tracé. The area seems a bit rundown. There is graffiti on the walls and there are some small shops but many have been closed. The buildings are a maximum of four floors and are different dusty pastel colours. On the side streets, I see many smaller one-family houses also painted in light pastel colours that characterises the old, wooden building style in Bergen. On this narrow street, the light rail path is double tracked and only allows for a one-way street with car traffic. Moving on, I get the feeling of being in the suburb. There are not many stores and most of the houses are low-density, one-family homes. Moving on, the light rail passes the light rail depot, located at a previous railway depot. The depot is does not stand out from its environment. The light rail then runs along Inndalsveien on a tracé on the left side of the road, and on the right side there is one lane of car traffic in each direction. The stop Kronstad, which is close to the depot, is a central node for the new developments. A large educational centre able to hold 6.700 students and 660 employees 'Høgskolen i Bergen' is going to move here. The centre should be ready in 2014. In proximity to the stop there is also a hospital, which is one of the largest workplaces in Bergen. The space along Inndalsveien is very small and contains small, wooden family homes and a few redevelopment sites. The street environment has been revitalised with new sidewalks and newly planted trees. The light rail still runs in its own yellow tracé until it reaches the stop at Wergeland. This is a historical node since the old tram in Bergen used to have its end destination here. The tracé from Nygård station to the stop at Wergeland is almost identical to the tracé of the old tram. I perceive the node at Wergeland as an edge connecting new areas in the city. From here, the light rail enters a tunnel and continues towards Nesttun. The stop at Sletten is located next to a large shopping centre that has its facade towards the light rail. The light rail stop is integrated with the main entrance through a small, urban space outside the shopping centre. The building density is still very low except for a 10-floor apartment block next to the stop. Climbing up the hill Slettebakken the light rail passes 'Bergenshallen' which is a sports hall and exhibition centre. The street is characterised by large, old trees and views of the city.

FIGURE 32+33+34: Left and below: The new educational facility at Kronstad (Mette Svanes, Bergen Kommune). Above right: The light rail depot at Kronstad (Photo by author).

FIGURE 35+36: Above: The light rail stop 'Sletten', Integrated at the entrence to the shopping centre Sletten (Mette Svanes, Bergen Kommune). Below: new health facilities finished in 2013 by Helse Bergen at the stop Danmarksplass, here the yellow pavement of the light rail trace is also visible (Mette Svanes, Bergen Kommune).

FIGURE 37+38: New and old student housing at the stop Fantoft. Many new developments are planned at Grønneviksøren Below right: neon lights installed as an art element in the tunnels. (Photos by Author).

The Heavy Rail Path

The light rail tracé has changed over to a heavy rail design. There is granite rubble between the tracks that visually signals that at this stretch the light rail travels at higher speeds. Furthermore this pavement does not allow cyclists or cars can use the tracé, something which could impact safety. A fence separates the tracks from the road that runs along the side of the transit path. The fence creates an edge between the corridor and the urban space—the light rail is not meant to be integrated in the city at this point. The light rail reaches high speeds at this section of the path and works mostly as an isolated transport mode moving quickly from point A to B. Newly established tunnels offer direct connections and high travel speeds. I have purposely not called this a district since I perceive this section mostly as a path where the system is completely segregated from the city. It practically runs through the backside of the city through tunnels and fenced off paths. Passing through the tunnels at high speeds I see that neon lighting has been installed in the tunnel as an artistic element. In motion the colourful lighting creates an interesting image of a wave. The neon lighting fits well with the light integrated inside of the light rail system over the doors. This lighting is red when indicating the door is closed and green when indicating it is safe to exit and enter. For me it was an unexpected element of the tunnel, and makes me think that the designers have intended to create some kind of identity in the dark tunnels.

District: Fantoft the Student City (figure 37+38)

At the node of Fantoft, a new quarter has literally been built around the light rail stop and the passage into a new tunnel. It is a 'student city' with student housing. To the left there are large-scale, 18-floor concrete blocks. A completely new building has been built around the stop and above the tunnel entrance. The building has been raised on concrete pillars above the stop and has lime green elements (Figure 37 and 38). The stop has been given a 'young' identity with street art painted on the walls behind the stop. The pink colours stand in contrast to the lime green elements of the buildings and the orange landmark of the light rail stop. Containers have been put up advertising the establishment of a new quarter 'Grønneviksøren' with 727 new student homes. There are open spaces in front of the buildings with yellow spiral art elements. This may also serve as a bike parking facility. Trees have recently been planted and the pavement has been modernised.

District: Paradis and Nesttun (figure 39-42)

The light rail faces the city again when it exits the tunnel on Nesttunvegen. I have just exited the urban quarter Årstad and entered the quarter Fana. From the stop at 'Paradis,' I see a building with a sign saying, 'clean your blankets before the light rail passes'. This node is an area for set redevelopment. I know that there are plans for 1.000 homes plus offices and services to be built here. From Paradis, the light rail continues in a green tracé at relatively high speeds alongside a road with one-lane traffic in each direction. The sidewalk is situated opposite the light rail on the right hand side of the road and is separated by the car traffic. There is a low fence just before the light rail enters another tunnel. After the tunnel the light rail continues on in the same suburban environment as before, char-

FIGURE 39+40+41+42: Above and middle: The stop at Paradis under the construction of the light rail (Google Streetview) and with the plans for new urban developments (Mette Svanes, Bergen Kommune) Below: left, extensions of the tracks through Nesttun centre (Mette Svanes, Bergen Kommune) and left, people waiting in the rain in Nesttun (Photo by author)

acterised by low population densities and one-family wooden house. The corridor is very green and has large, old trees. The light rail comes to its final destination in the suburb Nesttun. Smaller shops are located close to the stop, and to the right I see a newly built park-n'-ride facility. On the left I see the old parking garage. It is raining heavily when I step off the train and people are trying to find shelter at the light rail stop. However, the stops are not designed to provide shelter from the wind, and we all get wet because the wind pushes the rain under the roof of the stop. The building's design seems to be flawed since it is well known that it rains more than 200 days a year in Bergen. The 10 minute wait until the train leaves back to the city seem like forever when you are wet and cold. From the stop, I can see a pedestrian shopping street and a small village street moving through Nesttun. It is evident that this is the centre of the suburb, and the light rail stop has been integrated into what is to become the new centre of activity in the suburb.

CASE STUDY FINDINGS

The case analysis of Bergen light rail has shown that it is a case of a politically controversial project with many conflicting discourses. The controversies surrounding Bergen light rail are inscribed into the city's history and culture. The debate is also reminiscent of the political and planning practices at play in the old debate of the closure of the old tram in favour of automobility something which played a major role in the revitalisation of the tram-vision. This example shows how very different realities and visions for future urban development were enacted, mobilising strong emotional reactions towards this project. The original light rail project proposed in 1989 by the Environmental Union in Bergen, was grounded in the environmental discourse that dominated policies in this period. However, this was not the ultimate discourse that carried the project out. As the case study exemplifies, two main discourse coalitions and alliances of actors competed in the decision-making of the project; the economic discourse with its focus on getting the most transport for the money, and the strategic-urban development discourse, which focused on how future urban development could be supported by attractive transport infrastructures. Evaluating the planning process, the many competing discourses made the visionary and planning phases a drawn-out process where momentum was not created before the project gained political acceptance as an urban project. The organisational change where the responsibility for urban public transportation was handed over from the Region to the Municipality was an important strategic act in this regard; it grounded the project in the municipal organisation. A clearer storyline and an institutional anchoring in the Municipality from the beginning could have shortened and reduced the complexity of this process. There was no clear leadership and vision behind the project before it was placed under the 'light rail office' in the municipality. In some of the other cases analysed, in the later sections, a clear vision and leadership play an important role in a linear and less controversial implementation process.

Materially and spatially the light rail project was practised as an urban project that connects the city centre with the suburbs. It has also marked a change in planning practices since it has enabled new transit-oriented planning practices in the city. This has meant

that today the light rail can be perceived as a merger between an urban development project and a transport project. Parts of the light rail have been integrated with the urban environment on central parts of the line, but other parts have been completely segregated from the city and the existing traffic in order to reach higher travel speeds. This means that the light rail system changes its material and spatial character throughout suburban stretches of the line. To support higher travel speeds tunnels have been built and fences have been placed for security reasons. The light rail has proved to be a powerful, strategic tool for attracting investors to the corridor and many urban development projects have been placed close to the light rails stops. Housing prices along the corridor are also increasing, which is positive from an economic perspective, but can also create some challenges in the future via a potential gentrification process. Even though the light rail project has been successful in terms of reaching a higher patronage than expected, the level of car traffic has not changed in the corridor towards the city centre. This means that the light rail has not been successful in facilitating modal shifts and reducing car use. It proves that restrictive policies for car traffic in the city centre are crucial if the objective is to change the mobility hierarchy. This finding supports previous findings on this objective, as has been presented in chapter 2.

CASE ANALYSIS
ANGERS LIGHT RAIL

6B

FIGURE 1+2: First impressions of the light rail corridor at Boulevard Foch in Angers city centre. Above: the rainbow image in motion. Below: The green tracks (Photos by author).

MISSION TRAMWAY

PROLOGUE

Stepping off the train from Paris at 11pm in the evening I heard birds singing in the threes just outside the station in Angers. I found it a bit strange that there were birds singing at this time of day, but when I took a further look I could see that there were speakers placed in the trees. This was intentional 'staging' in an urban environment which provided a pleasant atmosphere even though it was a bit out of context at this time of the day. Even though it was November, I felt that the climate was warmer than expected. When I booked a hotel in Angers I made sure that it was located in the light rail corridor. By using the light rail line as a reference and a landmark, I was sure that I would stay in the middle of the city and in proximity to my object of study—the Angers Light rail. I chose to walk from the station to my hotel since it would only take me 10 minutes. After having travelled for a whole day, the exercise would feel good. Before arriving in Angers I had, as always, printed a map in order to navigate from the train station to the hotel. However, this map was unnecessary since I quickly discovered the green light rail tracks outside the train station—the green tracks area trademark of Angers light rail. I chose to follow this green path that led me directly to my hotel in Boulevard Foch. When I prepared the case study, the narrative framing of the light rail was very clear: the light rail in Angers was almost identical incarnation of the French vision to redesign the city, and the light rail was the symbol of a future-oriented city and political vision of the political project called 'Mission Tramway'. The light rail appears to be a mobile urban space. My first meeting with the light rail corridor certainly met my expectations. Angers was my fourth and last case study, and I had not encountered the same visual impact as Angers in other places. Every detail in the corridor was thoroughly designed; the vehicles, the stations, and the tracks together made for a totally new street environment. The light rail's bright, rainbow image lit up the in the night (see figure 1+2 and figure 8 for map of the light rail corridor).

QUOTE:
'Rainbow- a tram that gathers us'
(Angers Loire Métropole, 2011).

The case analysis of Angers' light rail will exemplify a project that is beyond an economic rationale. As argued in chapter 1, the light rail project in Angers is more deeply embedded in a vision of redesigning the city than it is about fast transportation. Through the case analysis, it is argued that a strong political vision and leadership have been key elements in implementing Angers' light rail project. This project is an important example of the linear implementation process that can occur when there are no competing rationales present in the decision-making process (as it was the case in the Bergen light rail project). The case analysis will furthermore exemplify how a clear redesign vision has materialised in the spatial and material layout of the corridor, creating new urban spaces and mobility hierarchies along the light rail corridor. The main finding between the discursive-institutional and the material-spatial dimensions as well as reflections on the process will be summarised at the end of the analysis by using the analytical model introduced in chapter 3.

THE DISCURSIVE AND INSTITUTIONAL DIMENSION

To understand the institutional and discursive dimensions behind the light rail project in Angers, it is necessary to understand the national context and policies which have been crucial in enacting the redesign, aesthetic rationales and urban development perspectives in many of the French light rail projects. Persons interviewed in Angers were selected according to the criteria introduced in chapter 4. The persons were identified and contacted through a snowball sampling method and were chosen to represent a variety of perspectives on the project. One of the major restrictions in this context was that the challenge of doing interviews in English; a methodological limitation that greatly influenced the case study in Angers (see chapter 4). Altogether three interviews were done, two of which with experts in the Angers context. The third interview represents the external view and shared insight into the French light rail context.

QUOTE:
"The tram is an emblem of renewal of Angers and its metropolis" (Angers Loire Metropole, 2011a).

The persons interviewed in the French context and the Angers case was:

- Pierre-Luc Papin - Technical director of the light rail system. Operation and maintenance is done by the private operator Keolis where Pierre-Luc Papin is employed. This interview provided insight into the operational and technical side of the system and the everyday challenges of the scheme.
- Olivier Sorin - Mobility planner at Angers Loire Métropole. He gave insights into the planning of the light rail system and the political process it endured. Olivier previously worked with the light rail project in Nantes.
- Mathieu Voisin, a consultant at SYSTRA who works on transport planning and engineering activities. SYSTRA participated in 21 of 28 total LRT projects in France. Mathieu was not a consultant on the Angers light rail system but has been involved in many of the other light rail projects in France and has extensive knowledge of the design of the system and its integration into the urban environment. He provides an outside perspective into the Angers light rail project and gives insight to the French context in general.

The Genesis of the Project - When the Timing Is Right

The Angers light rail project is part of a broader focus on light rail in France that started in the 1980s and has continued to develop ever since. Angers is a case where the urban redesign vision associated with the light rail system is taken to an extreme, and the dominating rationale behind the project was urban development rather the profitability or saving travel time. These factors support the presumption that light rail projects are more than transport projects, and in the case of Angers, it is a visionary project to redesign the city: *"The tram is an emblem of renewal of Angers and its metropolis" (Angers Loire Metropole, 2011).* The trend of constructing new light rail systems in Western Europe had its genesis in France with the implementation of the largely successful systems in France: Nantes in 1985 and Grenoble in 1987. Most tram systems were abandoned in France during the 1950s and 1960s largely due to the increasing automobility that demanded space in the cities (Hass-Klau, Crampton, & Benjari, 2004).

Angers had an old tram system, which closed in 1949 (Pulling, 2012). After the oil crisis in 1974, the French Minister of Transport announced a new policy that would encourage medium-sized cities in France to consider light rail as a viable alternative solution and promised funding to emphasise this commitment (Hass-Klau, Crampton, & Benjari, 2004). As in the other cases analysed in this thesis, an environmental discourse dominated the arguments for the need to re-invest in public transport. In Angers, a local transport tax was passed to finance public transport in cities (Priemus & Konings, 2001). This tax was important in creating a solid base for securing dedicated funding for public transport and in realising light rail projects. The local transport tax, 'Versement transport', was introduced in 1982 and gave the right to regions of 10.000 inhabitants and over to introduce the tax. The transport tax provided a unique possibility for financing public transport infrastructure investments and cover operating deficits. If a guided right-of-way system was introduced such as light rail or guided bus, then the tax rate could be increased. Furthermore, the increased environmental priorities of the 1990s made it compulsory for cities with a population of 100.000 inhabitants or more to make Sustainable Urban Mobility Plans (PDU—Plan de Déplacements Urbains). The rationale behind introducing these types of plans was to create a strategic urban planning tool to reduce private car use and integrate urban development with public transport (Hass-Klau, Crampton, & Benjari, 2004). Since the political objective behind these mobility plans was to reduce car traffic in the urban centres, the light rail vision was enacted in order to materialise this political goal (see timeline with key events figure 4).

QUOTE:
'A strong will to reclaim public space by favouring alternative modes and urban development' (Angers Loire Métropole, 2012).

Angers is the 19th city in France to enrol in the light rail vision (Johannson, 2011) and is the 16th largest city in France with 156.000 inhabitants. The planning process for the light rail project in Angers started in 2001 with the political vision and administrative taskforce, 'Mission Tramway', was established. Mission Tramway introduced the light rail vision of Angers by framing it as having: *A strong will to reclaim public space by favouring alternative modes and urban development' (Angers Loire Metropole, 2012).* The system began operation in June 2011. The first line is a stretch of 12 km with 25 stops, connecting the city centres in two out of thirty-three municipalities, Angers and Avrillé (Research Interview, Olivier Sorin)). The southern part of the line in Angers replaced an existing bus line and the northern part of the line partly serves a brown field set for urban development. Many new urban development projects are planned in this brown field and it is intended for new modern and attractive housing. The light rail is visually integrated into the real-estate advertisements as a part of promoting this new style of urban living. The stops are placed an average of 450 metres apart and connect all the central points of activity in the city including the university, the hospital and the central urban square 'Place du Ralliement', which is metaphorically framed as the heart of the city (Research Interview, Olivier Sorin). The integration of the light rail at Place du Ralliement was a physical manifestation of the political will to reclaim public space. It was a controversial act by Mayor Jean-Claude Antonini. He was a strong political figure in the implementation of the light rail project and was in charge of the project from its initial stages in 2001 to its implementation in 2011. Opponents argued that erecting the light rail at 'Place


1014

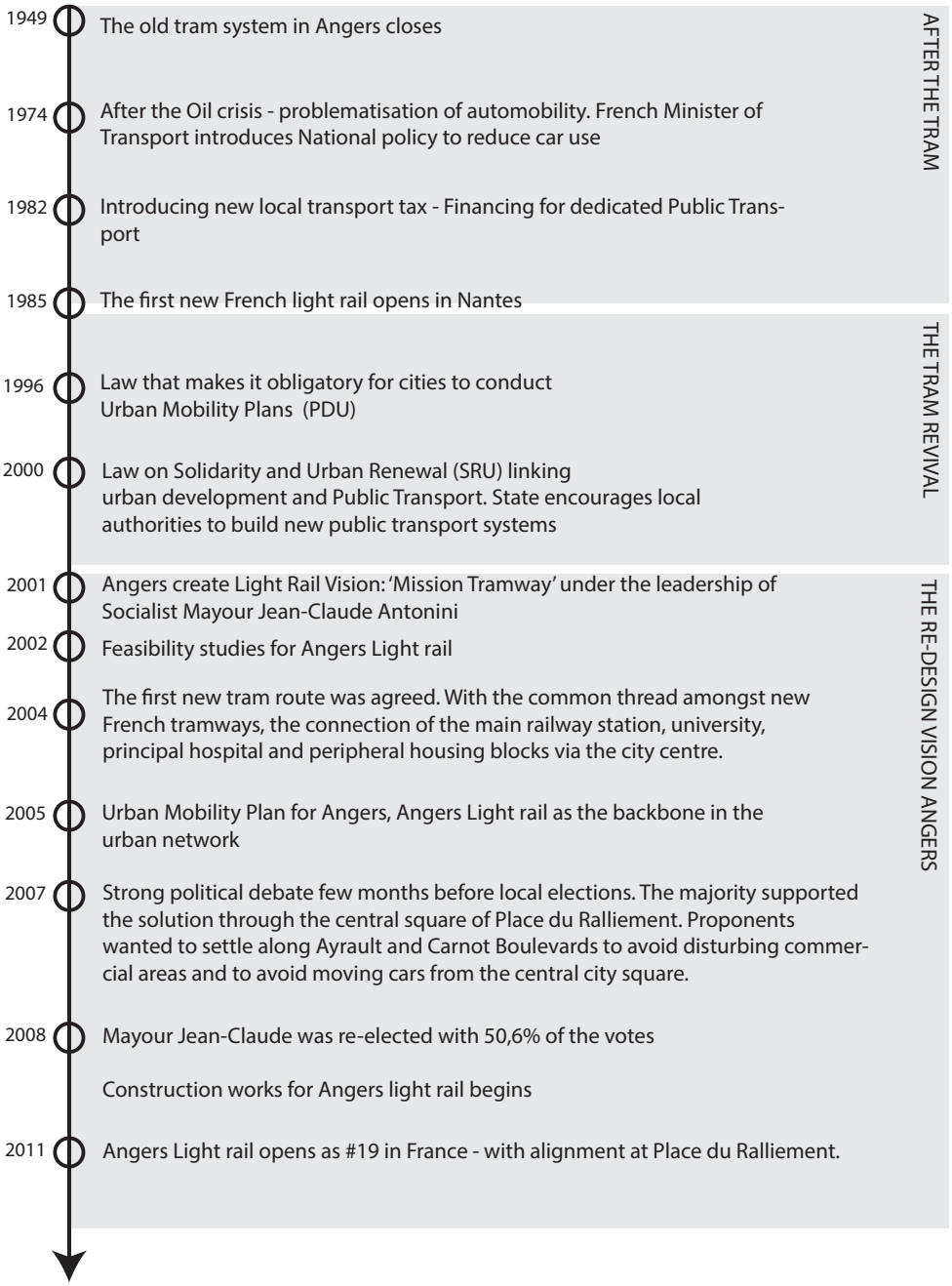


FIGURE 3+4: Left: Alstom vehicle with rainbow identity and the nose shaped as a ship (Photo by author). Right: Time line with key events that led to the establishment of Bergen Light Rail

QUOTE:
'When a French city decides to build a new tramline, they not only build a tramline they also remodel all the quarters around the tram between the buildings (…)' (Research Interview, Olivier Sorin).

du Ralliement' would affect car access to this central commercial area in the city. Their position was part of a vigorous political and public debate in 2007. Under the leadership of Mayor Jean Claude Antonini the decision on a placing a light rail line through Place du Ralliement was made, and in 2008 Jean Claude Antonini was re-elected with only 50.6% of the votes. Even with a small margin of victory, his re-election made it possible for him to continue as the political leader of the light rail initiative.

The line with frequent stops in the most central and narrow urban spaces and average travel speeds of 18 km/hour is evidence of the political ambition for the Angers light rail project, which was to redevelop urban space rather than just providing high-quality public transport with short travel times (Research Interview, Pierre-Luc Papin). In line with the national strategies outlined in the Mobility Plan for the Angers, Loire Métropole (the PDU) was launched in 2005. With the PDU, an integrated approach to mobility in the Angers area was introduced. One of the objectives in the plan was the upgrade of the public transport network by introducing a light rail system as the new 'backbone' of the urban public transport system (Angers Loire Métropole, 2005). However, the light rail project was also built on rationales involving more than just the creation of an efficient means of transportation. The light rail project was described by the Métropole as a manifestation of the strong will to reclaim public space: *'When a French city decides to build a new tramline, they not only build a tramline they also remodel all the quarters around the tram between the buildings (…)' (Research Interview, Olivier Sorin).*

The strong focus on design and aesthetics made the project in Angers very costly; the price was around 300 million euros at 2005 prices. The price included urban renewals along the corridor (Research Interview, Pierre Luc) and the advanced technology necessary to enable the tram to go through the 'Place du Ralliement', the most sensitive architectural urban space in the heart of the city. Such technology is called APS and was developed by the French company Alstom. The APS system provides access by the light rail without overhead wires in sensitive architectural environments allowing for the preservation of urban and architectural heritages (Angers Loire Metropole, 2011). The power supply runs via a third line positioned centrally between the tracks, an expensive solution (that had an extra price tag of 1.5 million euro compared to the traditional power supply system). However, this technology makes an important contribution to the overall design concept. Furthermore, a new bridge, Confluence, was built to cross the river which connects Angers with the city of Avrillé. Technically, this bridge could have been realised for the sum of 10 million euros, but the politicians decided for a more aesthetic solution that doubled the price of the bridge but created a landmark which worked as an important manifestation of the realisation of the city redesign vision (Research Interview, Oliver Sorin). Finally the redesign frame for Angers was realised through the choice to construct 70% of the tracks as green tracks with grass (Research Interview, Pierre Luc). The green tracks mediate the vision of an aesthetically beautiful system, and also refer to Angers' local history: *'The city is famous for agriculture and flowers and so the representatives wanted a tramline that represented this identity' (Research Interview, Pierre Luc Papin).*

Leadership - a Strong Political Vision

The opposite to a light rail project so common in many other light rail cities did not take place in Angers. For example, no alternatives to light rail, such as Bus Rapid Transit, were evaluated in Angers. The strong political preference for a light rail solution and the entire redesign vision was an important element in the Angers light rail project. The Mayor, Jean-Claude Antonini, and his representatives wanted a light rail, hence alternative technical solutions were not relevant in the Angers case. Mobility planner in the Métropole Oliver Sorin reflects on this choice: '

When they made the study to implement this new service, they already decided that it was the tram. There were no comparison studies because I think the mayor wanted a tram (...) He didn't want the locals to be transported by BRT he wanted to have the tram for the city. When you have an idea you don't change it. I am not sure it was a better idea, because of the price and with 300 million euros you could have had three or four routes of BRT. But it [light rail] was a choice'. (Research Interview Olivier Sorin)

The choice of the green tracks and the decision to build a neatly designed bridge, called Confluence, instead of a cheaper version offering the same connection over the river Maine was also an important political choice made to manifest change. The light rail system is considered to be a symbol of a future- oriented city and many French cities want to be part of this vision. The ambition to remain attractive and competitive cities plays an important role in this context (Research Interview, Oliver Sorin). Mayor Jean-Claude Antonini describes the importance of the tram by indicating the beginning of a new future and a step into modernity:

'The inauguration of the Angers Loire Métropole tram is a historic moment that definitely switches our city into a new modernity. There will be a before and after June 25, 2011 (…) At present, our city and its mobility is being upgraded and redesigned. Beyond a new and more efficient, more inclusive and cleaner means of transport, the tram has already helped to beautify the city and to restore colour to it. It changes our view of the neighbourhoods it passes through. It is a real link to all the inhabitants of the city. The train's rainbow identity now benefits all Angevins of the town as well as our visitors (…) The revival of Angers is happening through the tram' (Antonini, 2011).

Marie-Pierre Trichet planner at the Métropole describes this radical shift in visions for urban planning and mobility that is mediated by the light rail system from a future perspective:

'We came out of the single thought that everything had to be the auto-mobile. Today we must offer a real choice. Children are followed to school on foot. We take the bike to buy bread. Are we tram or bus travellers? We take the car to go windsurfing at Lac de Maine. Intermodality is the intelligent choice of transport according to means, needs and desires. It is in line with the expectations of younger generations. We have a duty to support them' (Own translation) (Courrierdelóuest, 2012).

Passenger levels and capacity was never questioned in regards to the choice of an urban

QUOTE:
"The inauguration of the Angers Loire Métropole tram is a historic moment that is definitely switches our city into a new modernity. There will be a before and after June 25, 2011 (…) At present, our city and its mobility is being upgraded and redesigned. Beyond a new and more efficient, more inclusive and cleaner means of transport the tram has already helped to beautify the city, and to restore colour. (Antonini, 2011).

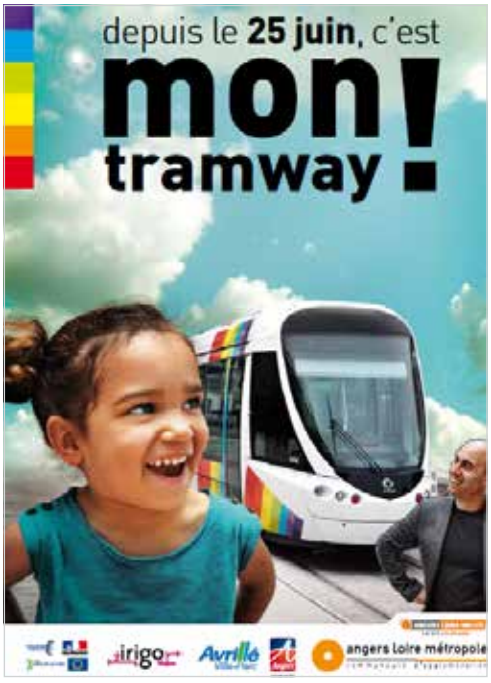


FIGURE 5+6+7: Above: Pictures from the Opening of the light rail at Place du Ralliement (Campion, 2011) Below: The front page of the light rail vision with the headline 'My Tramway' (Angers Loire Metropole) Right: Mayor Jean-Claude Antonini at the opening of the light rail (Campion, 2011) (Photos: Patrice Campion).

transit solution (as it was the case in Bern). It was widely recognised that public transport solutions struggle to create profitability from a purely economic perspective. The light rail system was a more expensive solution, but it was an important part of the city's political mission, and thus the urban development rationale was a stronger motivation behind the project than the economic profitability (Research Interview, Olivier Sorin and Pierre-Luc). It can be said that the ambition conceived and practised in the case of Angers light rail system was more inspired by architects and urban designers than the view of transport engineers and economists. Thus Angers light rail system is a case of very different ways of creating mobility corridors and integrating mobility into urban development visions.

The light rail project was strategically placed in the mayor's Department when the vision was created. This can be seen as an organisational upgrade of the project, indicating the political importance of the light rail project. The organisational structure was important in the planning process because it gave it the political strength to carry the project through and reduce the complexity of decisions being made. However in the following phases of the project, this political strength also caused some difficulties in relation to controlling who was responsible for and who had ownership of the different parts of the project in other departments (Research Interview, Pierre Luc and Oliver Sorin). Angers Loire Métropole had a crucial role in implementing the visionary politics of the mayor. As the main transport authority, it was responsible for the design and implementation of an Urban Mobility Plan, the management and restructuring of the public transport network, the promotion of soft transport and the introduction of the light rail system. The light rail project in Angers benefited from the fact that it was anchored in the Mobility Plan and led by the same authority, making the light rail technology an obvious choice. The organisational structure and placement of the project were important factors that contributed to the relatively little opposition towards the light rail project. However, it is also important to note that Angers was not the pioneer of a light rail system in the national context as was the case in Bergen light rail project. In 2001, Angers Loire Métropole created a specific administrative service 'Mission Tramway' under the leadership of the engineer Jacques Landreau, also called 'Monsieur Tram', metaphorically referred to as 'the Father of Angers light rail' (Sourisseau, 2011) (1).

The role of 'Mission Tramway' was to manage, coordinate and monitor all elements of the light rail project. The Métropole involved all the necessary technical and aesthetical expertise from various architectural companies and engineering firms in order to carry the spatial vision of Angers light rail out (Angers Loire Metropole, 2007). Based on the findings in Angers the connection between a strong vision, a personal passion and ideological belief in a project of this nature along with the political power to carry this project out were central components in Angers' light rail project. The 'powerful men concept' is thus an important contextual explanation for the relatively uncontroversial implementation process that occurred in Angers, and it also explains the clear link between the visions, the plans and the actual design of the system.

NOTE 1:
Jacques Landreau was a strong and powerful actor in fulfilling the light rail vision on the administrative and technical side. He was personally dedicated to this project, which was the last achievement in his career. He celebrated his 65 years birthday on the opening day of the tram and retired shortly after. The personal ring tone on his mobile phone was the bell from the tram, a gift from Alstom the tram manufacturer. During his engineering education he was an intern in Angers in 1967 where he was part of fitting the Boulevard Foch to the increasing car traffic, a mobility design that was completely rethought in the light rail project (Sourisseau, 2011).

A Clear Communication Strategy - Creating a Positive Image of the Project

The planning process was supported by a strong communication strategy in order to secure a positive image of the project and inform residents and other relevant stakeholders of the change process. One point five percent of the overall budget (see table XX) was allocated to this communication strategy, and it has become a paradigmatic example of a well-facilitated process. As explained by the Angers Loire Métropole (2012), a dedicated team was hired to create a project with an identity. A four-step approach was applied in this communication process:

- Before the construction works: to inform, to give people the urge to appreciate this project.
- During the construction works: to inform, to explain, to reassure that challenges are considered and handled.
- Operating start: to make people discover the new system.
- After establishment: to give people the urge to use the system regularly.

Some of the concrete initiatives in the communication strategy were 'totems' at future light rail stations, using the rainbow graphics to create a mental and physical image of the new light rail corridor and stop. Also, a real size mock-up of one of the light rail vehicles was on display in 'the house of the tramway,' which is a house where all relevant communication concerning the project was available to the public. A central part of the communication strategy was also to create solutions for show keepers in relation to accessibility and delivery of goods, a strategy that also made solutions for the time after the opening of the light rail. Another important element in the design phase was the creation of an inclusive and accessible system that would be easy to access for all passengers, especially the elderly or handicapped. An inclusive design process was facilitated in order to create a highly accessible and socially inclusive system (Research Interview, Olivier Sorin).

Central Discourses and Metaphors in the Decision-making process

Summarising the analysis of the political and cultural production of the light rail project in Angers, the central discourses and metaphors in the planning process can be summarised as follows (based on the analytical model introduced in chapter 3):

- Urban design discourse:—Facade-to-facade renewal of the city. –The tram as the 'emblem' of the renewal of Angers and its metropolis.
- Accessibility discourse: The desire to reclaim public Space from car traffic. The light rail system should access the 'heart' of the city at Place du Ralliement and create new car-free urban environments.
- Redesign mobility discourse: Mobility hierarchies should be redesigned in favour of sustainable modes.
- Liveability and future-oriented city discourse: A focus on quality of life and solidarity and modernity and urban competiveness should be offered along with a real alternative to car traffic.

- Urban development discourse: The light rail system is metaphorically framed as the 'backbone' of the public transport system and the urban network. The light rail is viewed as a generator of urban development.
- Urban competiveness discourse: Light rail as the new 'identity' of the city, which creates a new image for the city and for public transport and offers urban competitiveness and cultural production of new mobility practices and urban environments.
- Social discourse: A socially inclusive system that is accessible for all. The system's design and materials are integrated with social housing areas, providing a 'real choice' to automobility.
- Regeneration discourse: The light rail system as a tool for regenerating deprived districts both mentally and physically.
- The 'father of the tram' metaphor: The metaphor underscores the importance of leadership as well as the emotional side of this infrastructure, which is deeply embedded with emotions, passion and ideology.

An observation based on the identification of these discourses and metaphors is they often involve features that could be associated with the human being. The machine and the city combined almost make up a living creature with a backbone, identity and heart. The light rail is not only a transport infrastructure, but is inscribed in the culture of the city. The 'father of the tram' metaphor shows the strong ideological beliefs connected to this transport technology and underlines how implementation of infrastructure is associated with emotions, beliefs and ideology. The 'identity of the tram' refers to the material and spatial design of the system and its integration with the city, as well as the unique identity mediated through the material design that is further analysed in the following section. The light rail in Angers is an reflection of the city's history and culture. The visual image of the system is staging a shift in the spatial and cultural production of urban life. The establishment of the 'Mission Tramway' in 2001 provided an institutional setting and a 'taskforce' to carry the light rail project out, and the fact that the project was placed in the mayor's department made a significant difference and supported a linear process. Discourse coalitions were created within the Angers Loire Métropole and a particular language was created around the light rail project, with the redesign vision as the most important discursive framing. The light rail project was practised as an urban project, and thus the involvement of architects and designers was equally important as that of the engineers and technicians. The economic discourse was not present in Angers; this discussion was closed from the beginning when the Mayor pointed at the light rail solution and accepted that this was a project concerning more than travel time savings. Throughout the processes, decisions about the design of the system were grounded in an aesthetic rationale rather than an economic rationale. It is therefore also important to note that the entire redesign vision made the project very expensive and created a system that travelled with slower speeds than the busses it replaced.

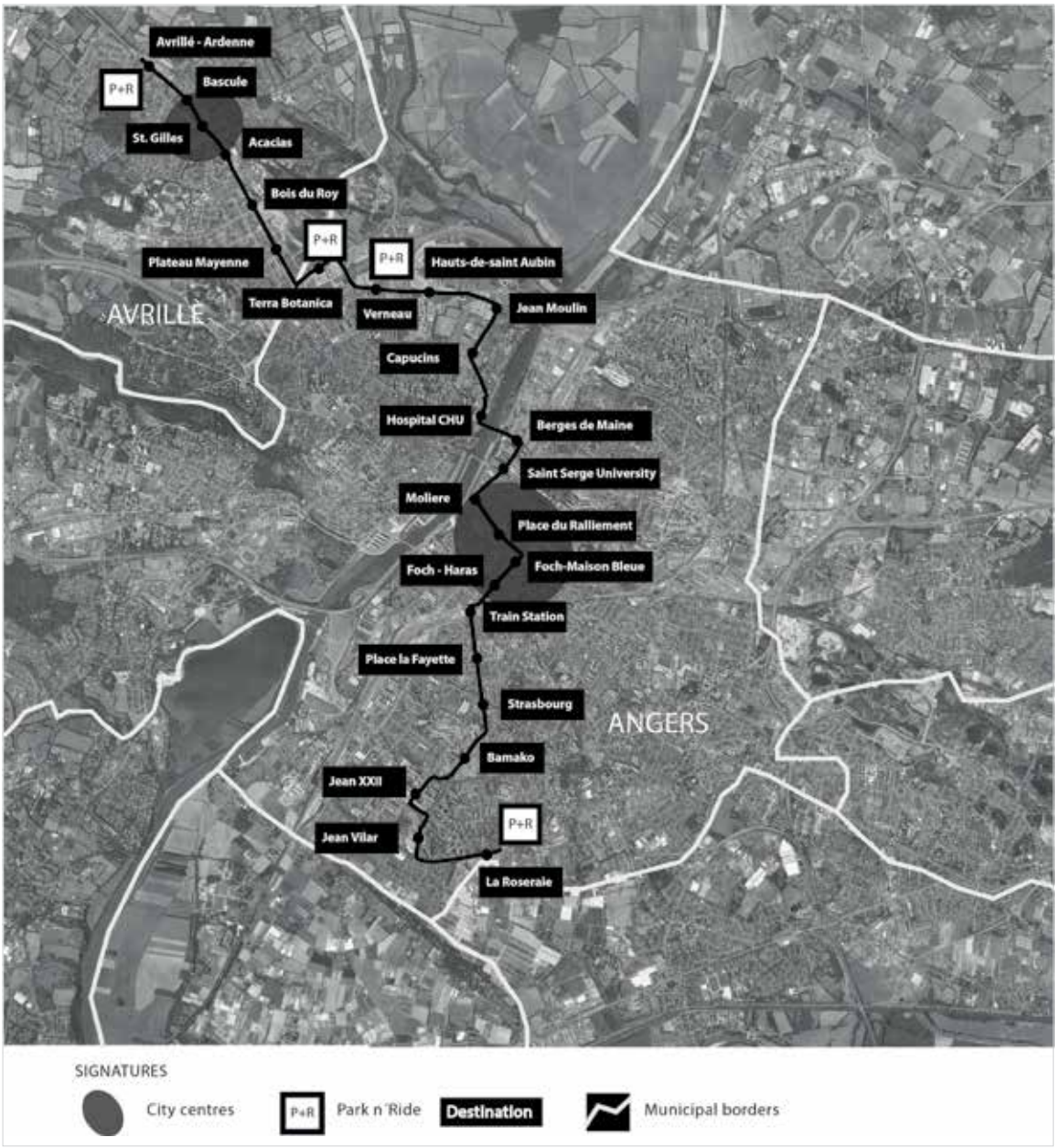


FIGURE 8: The first Light Rail line in Angers, and the urban development projects located in the corridor. Avrillé: redevelopment of downtown and densification along the route (15.000 inhabitants). Plateau Mayenne: 10.000 new inhabitants + amusement park. Hauts de saint Aubin 10.000 inhabitants, swimming pool, school and kindergarten. La Roseraie: area with state subsidies for urban renewal 18.000 inhabitants. (Background map Google Earth)

THE MATERIAL AND SPATIAL DIMENSION

The Spatial Re-design Vision

The light rail project in Angers is a case where many strategic physical and social considerations were made to gain political acceptance of the project, especially with regard to the light rail alignment. The light rail line is planned to connect both social housing areas in the southern part of the line with new, high-end urban developments in the northern part of the line. This makes some interesting new connections in the city and could be seen as a strategic act to couple some of the socially deprived areas with new high class urban developments by 'stretching' a new corridor that connects these different physical and 'social layers' in the city. Furthermore, the light rail system connects two of the thirty-three municipalities in the Angers Loire Métropole, which was a strategic prioritisation that helped it to gain the project acceptance since this alignment gains broader political support when a project is not only working to benefit Angers Municipality at the centre of the Métropole. The alignment supports a wider regional focus on renewals of urban space and street environment that is not just limited to the city centre. Finally, the equal technological and physical prioritisation of the entire corridor could be seen as a central strategy in this project. The fact that the expensive APS system was chosen in both Angers centre and Avrillé is a political signal of the equal prioritisation of the corridor in all districts that the light rail serves, and it makes equal districts that have not been historically considered as equal from an aesthetic and visual perspective. In this strategy, the APS technology was an important material actant.

The spatial redesign approach applied in the Angers light rail project is often referred to as a facade-to-facade renovation where both the urban space and the mobility hierarchy in the corridor have been redesigned with new bike lanes and 'park-n-ride' facilities which should feed the light rail system (Angers Loire Metropole, 2011).

Marie-Pierre Trichet, planner at the Angers Loire Métropole, describes how the space and mobility hierarchies along the corridor have been transformed:
'It's like with your children: they are different, but you love them all. Place du Ralliement, we hear the birds and the sound of the fountains instead of backfiring cars. The bridge is a beautiful book, Confluences. It prepares well for the future. Avrillé was a village street - It became a city. La Roseraie is also transformed, in connection with the operation of urban renewal'. (Courrierdelóuest, 2012)

New public spaces have been created throughout the corridor, and in the 'heart' of the city, parking spaces have been placed underground in favour of the light rail system and softer modes of transport. It has been an important part of the concept to create a barrier-free system that is not fenced off from the urban environment, but is rather integrated with pedestrians. The most controversial example of this is the most central city square, 'Place du Ralliement,' which was completely transformed into a pedestrian zone with underground parking, meaning it is not a bus/bike/pedestrian strategy only. As

PROJECT OVERVIEW

OPENING : June 2011

LENGTH: 12 km

STOPS : 25

AVERAGE SPEED: 18 km/h

TRAVELTIME: 37 Minutes

MAJOR DESTINATIONS:

PUBLIC TRANSPORT SHARE: 14 % - constant since 1998

FREQUENCY: Every 6 minutes during peak hours

PASSENGER LEVELS: Estimate 36,000 pas. /day (actual pr. November 2012 is 31,000 pas/day)

PRICE: 300 million euros in 2005 prices – 25 mio euro/ km (including street renewals)

Avrillé: redevelopment of downtown and densification along the route (15,000 inhabitants)
Plateau Mayenne: 6.000 new inhabitants + business hub (50.000 m2)- amusement park.
Hauts de saint Aubin: 10,000 inhabitants, swimming pool, school, and kindergarten.
La Roseraie: area with state subsidies for urban renewal, 18,000 inhabitants.
Hospital: 6.000 employees, 3.000 daily visitors
Univiserity: 3.500 students, 1.500 jobs.
Train Station: 11.000 daily travellers, new business district Gare + (60.000 m2 services businesses and 200-250 new homes

FIGURE 9+10: Above: The rainbow image is also implemented at the bus network creating the same visual identity of the entire network (Photo by author). Below: Overview of key figures of Angers light rail project.

previously described, this decision caused controversies in the planning process. The light rail in Angers crosses two of the thirty-three administrative communities in Angers Loire Métropole; Avrillé and Angers. The critical mass of passengers is in the southern part of the line in the Angers community, but in order to create political acceptance in more than one of the thirty-three communities, the light rail was planned to connect two communities (see figure 8). Olivier Sorin describes how the compromise of the placement of the light rail line was made:

'If he [the Mayor] wanted to create the first tram line he was obliged to make a tram between the suburbs city and the city centre. For the second tram line it is the same, because now everybody knows the tram, and everybody wants to have a tram in their area' (Research Interview Oliver Sorin).

The southern part of the line replaces an existing bus line with a critical mass of passengers. The southern part of the lines also serves Roseraie, which is a socially deprived housing area, where the light rail system is used as a tool to upgrade the area along with redevelopment and new developments. The northern part is a new brownfield area that has not previously been served by bus. In this area, new high-end housing districts are planned, and in this sense, the alignment connects districts with very different physical and social identities. Two sections of the line are served by a special ground power supply system invented by the light rail manufacturer Alstom, which avoids overhead wires. This system is called APS. APS is used in central and historical Angers (see city centres in figure 4), through the main square and shopping street Place du Ralliement, and is also applied in the city centre of the smaller village of Avrillé. In Angers, there are architectural and historical reasons for choosing this system in order for the light rail to access the 'heart' of the city, while the reason for applying the system in Avrillé is seen more as political. This act gives equal priority to the two areas and acknowledges the sensitivity of downtown Avrillé (Research Interview, Olivier Sorin and Pierre Luc Papin). The technology thus holds both a spatial and material power in the design of the Angers light rail.

The first year of operation has shown that the main number of passengers is in the southern part of the line in Angers, and there would be reasons to consider increasing the frequency in this part. However, in the northern part of the line, there are very few passengers due to the fact that major parts of the areas in the light rail corridor are under development. Again, due to political reasons, it is not possible to increase the frequency only on the southern part of the line, since this would indicate that the two communities are not equally prioritised (Research Interview, Pierre Luc and Oliver Sorin). The technical and the political motives are thus inseparable.

The corridors are loaded with activity since many large urban development projects have been placed along the light rail tracks as a part of the transformation process, especially in the northern part of the line, (see figure 4). One important reason for the introduction of many urban development projects was a demographic analysis showing that the level of inhabitants would increase remarkably. However, the increase has not yet (2012) oc-

curred and the need for new housing is therefore not as great as it was expected to be at the end of 2012 (Research Interview, Oliver Sorin). The unexpected demographic development coupled with the economic crisis creates an overcapacity of housing in the city, which might have a future impact on the price levels for housing in the city in general and potentially even more in the areas outside the prioritised light rail corridor. The strategy for the Métropole has been to react to the suburbanisation that has happened in Angers by creating attractive housing in the light rail corridor. It has, however, been a struggle to get the municipalities that are responsible for placing new urban developments to dedicate their efforts to the existing public transport corridors, and many large development projects have therefore been placed outside any proximity to public transport (Research Interview Olivier Sorin). This is in contradiction to the vision of using the light rail as the 'backbone' for future urban development. There is some organisational disagreement since the Métropole is in charge of strategically coordinating public transport and urban development, but it is ultimately up to the Municipality to decide on the urban development, and this creates some specific challenges of dedicating urban development in the light rail and overall public transport corridor. There are some potential downsides to the urban development strategy applied in Angers. The northern part of the line has proved to be economically vulnerable since there seems to be an overcapacity of housing in the city due to the stable demographic development. The operation of the light rail system is thus affected by the lower usage in the Northern part of the line, which is likely to change when the new housing areas are activated. Furthermore, there are some important organisational shortcomings in fulfilling the goal of using the light rail as a main axis for future urban development. The gap between the integrated public transport and urban development vision from the Métropole is challenged by the interests of the municipalities, which do not prioritise urban development in transit corridors, thereby causing increased levels of car traffic and making it even harder for the light rail to compete as an attractive alternative due to the continuously dispersed urban structures.

Redesigning Urban Mobility

With the introduction of the light rail in Angers, the entire public transport network was modernised and redesigned. The bus routes were categorised into core high frequency routes and supplementary routes, and the light rail is described as the backbone of this new and modernised network. Many of the bus lines have dedicated infrastructure on large parts of the routes, offering higher accessibility and shorter travel times. As has been the case in many other light rail cities, the bus routes have not been reorganised to feed the tramline, but rather run in radial lines through the city. The experience from other French cities showed that a city the size of Angers was too small to introduce the

FIGURE 11: New bike lanes are implemented in the light rail corridor, and 70% of the tracks have a green pavement. (Photo by author).

feeder system. When the trips are shorter, the users are less keen to perform shifts on their public transport ride, and this makes the service less attractive. The modal share of public transport in Angers is 14%, and the light rail presently stands for 29% of all trips in public transport. The visual image of the busses has been changed to fit the rainbow identity, providing one image of the entire system (Research Interview Olivier Sorin).

The forecasted passenger levels for the Angers light rail system were 36.000 passengers per day. This estimate was made based on experiences gained in the neighbour city, Le Mans, including the existing passenger levels and the potential new customers in the corridor coming from the activities that are located along there (e.g. hospital, university etc.). Furthermore, an important basis for this estimate was the many urban development projects located in the northern part of the corridor. Estimates were based on the assumption that all urban development projects in the corridor would have been completed. The actual level in November 2012 was 31.000-32.000 passengers (Research Interview Olivier Sorin). The fact that the passenger levels are lower than expected could possibly be explained by the many urban development projects that were not yet in use.

The average speed of the light rail system was expected to be 20 km/hour, the same as the speed of the bus system before it was modernised. Therefore, from a transportation point of view, there would be no sense in launching a new system with travel times higher than those of the existing system. Moreover, after the first year of operation, the current average speed of 18 km/hour is still lower than expected, and seen in this light, the passenger levels are actually quite good and must indicate attractors other than fast travel speeds for passengers. The relatively low travel speed is a result of an alignment that crosses some of the most sensitive central urban areas where the space is shared with pedestrians, which calls for lower speeds for security reasons. Also, on 12 kilometres of the line it has 25 stops, and there is a section in the city where the system runs on single tracks because of the very narrow passage, all of these elements slow down the system. This shows how the concept in Angers has not been to provide high speeds, but rather to penetrate the core urban areas, something which impacts travel speeds (Research Interview, Pierre Luc Papin).

Supplementary initiatives have been made in relation to the new modernised network in order to facilitate intermodality and a sustainable urban transport system. Park-n'-ride facilities have been established along the tram corridor at strategic spots, with intersections of different transport modes, and bike sheds have been provided to encourage combined mobility trips. City bikes are available at the main station, and the Métropole is implementing stations for car sharing. However, this is not yet very widespread or well-known among the citizens, and therefore has no major impact on modal split. Nevertheless, it is a symbol of a dedicated effort to promote alternatives and provide a sustainable city image. Furthermore, the construction of bike lanes has been an obligatory part of the light rail project, so bike corridors have also been constructed along the new connections made by the light rail system (Research Interview Olivier Sorin). The light rail project has

changed levels of automobile traffic. In 1998, the modal share for car traffic was 60% and 14% for public transport. These shares have not changed. The car is still prioritised in the city, as evidenced by the multitude of parking facilities, and there are no major problems with congestion (Research Interview, Olivier Sorin). In Angers, the politicians are reluctant to limit the amount of parking provided in the city centres, and Angers has considerably more available parking spaces than other cities of similar size; hence, it is a challenge to get people to use the park-n'-ride facilities (Research Interview, Olivier Sorin). The central square of Place du Ralliement has been transformed into a pedestrian zone and a parking garage has been established below the square. It could be questioned to what extent the many sustainable transport initiatives have had an effect in Angers, and it can, of course, be difficult to make conclusions on such a short basis. One of the main challenges is the half-hearted dedication to reducing car traffic, which has been placed more on the idea of promoting alternatives than it has been grounded in more restrictive measures to force cars out of the city. As was described in chapter 2, this remains a dilemma in many light rail cities, where one of the main obstacles for a sustainable urban transport is the lack of will to restrict car traffic and change transport behaviours and cultures in the city. The case of Angers supports this finding in regards to attracting car passengers, something which is crucial to changing modal split in favour of public transport.

A RAINBOW IDENTITY

FIGURE 12:The interior design characterises the special elements of the environment in the area. The flowers in the roof also symbolises the green identity of the area and the, and so does the seats with the bright colours. (Photos by author).

FIGURE 13:The vehicles are designed in the colours of the rainbow. The rainbow identity was developed in 2004 by the professional design company Dominique Pierzo - The colours that will light up in the urban environment which is consistent of grey and beige stone. The large windows are designed to provide a good view of the city. (Angers Loire Métropole, 2011) (Photo by author).

FIGURE 14: The local gained material slate is used at the stations, also to symbolize the local identity in the project. The colours of the station are in the same as the pavement, and the paper bins and the lamp post have same finesse. Notice the mast in the backgroun with the circle and a T for 'Tram' in the middel - a landmark to indicate the prescene of a stop. (Photo by author).

FIGURE 15: 70% of the route is green tracks. It was a political decision to construct the green tracks. This is to reflect the agricultural history of the area, and the identity as a green and agricultural area. (Photo by author).

FIGURE 16: A special ground power supply APS is chosen in Angers, this is in order to limit the visual effects of overhead wires in the historical city centres. There are 700 m in Avrielle and 725 in Angers centre. Compared to a tradtional over head power supply the additional prices for this system was 1,5 mio. Euro. (Photo by author).

FIGURE 17: As every other element in the Angers light rail project the depot is also thoroughly designed. The building is designed as the wing of an aeroplane, because of the history of the area, which used to be an old airport, the price was 22 mio. euro. (Photo by author).

FIGURE 18: The Confluences bridge was one of the major expenses on the budget 27 mio euro. The politicians wanted a beautiful bridge and the bridge is a manifestation of the restructure of priority for public transport since cars cannot access the bridge. (Photo by author).

FIGURE 19: Park n' ride facilities has been implemented to encourage modal shifts. (Photo by author).

Spatial Analysis

The spatial analysis was performed by a phenomenological registration of urban space, where my own personal experience of riding or walking along the corridor has been used as the medium to perform the analysis of the material and spatial implications of the light rail system. The trip along the corridor starts in the northern part of the line in Avrillé.

District: Avrillé (figure 20+21)

At the entrance of the downtown of Avrillé, marked by the stop of Acacias, the light rail draws back its masts and continues, guided by the underground power supply (the APS) system. It moves from running in its own right of way to running in shared tracks with cars and bikes through the city's central urban environments. Avrillé is a small village with low-rise buildings of not more than four floors. The scale of the buildings still allows sunlight to enter. The buildings as well as the pavement are characterised by the beige and grey stone which is typical of the area. Shutters on the windows underline the special French village style and many green trees are between the building facades. The building facades are drawn directly to the street, creating a pleasant, small-scale environment. Stone dikes indicate that the village holds a long history, and that it has been an important town centre for the agricultural hinterlands around the village. Avrillé's downtown is the commercial centre for the Avrillé community, with many small stores located side-by-side along the central avenue through the city: Avenue Pierre Mendés. There have been planted trees and bushes in the area and you sense that the urban space here has had a recent upgrade. Everything still seems new, fresh and unspoiled by daily use. The Stop at St. Gilles is the heart of the Avrillé downtown and the redesign of this square creates a new urban space in the corridor and a central node in the district. It is actually hard to see indications that there is a light rail stop placed here since it has been so neatly integrated in the urban environment. However, a large pole with a big T placed in a circle between the tracks is a landmark indicating that this is a light rail stop. This central node is placed directly in downtown Avrillé, in proximity to most of the businesses here; it underlines the transformation of this village street.

District: Les Hauts de Saint Aubin (figure 22-26)

Continuing from the narrow streets in Avrillé, you experience a shift in the corridor, indicating an edge between the small-scale urban village and a new development side. The district that I enter is characterised by its open widths and has green and brown fields. To the west of the light rail line, the existing neighbourhoods are located, composed of buildings of not more than three floors and small gardens in front of the houses. To the east is what is to become a new neighbourhood. Much construction is ongoing and huge cranes are everywhere. None of the new apartments and businesses has yet been occupied, which gives an image of an empty shell where history and identity is yet to be created. This unused area is definitely a previous spatial and mental edge between the communes of Angers and Avrillé. The green light rail corridor creates the axis from which this new area is to develop, and this is also the only element that is completely finished as it was when I visited in November 2012. Along the tracks, real-estate agents have put

FIGURE 20+21: Avrillé centre before and after the implementation of the Light Rail. Picture from St. Gilles station (Angers Loire Metropole (2012))

up commercials with spectacular images of what the area is to become. On many of these advertisements, the light rail is pictured as the 'friendly and green neighbour.' The area Les Hauts-de- Saint- Aubin (100 ha) has been appointed by the Métropole as 'the urban quarter of the future', with housing (6.000 units), a business hub (50.000 m2) and services, shops and plenty of jobs (Angers Loire Metropole, 2007). The light rail line is placed in the centre of the corridor in its own tracé. A lane dedicated to cyclist use is indicated with red pavement on the road space for cars. One lane for bikes and cars is provided in each direction, materially designed in a way that affords low travel speeds in the corridor and encourages alternatives modes. The implementation of bike lanes has been a key aspect of the re-design of mobility and a way of underlining a new priority to softer modes. The entire street layout is redesigned: everything from pavement, to lampposts, to sidewalks and paper bins is new, and many green elements have been introduced.

Turning east towards the stop of Terra Botanica, there are brown fields on both sides of the light rail line, and I am now in the middle of a construction site. I am walking in mud and the wind is strong since there are no buildings to offer shelter; this area is under construction and reminds me of a ghost town. Close to Terra Botanica, I see the light rail depot. It is a landmark in this very open area, and just as the entire light rail project, it represents the light rail redesign vision. From a distance, it is easier to see that the building is shaped like an aeroplane wing in a nod the old history of the area, which used to be a local airport. The light rail now runs on the east side of the road, and only one lane for cars and bikes is provided in each direction. It is still a corridor with low speeds. The district ends where the light rail crosses the River Maine via the new bridge, Confluence, which can be characterised as an edge between the land areas, an edge that the light rail now connects. Just before the light rail goes on to the bridge, it passes one of the main workplaces and central destinations in Angers: the hospital CHU. More than 6.000 people work here and the hospital receives 3.000 visitors every day, as well as students at the academic medical centre. The hospital is a key node in both the city and the region (Angers Loire Metropole, 2007).

District: Angers Down Town (figure 27-33)

From the hospital, the light rail takes a sharp left hand turn to cross the River Maine. You can hear its wheels squealing because of the sharp curve. The river is one of the major spatial edges that has been seamed together by the light rail infrastructure and the bridge Confluence. Other bridges have connected the two sides before the implementation of the light rail, but Confluence is a landmark and a symbol of the redesign vision. On the bridge, priority has been given to softer transport modes, since this new connection is only accessible to the light rail, cyclists and pedestrians. The name Confluence was suggested by public vote and is intended to mark the merger of two areas, between river and mainland. The bridge evokes the idea of a harp, a music instrument with its bows and strings; it is obvious to see that architects have been involved in this design. A large public square opens up at the station of the Saint Serge University after crossing the bridge. This is an important node on the route and a centre of activity. Close to the stop there are many

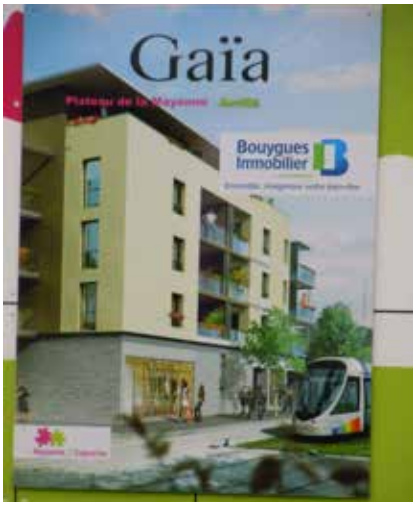


FIGURE 22+23+24+25+26
DISTRICT LES HAUTS DE SAINT AUBIN

Impressions from the district: 22 Real estate advertisment with the light rail as an integrated element. 23+24+25: Constructions and new developments in the corridor 26: Newly established public space waiting to be used

FIGURE 27+28+29
DISTRICT ANGERS DOWN TOWN

Place du Ralliement in Angers before and after the light rail. Above - busses and cars had acces to this central commercial area. Below: with the implementation of the light rail all car and bus traffic was removed from the square, and a new pedestrian zone has been created with outdoor serving.

FIGURE 30+31+32+33
DISTRICT ANGERS DOWN TOWN RÖE STREET

Above right: The small cafe 'Le Tram' named after its new neighbour the tramway. Middle left: the light rail at stop Place du Ralliement after entering the square from the narrow passage at Röe street. Below left and right: Röe Street befor and after the light rail. A narrow passage of only 9,6 meters. (Photos by author).

small eateries, and there is a main pedestrian walkway crosses the light rail line close to the light rail stop, creating a central mobility node. After this node, the light rail continues into the denser and more central part of Angers downtown area, where building facades are drawn to the street and the streets are narrow. This district has one-way traffic for cars, whereas the light rail has double tracks with grass pavement. The red pavement on the side of the road is allocated to cyclists. Buildings are grey and beige, as in Avrillé.

The light rail takes a sharp left turn into the narrowest stretch through downtown Angers, a passage with only one light rail track because of the narrow Röe street of 9.6 metres. Here, the light rail shares the space with only cyclists and pedestrians. No cars are allowed in this urban space. At the bottom of a relatively steep street, the light rail merges into the APS ground power supply system at Moliére station. From here on, no overhead wires are visible in the urban environment. At Moliére station, a small cafe has been named after its new neighbour. It is called 'Le Tram.' As the light rail very slowly climbs Röe Street, the many small stores and the pedestrians walking slowly in the middle of the light rail tracks indicate that you are now in the very heart of the city. The pavement is cobblestone, and the light rail tracks are integrated into this street layout. The narrow streetscape opens up into a large plaza at the top of Röe Street. This is the commercial heart of the city, and this is where the most controversial part of the light rail project, Place du Ralliement, is located. The light rail line runs directly through the city square and stops at the centre. The glass roof of the light rail stop has the same shape as the square, but is cut in two by the light rail line. This node is also a landmark on the square. The square is surrounded by some of the most spectacular old architectural buildings found in the city. It is evident that this place has always been the heart of the city, and the historical facades of the buildings underline this role. The pavement is the same everywhere, worked in grey flagstone and a smaller version of the same pavement to indicate the light rail track. There are fountains and outdoor dining, which indicates that this is a public space. All car traffic and parking has been removed, leaving large surfaces available to reuse as public space. Since it is November, small huts have been put in the square in preparation for a local Christmas market. The corridor narrows again towards Foch Boulevard. I see Foch Boulevard as one of the most extensive re-designs in the corridor. As the name indicates, this boulevard was previously paved with asphalt and dedicated to cars. Now, the green light rail track has been placed centrally at the corridor and creates a completely different and narrower street scape. There is only one lane for cars and a dedicated lane for busses in each direction.

District: Train Station (figure 34+35)

The district around the train station is a major node in the city and a gateway to the rest of France. A light rail station has been placed just outside the railway station and the design of the station indicates that this is a central node. On the roof of the light rail station, a major glass sign and landmark is placed with the text 'Les Gares'; it is at this point that local and regional traffic meets. The roof of the rail station opens up towards the light rail stop, and 11.000 passengers run through the rail station every day. A new business dis-

FIGURE 34+35
DISTRICT TRAIN STATION
Above: Art installation in the corridor "The Standing Warrior". Below: The stop at the train station 'Les Gares' as a central node and landmark (Photos by author).

trict is planned in proximity to the railway station 'Gare +' (60.000 m2 service businesses and 200-250 new homes and businesses) (Angers Loire Metropole, 2007).

District: La Roseraie (figure 36+37)

Continuing from the railway station on narrow streets, I discover a shift in building architecture and period toward the older city centre; it is the district La Roseraie. This district is characterised by much larger building volumes than the rest of the city. The area is planned in a functionalist style, with apartment blocks of eight floors or more and wide boulevards. It has modern architecture with prefabricated construction, and parking is provided in front of the building blocks. As it is in the rest of the city, the colour of the buildings is beige and grey. There are many large, old trees in the area, which underlines the volume of the building structure in the area. The green light rail tracks have been placed on the left side of the road and there is one lane for cars in each direction. The red pavement on the side of the road is dedicated to cyclists. In this area, there are many roundabouts through which the light rail passes directly. The light rail has been given priority at intersections. The many large green spaces between the buildings allow the light rail access without having to interfere with existing infrastructure. Designated for urbanisation in 1965, Roseraie became prone to unemployment and social unrest often associated with French suburbs. The light rail line supports the regeneration of the area. The light rail line provides a mental and physical connection to this edge with a very different physical feel than the rest of the city.

The new Path through the City

The whole streetscape has been organised around this new transit line and it is a visual guideline through the most central parts of the city, with immobile tracks that underline the proximity to a main transit line. The 'backbone' metaphor suddenly materialises when you discover how the light rail has been integrated into the narrow street environment; it is almost as if it had always been there and the city developed according to it. The entire 'staging' (Jensen, 2013) of the scenery reminds you that the urban environment is served by public transport, but also that this corridor is dedicated to urban life and not traffic, especially not car traffic. The infrastructure is fitted to the requirements of the city and not vice versa. In the narrow urban spaces, light rail, cars and cyclists share the same space—a mobility design that indicates that all modes are equal and affords slow travel speeds. In many parts of the corridor, the central reserve is heightened slightly, which makes it difficult for vehicles to cross the opposite lanes. This design also affords slower travel speeds. The central reserve is paved with locally extracted shale and small bushes are planted here. Signs tell you that you are in a 30 km/hour zone, but the whole street environment emphasises this regulation, which almost makes the sign unnecessary. Everything along this path is neatly designed to fit the new image of the corridor, from the lampposts to the paper bins. In the most central urban areas, there are no overhead wires, only tracks that are integrated in the street scape. This underlines that you are now in the most sensitive parts of the city, where disturbing visual elements is not wanted if other options are possible. Also, new art installations are provided in the corridor since the light

FIGURE 36+37
DISTRICT LA ROSERAIE
Impressions from before and after the light rail Source: Angers Lorie Metropole (2012)

rail is a part of a larger urban project:
'The construction of the first tramway line is part of a larger urban project conducted in recent years in the city of Angers. This urban renewal is accompanied by a willingness to trim public space. Art, already present in the city of Angers, fits naturally into this project. Two sculptures have been inaugurated in emblematic places of the route of the tram.' (Angers Loire Metropole, 2011).

CASE STUDY FINDINGS

The case analysis of the Angers light rail has shown that this is a case of a powerful political vision and a clear storyline that has been practiced through the entire process, from vision to plan to implementation (see also the analytical model in chapter 3). This creates a very clear picture of the objectives behind the system as being more than a transport project, and the political and administrative leadership has been key in the relatively linear implementation process that has happened in this project, especially considering the higher budget that was given for this system than those in some of the other cases analysed. Furthermore, the Angers light rail project is an example of the dedication to an aesthetically beautiful and consistent project, and the ownership and the positive image that exists towards the project locally could be seen as a result of the equal political, social and aesthetic prioritisation of the entire corridor. The dominating discourses that are clearly tracé able in the material and spatial design of the corridor and every part of the system are mediating the redesign vision and story from the green tracks to the rainbow image and new urban spaces created in the corridor. The case analysis also showed that the Angers light rail project should be considered part of a wider light rail practice which has emerged in France since the opening of the Nantes light rail system in 1985. In France particularly, there has been a strong emphasis on perceiving the light rail as a strategic urban redesign project in which there should be a focus on aesthetics and the creation of new urban spaces that favour softer transport modes. This light rail practice has, together with the introduction of obligatory urban mobility plans (PDUs) and transport tax to finance urban public transport, marked a shift in the management of cities away from the car-dominated development that has been prevalent since the old tram system was closed. In this regard, the light rail is used as a strategic tool to redesign central urban corridors and regain urban space.

There are also some central critical points to make regarding the concept behind the system. The analysis also proved that the light rail project in Angers has not been about faster travel speeds, since the light rail today travels with slightly lower speeds than the buses it replaced. As the case analysis proved, this was a necessary compromise of the system that had to be made in order to get the light rail into the most narrow and central urban areas. This decision means that the light rail, in some parts of the line, runs in one-way alignments that create clear capacity restrictions. Also, the integration with the city in central pedestrian areas does not afford the same travel speeds as it would have if the light rail was completely separated from the urban environment. Compared to the findings in the case of the Bergen light rail, this is a considerably different design, which

has potential implications for performance indicators (see chapter 2). In Bergen, the light rail ran on segregated tracks on the suburban parts of the line, affording higher travel speeds, and this has the implication that the average travel speed in Bergen is 28 km/hour, whereas the Angers light rail only travels at 18 km/hour. These are major contextual differences regarding the concept and the idea behind the system that are important to consider when the performance of the system is evaluated. They exemplify how the objectives behind the system and the specific design of the system and the corridor have to be taken into consideration. This underlines the argument introduced in chapter 1: The impact of light rail systems should not be reduced and generalised without taking context into consideration.

The light rail project in Angers ended up being a very expensive and prestigious political project in which there was little attention to the cost-benefit analysis of such as system from a traditional economic perspective. The project also displays some shortcomings of changing modal split in favour of public transport, which was a major objective behind the project. It could thus be questioned if the money spent has proved a successful outcome in regards of meeting the objectives behind the system or if the process was 'blinded' by the light rail vision, in which focus on aesthetics happened on behalf of creating a competitive transport system. However, it could also be questioned if a stronger focus on creating an efficient and competitive transport system would have happened on behalf of the aesthetic and visual impact that the light rail has had on the transformation of the corridor. The result is an aesthetically beautiful transport system in which the residents have an ownership of, but which has created longer travel times than the bus system it replaced. The case underscores some important questions regarding the perception of the role of transportation and infrastructures in our cities, and which qualities are the most important. In Angers, the light rail is an interesting example of the dilemma of being a technology in between a transport system and a tool in urban development, since it has been implemented as a hybrid between a transport technology and an urban development project, proving that these two uses are sometimes irreconcilable.

CASE ANALYSIS
BERN WEST LIGHT RAIL

6c

FIGURE 1+2: First impressions of Bern light rail. Above: the central node at the rail way station where the light rail network integrates with the regional network. The roof is shapes like a wave connecting the nodes. Below: The new light rail corridor in the midernistic housing area in Bern West (Photos by author).

HAUPTSTADT WIRD ZUR TRAMSTADT

PROLOUGE

I arrived to Bern by train from Freiburg. The regional train network worked very well and it did not take me long to get from Germany to Switzerland. Just outside the train station I saw a huge glass roof shaped like a wave—it was the central node in the city station linking the regional and the local transport networks. My hotel was close to the train station and by walking there I saw how the light rail moved slowly through the very core of the city centre, passing the old city gates and accessing the central shopping areas. It was obvious that this city has a tram history and parts of the city have almost developed around the old tram lines. The light rail vehicles in Bern are red and so are the busses—it creates an integrated identity of the public transport network. The trains are very long but the sections are short to allow the tram to take sharp curves and enter narrow streets in the city centre. Small shops are hidden in the covered arcades along the central street. The pavement in the city centre is cobblestone, affording very low travel speeds—this is a pleasant place to be a pedestrian. I get on the light rail line 8 towards Bern West. This is the new extension of the old network. The light rail moves in shared traffic through the old part of town and enters a huge modern housing area, Bethlehem. The scale of the buildings here was very different from the rest of the city. Trees were planted in the corridor and parts of the tracé had been planted with grass, which provided a green element in the urban space. New developments were being used and more were under construction. The light rail line worked as the main corridor in this development and redevelopment project. (See pictures 1 and 2 for first impressions, and figure 7 and 8 for map of the light rail corridor).

QUOTE:
'A tram is not just a tram. A tram means new street environments, successful squares and new urban districts. I think that Bümpliz and Bethlehem have gained in quality of life.' (Egger-Jenzer, 2010).

The case analysis of the light rail Extension to Bern West exemplifies a clear political vision and project that was not initially accepted by the community in Bern West. This shows how challenging it can be to get public acceptance for the urban transformation often associated with a light rail project and how the project must be then translated to fit the requirements of the citizens. The case of the light rail extension to Bern West is also a case of how the light rail is used as a strategic tool in a wider regeneration and urban development process. The analysis will show that the light rail has been perceived as a perquisite for regenerating the social housing areas in Bern West and creating a new image and mental and physical link between these quarters and the rest of the city. The light rail is furthermore used in a transit-oriented planning where new urban developments in Bern West should be supported by a high-quality public transport system. The main finding of the discursive-institutional and the material-spatial dimension, as well as reflections on the process, are summarised in the end of the analysis.

QUOTES FROM THE OPENING DAY

Mrs. Councillor Barbara Egger-Jenzer:

"We are in the midst of the Advent season. The time of great expectations, in which we are all are looking forward to Christmas with all the presents. The shepards and the wise men looked to the east 2000 years ago and saw the star over Bethlehem and new something good was about to happen. This year we have a star over our Bernese Bethlehem on Bümplizstrasse and Holligen you can already see the bright lights. Just as the Advent candles already announce Christmas, so there are, for example, the lights roofs at bus stops , which announce that something new is coming. Of course, we are not only waiting on one star - We wait for three stars. There are the three top lights of the first trams, which opens the newly laid rails and brings sparkle in Bümplizstrasse and Bethlehem".

"The day tomorrow is a long-awaited day. Long awaited by those who from the beginning for have fought this project. Long awaited by those who in recent years under the inconvenience have suffered from the construction site (...) Long awaited by the planners, the now welded their thoughts firmly into the steel of the rails (...) Long awaited by the contractors and their employees which finally can see the perfect result of thier work. And long awaited by many former opponents of the trams, which now say "yes" to the project, because they can admire in real life the upgraded roads and squares"

Rytz, councilor of the city of Bern and Director of public works, transport and city Greening:

"The Tram Bern West has many Mothers and fathers. It is a joint infrastructure project of the Confederation, canton and city of Bern and we can only thank the wide support from all social circles and plenty of expertise be brought to the rail. A large proportion of mothers and fathers is here in gathered here in Sternensaal to raise the Tram Bern West finally out of baptism".

"We have for several years been experiencing a world Renaissance of trams. And it will not surprise you Laides and Gentlemen, that representatives from the growing district of Bümplitzstrasse - Bethlehem saw this opportunity as obvious. Even before new tramlines opened in Paris, Manchester or Los Angeles has the councillor Heinz Junker demanded a tram to the western part of the city. But it took 20 years before this concern could be realised".

"The light rail has many mothers and fathers, but also brothers and sisters. I am happy to see that we on our official opening of the new line have guests from other cities, regions and from Germany and France. There is representative from governments and transport companies who themselves are planning or already building new light rail lines, we stand together for the future of public transport. I hope ladies and gentlemen that the opening of the Light rail to Bern West will bring inspiration to your own future projects".

THE DISCURSIVE AND INSTITUTIONAL DIMENSION

The Bern West light rail project is a case in which a new light rail extension to an existing tram network has been framed in a discursive, institutional, spatial and material context (as referred in chapter 3). The new extension to Bern West has been used in an urban development and redevelopment process, and provides interesting perspectives to the challenges of extending an existing network to new parts of the city. In this case, it is only the process and spatial implications of the new extensions to Bern West that are analysed since the history of the old network goes much further back. Switzerland is often referred to as a 'paradigmatic case' of public transport, given that it has a strong public transport culture (see chapter 4). As was argued in chapter 1, to understand the framework behind the light rail project in Bern West, it is necessary to understand the national context and policies which have been crucial in enacting a particular public transport culture and planning practice that is often framed as this 'best practice example.'

QUOTE:
"Mit der Eröffnung von Tram Bern West werde die Hauptstadt Bern zur Tramstadt"

"With the opening of the light rail to Bern West is the capital Bern transformed to the light rail city "
(Kanton Bern, 2010).

Persons interviewed in Bern were selected according to the criteria introduced in chapter 4. They were identified and contacted through a snowball sampling method and chosen to represent a variety of perspectives on the project. Altogether, five interviews were conducted in order to accomplish this goal.

The persons interviewed in relation to the Bern context were:

- Daniel Schwarz, planner in the office for public transport in Canton Bern, the regional transport authority.
- Elisabeth Bäschlin, lector in geography at the University of Bern.
- Rolf Meyer - Chef for Corporate Staff at the Public Transport Authority of Bern Mobil.
- Mirjam Bütler, vice-director of Verband Öffentlicher Verkehr (VÖV), a public transport organisation formerly employed in Bern Mobil.
- Ueli Müller, planner at Bern Municipality.

The Genesis of the Project

Bern is the capital of Switzerland. In the Municipality of Bern, there are 130.000 inhabitants, and the greater Bern region has approximately 350.000 inhabitants (Research Interview, Ueli Müller). The 'Swiss model' is often referred to as a paradigmatic case of public transport due to the high modal share of public transport in many Swiss cities and their well-known public transport culture (Kaufmann, 2004; VÖV UTP, 2010). The politically holistic approach to transport and urban planning is, in many ways, unique to Switzerland, with an integrated regional and urban network. Rolf Meyer from Bern Mobil describes the planning philosophy behind this integrated system:

'we have a fitted time table over the whole country. Every hour or every half an hour you have the train from each city to another. And, if you, for example, are going from Bern to Zürich, you always go three or four minutes past 00. And then you arrive just two or three minutes before the next hour. And all the trains departing from Zürich are just two or three minutes past 00. And so you always have five to ten minutes to change from

FIGURE 3: The light rail through the old city centre where the light rail moves at very low speeds. Small shops are hidden behind the archades. (Photo by Author).

one train to another. That is the system that exists over the whole country'. (Research interview Rolf Meyer).

QUOTE:
"With the new tram lines 7 and 8 the historical "rift" between Bern east and Berne West is overcome". Regula Rytz (Stadt Bern, 2010a).

Furthermore, the regional network is also strongly integrated with the local urban transport and supported by restrictive transport policy measures:
'You just go out at a stop, you are waiting for the tram and you never care about the schedule. (...) over ten minutes, you will look at a schedule (...) I would say transport policy in of great importance. I mean, for most of public transport is one thing, but restricting individual transport is another thing. (...) is not very easy to go by car through the city, so there are many traffic restrictions. (...) And also we see in the inner city of Bern, I think, 50% of the people do not own a car. Around 50%. You do not need a car. That is the idea.' (Research Interview, Rolf Meyer).

In Bern, there has been a strategy to minimise car traffic in the urban centres, and an important actant in this process has been the implementation of a high-quality public transport system in order to provide an attractive alternative. This strategy overcame the problem of the lack of space in the city caused by increasing automobility. Possible solutions to this problem have been mediated through extensions and modernisation of the old tram network via upgrading to a modern light rail system. The old tram system has existed in Bern since the beginning of the 20th century. In the 1960s, parts of the system were modified for diesel buses. In the 1970s, under the influence of a strong environmental discourse, the citizens of Bern voted against a referendum that suggested continuing extensions of the diesel bus system. The referendum was seen as a 'turning point' in mobilising support for a new urban transport system and marked the beginning of the trolleybus system and modernisation of the tram system. Likewise, softer modes, such as biking and walking, were put on the agenda (Research Interview, Elisabeth Bäshlin).

The light rail line to Bern West was the first new light rail line since the 1960s-70s, when minor adjustments were made to the old tram network (Research Interview, Daniel Schwartz). A general plan for urban development in Bern was made in 1995. This was the first time that the city of Bern had a general plan or a general frame for urban development, which also addressed issues of integration with public transport (Research Interview, Daniel Schwartz). Until 1998, the city of Bern had full responsibility for planning and financing urban public transportation. The canton, which is the regional authority, did not commit to financing and subsidising plans for improvement of public transport in the cities which resulted in a lack of resources to develop the urban public transport system (Research Interview, Daniel Schwartz). In 1998, a new law from the canton changed this practice and the cantons took over responsibility for planning and financing both regional and urban public transport, creating a new momentum for urban public transport projects. Rolf Meyer from the City-owned transport operator Bern Mobil describes this:
'Until '98, the city of Bern was responsible for public transport in the city, but from '98, the city has no responsibilities anymore. It is the regional authority of the Canton Bern. So the city has now a public transport company, but it has nothing to say about public

FIGURE 4: Key events that led to the establishment of Bern West Light Rail

transport. (...) the main reason is that our interests are so connected with the roads and the streets—the infrastructure of the city, so it is good to have this close relationship with the city. Because if we have constructions for our infrastructure, we always have to make a project together with the city.' (Research interview Rolf Meyer).

QUOTE:
"Public transport is only… it serves the urban development. This is the function of public transport. It is not a project by its own" Research Interview Rolf Meyer Bernmobil.

Bern Mobil operates all bus lines and light rail lines in the city centre and it is a city-owned public transport company. As it still is today, Bern Mobil cooperates with the city and the canton on public transport, but has different roles in this regard, and these are very much related in order to create holistic public transport planning. Daniel Schwartz, a cantonal planner, explains:
'For urban transport, in every canton it is different. There are some cities which are still responsible for urban transport, but in the Canton of Bern, they said 20 years ago, when they also changed the law in the canton, that it would make no sense to distinguish between urban transport and regional transport. It is a whole system that belongs together, and it is the canton which is responsible for urban transport and regional transport (...) I am sure that this is also part of the success of the public transport in Switzerland. It is one system, and you will not feel any different as a passenger. You can use it also with one ticket. It does not matter if you take urban transport or regional transport' (Reserach interview Daniel Schwartz).

In 2006, there was an opportunity to get money to finance the project from the federal level, which was introduced by a new federal law called the 'Infrastrukturfond.' This was the first time that road infrastructure and public transport were financed by the same budget ([VÖV UTP, 2010]; Research Interview, Daniel Schwartz). The 'Infrastrukturfond' was a key actant that was part of mobilising both the city and the canton to get the project of Bern West light rail project moving, since there were then financing possibilities available to bring the project to fruition. In the period after the enactment of the federal law, many developments and improvements of the network happened in Swiss cities. There was a strong local commitment to upgrading the urban public transport system and to accessing the national funding available for these projects. In Bern, the light rail was framed as the future of public transport and urban development, with a reference to the tram-renaissance that happened around the world, the travelling idea (for elaboration see chapter 7) of light rail mobility also reached Switzerland (Canton Bern; Stadt Bern; Bern Mobil; Energie Wasser Bern, 2012).

QUOTE:
'from Tram city to Tram region'
(Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern, 2012).

Extending the City to the West

The light rail extension to Bern West was an important actant in the strategic plans for developing the city to the West and a perquisite for supporting the plans for urban development. Approximately 35.000 inhabitants live and 15.000 people work in Bern West. The light rail line was opened in December 2010 and is an extension of 6.8 km to the existing network of 17 km (Canton Bern; Stadt Bern; Bern Mobil; Energie Wasser Bern, 2012). The new extension is separated into two lines; line 7 to the old village Bümpliz, and line 8 to the new quarter Brünnen and Westside, as well as the large existing housing area of Bethlehem.

QUOTE:
From tomorrow morning with the implementation of the light rail lines 7 and 8 Bern Mobil has overcome the historical rift between Bern and Bern West.' (Rytz, 2010).

The extension to Bern West consists of two new light rail lines that share track in parts of the new extension (see figure XX). The line no. 7 moves through the old village street in Bümpliz, which is characterised by low densities and many one-family houses. The line no. 8 moves in the modern housing areas in Bethlehem towards Le Corbusier Platz and the new quarter Brünnen and Westside. The area is characterised by large-scale functionalistic concrete apartment blocks built under CIAM principles (Congrès International pour l'Architecture Moderne) in the 1960s, offering 20 floors or more and many large, open green spaces, with room between the houses and a segregated traffic layout. The modern developments are called Tscharnergut, Gäbelbach, Bethlehem and Holenacker. Since they were ground-breaking for their time and the first buildings of this sort in a Swiss context, some of the buildings are scheduled for preservation (Research Interview, Elisabeth Bäschlin).

The light rail to Bern West is framed as an urban project and a generator for redevelopment of the areas through a facade-to-facade approach where the urban spaces in the light rail corridor have been redeveloped (Canton Bern; Stadt Bern; Bern Mobil; Energie Wasser Bern, 2012). Another important material actant in this process has been the Westside Shopping and Leisure Centre, which opened in 2008, along with the construction of the tramline. This shopping centre was designed by the famous architect Libeskind and has become a landmark, along with the light rail in the area. The shopping centre is the end destination of the light rail line in Bern West, and a new stop for the regional train was also established here as well. The Shopping Centre is placed right above Bern's A1 highway to secure maximum mobility to the new activities in the area. The incorporation of the many modes of mobility with the regional character of Westside is framed under the idea of regional development: 'from Tram city to Tram region' (Canton Bern; Stadt Bern; Bern Mobil; Energie Wasser Bern, 2012). The frame of Westside was to create a public space with both day and night facilities, acting as a self-enclosed district offering amenities and services. Much modernisation is happening in Bern West, and developers have seen the realisation of the light rail plans as an important actant in this process. Also, renovation of apartments is causing rent to rise by up to 30% (Research Interview, Elisabeth Bäshlin).

The shopping and leisure centre of Westside was one of the key nodes in the new urban development vision. The background for this vision is described at the homepage of the shopping centre:
'The vision of a linear city for 150.000 people along the Bern-Neuenburg railway line was born back in 1967. A concrete plan to expand Bern in the Brünnen area was conceived for the first time in 1972. The idea was to create a city with good transport links and high-rise buildings. This project faltered due to the oil crisis in the 1970s. In 1978, the General Council made another attempt to use the reserved building land in Brünnen for extensive construction. However, this project was rejected in 1984 in a vote by the Bernese electorate. In 1989, the Municipal Council drew up an alternative plan to a people's initiative to create a green belt for the whole area. It proposes just turning Brünnen South into a green belt and keeping Brünnen Nord as a construction area. This proposal was put to

vote and accepted by the population. In 1991, the Bernese population passed the detailed concept by a big majority for a housing estate for 3.000 people (...) A new gateway to the city was to be designed and implemented' (Westside, 2008).

The rationale behind the light rail project to Bern West was not, however, based only on urban development. The existing trolleybus lines to this part of the city had reached the maximum capacity and had to be upgraded. Rolf Meyer from Bern Mobil describes this double rationale:
'Capacity problems. That is the main driver, I would say. We had two trolley bus lines, which went out into the west, and we had capacity problems during peak hours (...) a common part of the two lines and there was each half one and ninety seconds with the bus. And it is quite impossible to operate. And that was the main reason and, of course, the western part of the City of Bern to the most dynamic part of the city. That is where there is still a potential for the city to make development. And there were also plans for a big shopping mall called Westside (...) and also a new part of the city is in construction there. About 2.000 more inhabitants. All this potential, which was the point where we had to say: "If you want to develop this part of the city, you have to have a great transport system' (Research interview Rolf Meyer).

QUOTE:
"The light rail belongs to the future"
(Tram Bern West Dossier).

The planning of the new urban developments and upgrading the public transport network was closely related. In the canton of Bern there has been a rationale saying that large scale urban developments have to be supported by public transport:
'There is a planning philosophy, or I would say not a strategy, from the Canton of Bern, which says that main development can only be where there is a good public transport service. So, it was clear that if this development would go, you have to have a great transport system. And also when the shopping mall was constructed, there was an obligation for them to upgrade the transport system. Otherwise, they could not build this shopping mall(...) private cars were limited to 4.000-5.000 cars per day (...) But if there are coming more cars to this shopping mall, they have to take measures that will allow more public transport. (...) urban development and urban transport development go hand in hand.' (Research interview Rolf Meyer).

At the opening of the tramline to Bern West, councillor Barbara Egger-Jenzer declared that the rationale behind the tram concerned more than transportation:
'A tram is not just a tram. A tram means new street environments, successful squares and new urban districts. I think that Bümpliz and Bethlehem have gained in quality of life' (Egger-Jenzer, 2010).

The Historical Separation between Bern and Bern West

Bern West and the village Bümpliz were included in Bern Municipality in 1916. After this inclusion, the area and its residents were still marked by this previous spatial and organisational division and a mental barrier existed towards the rest of Bern (Research Interview, Elisabeth Bäshlin). Physically, a highway separates Bern West from Bern. It is a

very visual and spatial barrier. In the process of framing the Bern West light rail project, the missing link between Bern West, the rest of the city and the previous administrative separation was problematized. At the opening of the light rail, municipal councillor Regula Rytz stated that:
'The light rail to Bern West has brought a rail line and thereby public transport has been implemented, but the internal cohesion of the city and the Canton of Bern has also been strengthened. From tomorrow morning, with the implementation of the light rail lines 7 and 8, Bern Mobil has overcome the historical rift between Bern and Bern West' (Rytz, 2010).

Due to spatial restrictions caused by the boundaries of surrounding municipalities, the city of Bern has only been able to develop to the west. After the Second World War, Bern experienced a need for an extension of the city due to an increase in the population (Research Interview, Ueli Müller). In the 1960s, the problem of the need for space to develop the city resulted in many large, functionalistic apartment blocks being built in Bern West (among others Bethlehem, Gabelbach, Tschnargut) (Research Interview, Elisabeth Bäshlin, Ueli Müller). These are the areas that are presently the subject of regeneration through the introduction of the new light rail line. Daniel Schwartz describes the fact that some areas in Bern West struggle with social problems:
'The parts in the west of Bern Bümpliz and Bethlehem, which are not well …. Is a part of Bern where poorer people live, lots of immigrants. So it is just a part of Bern that had a… not so good a reputation' (Research interview Daniel Schwartz).

The Bern West project will extend tram coverage to a part of the city that is due for commercial and residential growth. Before, the area was reliant upon buses and trolley buses, which were increasingly unable to cope with demand. Brünnen is a new urban development area in Bern West and an important actant in the light rail strategy. Since the 1960s, there have been plans to develop Brünnen to a new quarter on a green field site with 30.000 inhabitants. In this period, there was political debate concerning urban development and urban sprawl and the need to preserve the nature around the larger cities (Research Interview, Ueli Müller). As a result of this problem, the project of the urban development of Brünnen did not take place for about 20-25 years. This means that from the 1960s until the 1990s, there was a political blockade of the development project in Brünnen. After this period, a new project for urban development in Brünnen was discussed and eventually gained political acceptance. This project had a smaller scale of only 4.000—5.000 inhabitants. It also had an important argument for the realisation of the project, namely that a light rail line to the new quarter would be implemented along with the new urban development. The incorporation of public transport and urban development was a requirement based on an estimate of the capacity needed for the public transport to this area, but it has also been an important planning rationale in the Canton of Bern that large urban developments should be supported by an attractive public transport system (Research Interview, Rolf Meyer).

The light rail project was put up for referendum in 2004 due to the direct democracy in Switzerland, by which the citizens vote for larger infrastructure and development projects. The public voted down the first version of the project. Daniel Schwartz explains that even though Bern was an old tram city, politicians had to convince the citizens that this was a good solution:

'It needs some effort to build this tramway. It is partly because there was also no experience in newer tramways, so they first had to explain to people what it is, and why to build new tramways, because there was still a perception those tramways are something old-fashioned, and especially something expensive. And it is true, it is expensive, but to have a bus line with a bus every two minutes is also expensive' (Research interview Daniel Schwartz).

QUOTE:
"It is not just about transport. It is more"
(Research Interview Rolf Meyer Bernmobil).

It was the votes from residents in Bern West that temporarily stopped the project due to the historical tensions between Bern West and the rest of the city. Daniel Schwartz from the Canton explains the outcome of the referendum that was rejected by the citizens in Bern West:

"Maybe it was at the wrong time. People outside of the region or in the Bern outer land did not really see how or why they should finance a project in the city of Bern. And then there was also the problem that the city of Bern said yes to the project, but the concerned people in Bümpliz and Bethlehem said no. And that was also that sign for the rest of the canton. Had to say: 'that is nice, but the concerned people say no, and we should pay for them?' They do not want it? 'We do not have any positive things, because the local people, who should use it… so why should we finance this?' (Research interview Daniel Schwartz).

The opposition against the tram to Bern West was led by the politician Thomas Fuchs from the conservative SVP party (the Swiss people's party) who managed to mobilise the inhabitants of Bern West to criticise certain aspects of the project: the project was too expensive, it would cause less accessibility for cars and some parts of the area would lose their bus stops (Research Interview, Mirjam Bütler). This changed parts of the project and minor adjustments were made to the plans, though they largely kept the original line layout and the referendum passed in 2006 (Stadt Bern, 2006; Stadt Bern , 2010). Daniel Schwartz comments on the influence that Thomas Fuchs had in the decision-making process and the ownership of the project afterwards:

'I think everybody is happy with the existing line. The politician who was against the tramway, now sees this as his success to have made the project much better than it was before. And maybe he is also a little bit right. There was also the need to make the second project cheaper than the first one. And this works also with the existing line instead of the one below the road' (Research interview Daniel Schwartz).

The adjustments made the project 22 million francs cheaper, the savings being due to the shorter alignment of 6.8, instead of the 7.4 when the light rail also connected the area of Weyermannshaus. The state and the canton were paying for the light rail infrastructure,

whereas the city of Bern paid for the adjustments to the existing street network and the urban areas along the corridor. The link between the urban development projects and the need for more capacity in the area was a stronger actant in the mobilisation of support for the project among the population, and the light rail was metaphorically described as the 'backbone' of the transport network and development for housing and businesses in the corridor (Stadt Bern, 2006). Today, the tram is often articulated as a new mental connection in the city:

'I think that the tramway has marked a change (…) not only in the architectural layout and the votes, but also mentally in people. Something like a new start for the whole part of the city. (...) I think that what people see is that city of Bern invests in our quarter. And they did not expect this because they knew that we are just not...They do not look at us. As if we were a city for our own and we live for ourselves and this was positive.' (Research Interview, Daniel Schwartz)

The new mental connection was supported physically since the bus line to Bern West used to be a single radial going from the rail station to Bern West, and with the implementation of the light rail, this line was connected with Saali in the south eastern part of the city (Research Interview, Daniel Schwartz).

Seen in a critical perspective, the light rail in Bern West has created the potential for a redevelopment of the city and the establishment of new quarters and activities in this part of the city. The light rail has established a new physical and mental link in the city and this has been articulated as one of the most important results of the new light rail extension. The urban spaces in the light rail corridor have been renewed and the rental levels on the apartments are rising, which could potentially support the gentrification processes, an occurrence which is, to some extent, also tracé able in the other two cases.

Central Discourses and Metaphors in the Decision-making process

Summarising the analysis of the political and cultural production of the light rail project in Bern West, the central discourses and metaphors in the planning process can be summarised as follows (based on the analytical model introduced in chapter 3):

- Environmental discourse: This discourse was dominant in 1970 and afforded a shift in focus on urban public transport and the use of space in cities.
- Economic discourse: The tram was viewed as being old fashioned and is argued that more affordable solutions should be implemented.
- Accessibility discourse: This discourse was problematized by the opponent Thomas Fuchs of the SVP party, who argued that implementation of the light rail in the existing road network would lead to less accessibility for cars.
- Regeneration discourse: The light rail alignment was seen as a 'generator' for a more positive development social and physical development in Bern West.
- Urban development discourse: The light rail system was presented as the 'Backbone' of the transport network and new urban and business developments.

- Social discourse: This focused on the new mental connection between Bern and Bern West creating a socially-inclusive link for deprived urban areas.
- Redesign discourse: - 'facade-to- facade renovation. ' A focus on upgrading the entire street layout and urban spaces along with establishing a light rail corridor.
- Mobility discourse: The light rail viewed as a strategic tool in the overall integrated mobility approach in the Swiss context - 'From Tram city to Tram region.'

The case of the new light rail alignment to Bern West is interesting in regards to the institutional context, since the citizens played a major role in the decision-making process. The first referendum was rejected because the majority of citizens in Bern West voted against the project. The politician Thomas Fuchs from the Conservative Swiss people's party was a strong actor and spokesman in this opposition. The dominating discourses were that the project was so expensive, it would reduce car accessibility, and the alignment would afford less access to public transport for some areas. The history of the mental and physical separation between Bern and Bern West also played a role in this process.

From the administrative and political level, the governing rationales were based on very different discourses. One of the governing rationales was that having exceeded the capacity levels was a main motivation to upgrade the trolley busses. Another very important discourse was the regeneration and urban development discourse, which was supported by many new investments in the western part of the city. This was also framed as a political priority of the development in the western part of the city and a way to overcome the mental barrier. The Canton of Bern, Bern Municipality and Bern Mobil shared the same rationality and cooperated in order to implement this holistic mobility and urban development planning. Rolf Meyer from Bern Mobil explains how important it is for light rail projects to be perceived as more than transportation. Furthermore, in the extension of the tram network to another Municipality in Köniz and Ostermundingen, they are beginning to see the importance of drawing on this rationale:

"I think that one main reason, one main point that we also have to make in this project in Ostermundigen/Köniz, it is not yet closely connected to urban development. And I think that we have to alter the communication. We have to raise this point, because you are not just building a tram line. Tram lines—that is urban development. And that is what we have to sell to people. And I think that with this we can convince people. I just talked with a new tramline in Germany. They also have a problem. They are also planning a new tram lines through the inner city and had problems. There was also a public vote. And then they realised that they must connect urban development and this tram line. And now they really have a communication that does not tell them 'you are planning tram', but 'we are making urban development' in the city and now people accept. And I think that that is also what we have to do. (...) It is not just about transport. It is more. Of course, if you only sell a transport project, people will always discuss 'was it as good as tram or are buses still enough for it' or 'it is hampering private motor vehicles—no, we do not want it.' If you involve people, they will be for it" (Research Interview, Rolf Meyer).

PROJECT OVERVIEW BERN WEST LIGHT RAIL EXTENSION

OPENING : December 2010

LENGTH: 6.8 km (Total network 24 km)

STOPS : 19 (Bümplitz and Brünnen)

AVERAGE SPEED: 17 km/h

PUBLIC TRANSPORT SHARE: 26%

FREQUENCY: Every 6 minutes from 6.30 - 19.00

PASSENGER LEVELS: 21,000/day
(to Brünnen/Westside); 18,000 to Bümpliz

PRICE: 124 million euros in 2006 prices 18 mio. euro/ km (including urban renewals).

MAJOR DESTINATIONS:

The new Quartier Brünnen: around 4,000 new inhabitants and 7,000 workplaces, the Leisure and Shopping Centre Westside with 3.5 million visitors annually. Redevelopment of the appartment bloks in Bethlehem.

FIGURE 5+6+7+8: Above: Overview of key elements in the Light rail project. Below: Map over the new urban development projects in the light rail corridor: Yellow urban development areas, Green preservable green spaces. (Source: Dossier Stadt raume) Right: Overview of Bern and Bern West which was previously two separate administrative units. The new light rail alignment in Bern West is illustrated below. (Background maps Google).

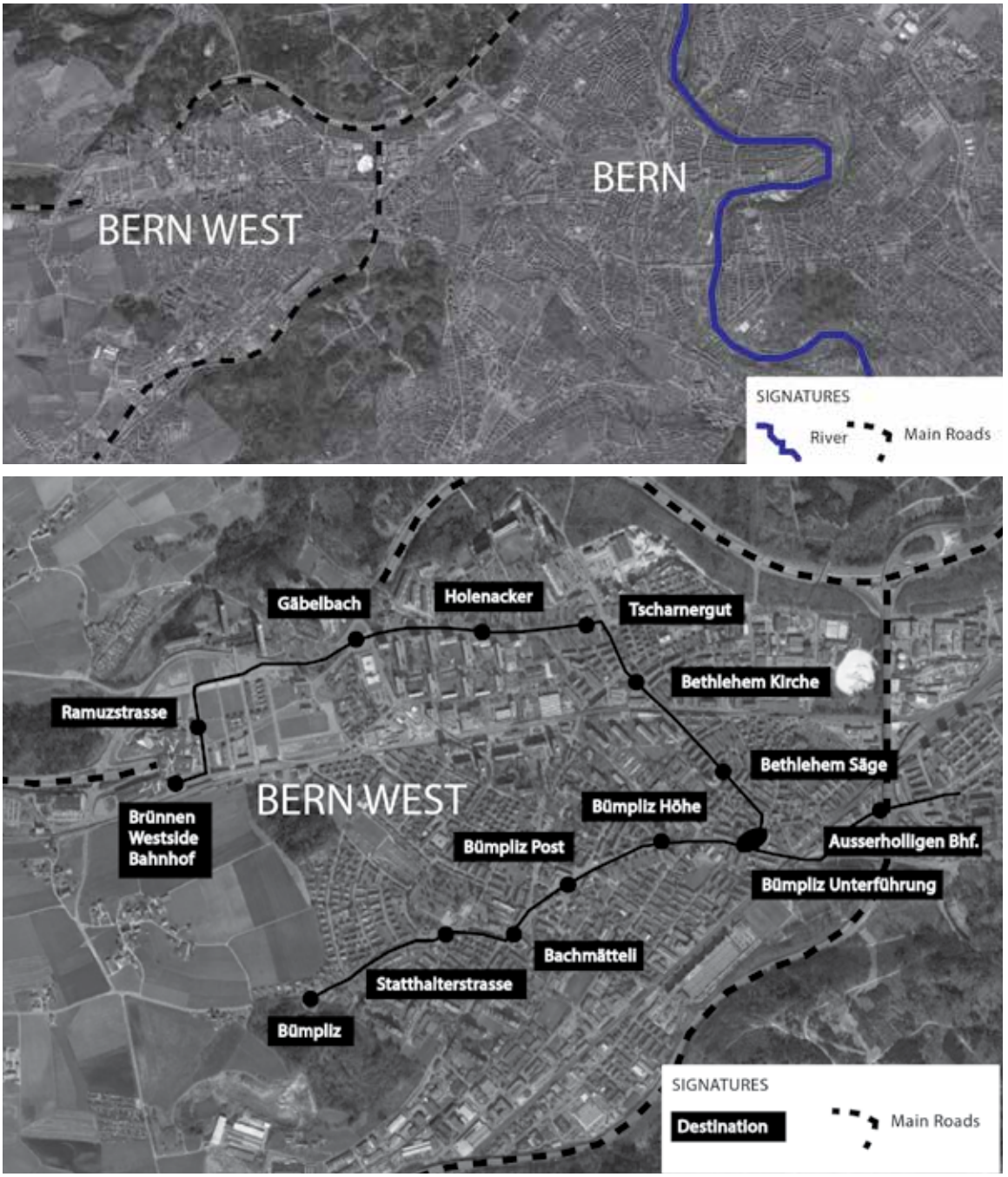

BERN WEST
BERN
SIGNATURES
River
Main Roads
Gäbelbach
Holenacker
Tscharnergut
Bethlehem Kirche
Ramuzstrasse
Bethlehem Säge
BERN WEST
Brünnen
Westside
Bahnhof
Bümpliz Höhe
Bümpliz Post
Ausserholligen Bhf.
Bümpliz Unterführung
Bachmätteli
Statthalterstrasse
Bümpliz
SIGNATURES
Destination
Main Roads

FIGURE 9+10: Above: The design of the light rail line has been created through a site specific approach where the unique character of each stops has been the basis for each design. Below: Ansermetplaz a new connection between the existing quarter Gabelbach and the new quarter Brünnen (Source: Dossier Stadtraume 2012).

THE MATERIAL AND SPATIAL DIMENSION

Holistic Urban and Mobility Planning

The light rail to Bern West was a complex development project. The new light rail line had to be implemented in existing urban areas and streets, which caused some challenges in the construction phase as all infrastructures were renewed and prepared for the light rail line. The light rail project has not only been a matter of increasing capacity on the transit lines to Bern West, but has also been a prerequisite for a holistic town-planning approach where the development of new quarters has been supported by high-quality public transport infrastructure. The city engineer and city planner states that the goal has been to: *'Balance between quality of life and mobility (...) a project like Tram Bern West also offers the chance to plan new outer quarters and integrate this into the existing public transport infrastructure network. Illustrative examples are Brünnen and the Shopping and Leisure centre West side.' (Canton Bern, Bern Mobil, Energie Wasser Bern, Stadt Bern, 2012).*

QUOTE:
"the tram line creates a contemporary urban Urban district with high quality" (Dossier Stadt Raume, 2012).

The light rail line to Bern West was also seen as a possibility to fit urban design to the implementation of the new infrastructure, and in the process it was widely acknowledged that transport planning and the urban design were closely related in this process of re-designing the corridor. This is also why many different professions were involved in this process, ranging from engineers and technicians to architects and landscape designers. New public spaces have been created along the corridor, some of which are still under development in the new quarter of Brünnen. The light rail alignment through the modern housing areas in Bethlehem was also thought to provide a physical and mental upgrade of this housing area. Many of the apartment blocks are being modernised and a gentrification process is tracé able via an increase of up to 30% in rental levels (Research Interview, Elisabeth Bäshlin). Trees have been planted in the corridor, and on parts of the alignment, the light rail runs in a green tracé , providing a new image of the wide streetscape in the area.

The approach to the design of the new alignment has been site-specific. The individual character of each quarter was integrated into the design of the corridor. Different teams were responsible for different parts of the alignment, and engineers, transport planners, urban designers and architects worked together in order to balance the mobility aspects and the creation of new urban spaces. The design process was framed as 'facade-to-facade renovation' of the urban spaces (Canton Bern, Bern Mobil, Energie Wasser Bern, Stadt Bern, 2012).

The light rail project to Bern West was awarded the Bernese Culture Award for Architecture, Technology and Environment in 2012. The city architect Fritz Schumacher from the Canton of Basel stated that: *'.. This project makes you hungry for more–we need more of such projects for the metropolitan area of Bern' (Canton Bern, Bern Mobil, Energie Wasser Bern, Stadt Bern, 2012)*

QUOTE:
Following the development the well-designed public spaces and the tram line creates a contemporary urban Urban district with high quality. (Dossier Stadt raume, 2012).

Mobility Design

A principle behind the Bern West light rail alignment is that coexistence of different modes of transport provides a safer urban environment with slower speeds. The new extension to Bern West is altogether 6.8 km, with only 2 km runs in segregated tracks. One reason for this choice has been the lack of space in the urban environment. Another reason has been that different modes of transport have to be considerate of each other, and automobiles and the light rail travel in the same lane in the largest parts of the new tracé . This also means that the cars have to wait behind the light rail when it stops at stations and, only at every third station is there a possibility of passing the light rail by car. There are many zones that are 30 km/h only. The light rail runs through existing quarters, and the tracks are implemented in the existing street layout, which requires minimal changes and expropriations in the corridor. New public transport radials connecting new parts of the city have also been established as a part of the Bern West project. Daniel Schwarz explains this:

'One effect, which is also quite important, I think, is that the system before with Trolley buses ended at the station in Bern, or the Bahnhofplatz. Even a little bit before the Bahnhofplatz. And now with the tramways, there is the possibility to make the lines going through city. And this is really something that changed a lot' (Research interview Daniel Schwartz).

This means that Bern West is now not only connected to the city centre by a light rail line, but the radial continues through the city to the end destinations in Ostring and Saali.The new area of Brünnen is developed around public transport and it has been a requirement that good and high-class public transport should be provided in to support the development area. A central node or transport hub was created at Westside, where the regional train meets the local public transport and the A1 highway. Multimodality is almost a trademark in a Swiss context. The light rail is thus just a small part of a wider holistic approach to mobility planning in the Swiss context. All modes are integrated through the regional public planning authority 'Regionale Verkehrskonferenz,' an organisation that affords timetables that are fitted for both regional, urban and peripheral transport, and all modes use the same ticketing system. One of the important reasons for the high modal shares in public transport is the general ticket that one can buy for 3.500 Swiss francs, or approximately 2.800 euros, for a year. In 2010, 400.000 people owned this ticket, out of a population of approximately 8 million people (5%) (VÖV UTP, 2010). If one is not a regular user of public transport, he can buy another yearly ticket at half price on all regional and local public transport. Of the Swiss population, 2.29 million people hold this ticket (28%) (VÖV UTP, 2010). The ticket allows one to travel everywhere with public transport in Switzerland, and also to rent a car through the popular, privately-owned car-sharing scheme 'Mobility car-sharing.' The combination of a highly integrated urban and regional network and an attractive fare system has created a high mobility between the cities in Switzerland, and integration with the urban public transport system has made travel within the cities easier. Daniel Schwartz explains how the public transport system is so successful that the transport authorities are often struggling with creating enough capacity:

'It also has some disadvantages: That you make travels too easy. Mobility does not cost anything after you have paid, so you just go to Zürich to drink a beer, or the long-distance commuters buy this ticket once a year and they are travelling every day to Zürich to Bern or even longer distances.' (Research Interview, Daniel Schwarz).

QUOTE:
"Each year we have 3-4% more passengers" (Research Interview Rolf Meyer - Bernmobil) Supported by figures from (VÖV, 2010).

Restrictive parking policies have also made it attractive to travel via public transport in the cities, and 50% of the citizens in Bern do not own a car.
'Normally, people see that if they move around the city, then it is much more comfortable to use public transport because of the lack of parking possibilities. Or, if you have a possibility, then you will have to pay a lot of money for it. That also makes one part of the success.' (Research Interview Daniel Schwartz)

After the success of the extensions to Bern West, there are plans to upgrade the bus lines to Köniz and Ostermundingen to light rail also, and planner Daniel Schwartz estimates that this is going to be an easier process due to the previous experiences in Bern West having changed the mindset of both the citizens and the planners.
'We now have the experience with Tram Bern West and people see that it is quite a good thing. You can show them the effect that it has, and also in the organisation in the planning with all the engineers… they are now used to planning for tramways and to building tramways. So we have experience that was not here before.'

Also, new urban developments will be linked to this new transit line. The challenge, however, is that many of the streets and urban spaces in Köniz have already been upgraded and it is therefore going to be more challenging to convince the citizens that the light rail will afford urban development. Finally, the light rail vision is integrated in the overall obligatory mobility strategy for the Canton of Bern. This strategy has a focus on the long-term orientation of the policy for integrated mobility in the Canton of Bern. The strategy is aimed primarily at the cantonal administration and is mandatory for this. It is also part of the requirements for the regional transport and settlement concepts (RGSK). Its central elements are to be integrated into the cantonal structure plan. Some of the central themes in this strategy are that softer modes should have the highest priority in the city and the access for cars should be limited. This means that road space should be optimised rather than expanded (CCanton Bern, 2008).

The success of the light rail system has to be understood in a wider context than just the technology itself. It is a small part of a long-term strategic prioritisation of upgrading the entire public transport network and creating a strong public transport culture. In addition to this, via the implementation of new infrastructures, the incitement to use public transport is supported by fitted and frequent timetables, as well as a ticketing system that makes it easy and affordable to understand and use public transport. This integrated focus can be seen as a fruitful strategy behind the success of public transport in Switzerland.

AN URBAN CORRIDOR

FIGURE 11+12+13: Left: Redesign of urban place at Kreisel Bümpliz Post. Middle: A universal design of the stops and ticket-machines provide a holistic design for all local modes in the area. Bern's city centre transport is provided by city authority Städtische Verkehrsbetriebe Bern (Bernmobil), operators of trams, buses and trolley buses. Below: Art Installation at Le Corbusier Platz. (Pictures: Dossier stadt raume and Photos by Author).

TO THE WEST

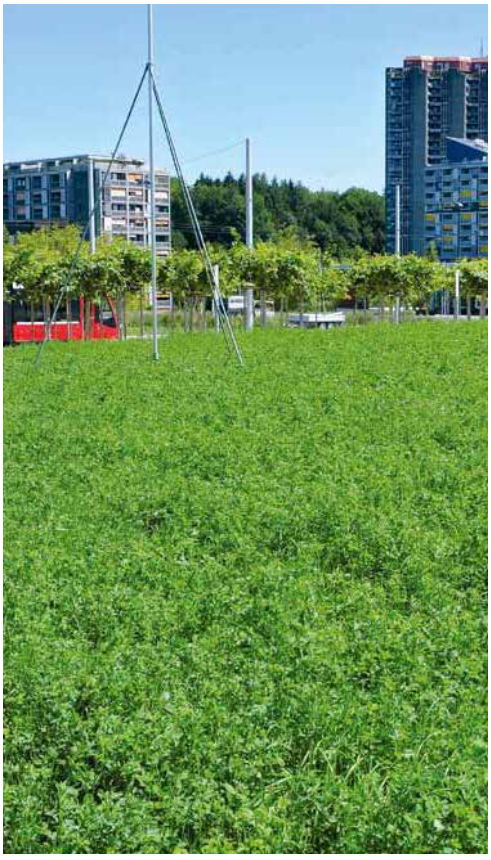


FIGURE 14+15+16: Left: View of the green quarter and urban spaces arround the modernistic housing area Gabelbach. Avove right: Le-Corbusier-Platz with newly planted green trees. Below: The light rail as a new mobile landmark and urban project in the modernistic quarter Bethlehem/ Bern West. Altogether 152 old trees were felled and replaced with 195 new trees. (Dossier Stadtraum, 2012).

FIGURE 17+18: Above: The light rail line no. 7 through the village street in Bümplitz. Below: The light no. 8 as a main corridor though the modernistic housing area Bethlehem continuing towards the the new quarter Brünnen and Westside Shopping Centre. (Photos by author).

Spatial Analysis

The spatial analysis was performed by a phenomenological registration of urban space, where my own embodied experience of riding and walking along the corridor has been used as the medium to perform the analysis of the material and spatial implications of the light rail system. The trip along the corridor starts where the new extension of the light rail network meets the highway E27, which has been described as a physical and mental barrier between Bern and Bern West. The two new light rail lines to Brünnen and Bümpliz share the track until the stop at Ausserholligen Bahnhof, after which the line splits up towards each end-destination. The line to Bümpliz runs through the old village street in shared traffic, a solution that was chosen to give equal priority to both cars and public transport. The car does thus have to wait behind when the light rail stops. In this quarter, there haven't been any changes to the urban areas in the corridor, and the light rail is simply fitted into the existing street environment. However, the other light rail extension to Brünnen has been integrated into urban development and redevelopment plans for the new urban area of Brünnen, as well as the existing modern areas in Bethlehem.

QUOTE:
A project like Tram Bern West also offers the chance to plan new outer quarters and integrate this into the existing public transport infrastructure network .Illustrative examples are Brünnen and the Shopping and leisure centre West Side. (Dossier Stadtraume (2012).

District: The Egde Towards Bethlehem (figure 17)

From Bern Strasse, the light rail takes a right turn and enters Bethlehemstrasse. The street is dominated by medium-scale housing apartment blocks with four floors. The houses are beige and grey, traditional colours from the older architecture in Bern. In between the smaller apartment blocks, large-scale concrete blocks rise and change the scale of the urban environment. The light rail drives in the existing street environment where it shares the lanes with car traffic. The streetscape is narrow and the front of the buildings is drawn towards the street.

District: Tscharnergut and Gabelbach (figure 18-20)

As the light rail continues toward the node at Tscharnergut, the scale of buildings increases and the area changes character and begins being dominated by large-scale modern blocks. The light rail now runs on segregated green grass tracks in the centre of the roads. To the right of the light rail lines is a shared pedestrian and cyclist track, which has been separated by a low fence towards the light rail track. Smaller paths are created in the green spaces in front of the apartment blocks, which create pedestrian paths in the area connected to the transit corridor. To the left side of the light rail track, there is space allocated for car traffic, with one lane running in each direction. The horizon seems far away because of the straight and wide street layout and the light rail increases its speed–this is an urban environment that affords higher travel speeds. The design of the light rail stop has a universal charter, which is almost identical at all stops. The only difference is that the stop increases in size to fit capacity requirements. The red visual image of Bern Mobil is implemented at the stops, but it does not have a significant landmark character, especially not in this large-scale urban environment. Because of the scales, one can almost overlook the light rail stop. Trees have been planted along the corridor, but there is not much else to indicate extensive renovations of the urban environment.

FIGURE 19+20: Above: The stop is almost not visible in the large scale urban environment. Below: View towards the large scale housing blocks (Photos by author).

District: Brünnen and Westside (figure 21-24)

The new urban quarter is located at the end destination of the light rail line and has been integrated with the regional train line. This is an area with more idle space for future development. One has the feeling that it is unfinished. Highway A1 enters directly under the shopping centre. There are no visual implications of this main traffic corridor, but I can hear the sound from the fast traffic in the distance. Westside has been framed a meeting place for the whole greater region of Bern and that the slogan for the light rail project has been 'From Tram City to Tram Region'.

QUOTE:
"Bümplizstrasse shines again with a public space that everyone can enjoy". Councillor Barbara Egger-Jenzer: (2010).

Westside Shopping and Leisure Centre is a remarkable building and landmark that stands out from the rest of the architecture in the area. The building has a natural look that fits neatly into the landscape. It is covered with wooden panels and has an asymmetrical design. The building is designed by the famous architect Daniel Libeskind. Outside the shopping centre's entrance, there is a large square with a volume that affords a suitable radius to be used as the turning space for the light rail. The other traffic modes (cars and train) have been integrated at the backside of the building. The regional train is separated by a platform and the highway enters under the building.

FIGURE 21+22: Above: Opposite to the main entrance og Westside shopping Centre the light rail is integrated with the regional train (Source Stadt Raume, 2012). Below: The highway A1 that enters under the building.(Photo by Author).

FIGURE 23+24: Above: The light rail is integrated at the new Shopping Centre Westside at the new square Gilberte-de-Courgenay-Platz where there is also a regional train stop -This is the new transit station, leisure and meeting place in Bern West. (Source News.ch 11/12 -2010 Photo: Sam Bosshard) Below: Views to the new quarter Brünnen (Photo by author).

CASE STUDY FINDINGS

The case analysis of the Bern West light rail proved that this is a case where the light rail has been an important actant in the strategic plans for developing the city towards the west. The light rail is perceived as the mental and physical link between the old city centre and Bern West. The analysis furthermore proved that the light rail has been used to upgrade the modern housing areas in Bern West and an extensive façade-to-façade renovation has been facilitated, along with the implementation of the light rail line which created a new image of the corridor and manifested the new prioritisation of the area for future investors. As was indicated in the prologue of this chapter, the Bern West light rail project was supported by a strong political vision of using the light rail as a tool in the urban redevelopment and development process, and many of the old apartment blocks in the area are being modernised as a part of this overall strategy of changing the image of the area.

As was also the case in the analysis of Bergen and Angers light rail projects, the Environmental discourse that influenced much planning in the 1970s marked a turning point for the planning practices in Bern towards greener solutions and prioritisations of softer modes. There was also a stronger focus on a multi-modal and integrated public transport system that was created when the responsibility for financing urban public transport was given to the Region (the Canton). This facilitated a planning practice where regional and local transport was considered equally important in facilitating an overall attractive public transport network. A new ticketing system that worked for all regional and local modes was introduced, and timetables were fitted with high frequencies that made it easier for passengers to use public transport for both regional and local journeys. This context is important to understand the overall success of Swiss public transport. The light rail is just one part in this overall strategic prioritisation of public transport and multi-modality that has facilitated a successful public transport culture in the entire country. Furthermore, the city has a tram history and cultural practices linked to this mode, which made the decision-making process less controversial.

In the relation to the material and spatial dimension, the case analysis also proved that the light rail can be seen as a mediator of a specific planning philosophy that is current in a Swiss context. The Canton of Bern states that large scale urban development has to be supported by high-class public transport, and also that multi-modality and integration with regional modes is key in the Swiss context. The material layout of the system also underlines this prioritisation. The light rail is integrated at the new main destination in Bern West: the shopping centre at Westside. Here, parking space has been limited, and thus, mobility is secured by the new light rail line, as well as a stop of the regional train that passes directly along the shopping centre. This creates a new central node in Bern West where regional and local transport connects. Another central element in the concept of the Bern West light rail is that through most of its length, it runs together with car traffic in order to fit into the existing street environment. This causes some obstacles for car-traffic, which was also one of the major critique points in the opposition from the

residents in the west. It also has the implication that the light rail must adjust to the travel speeds of the existing traffic and is thus not practiced as a fast transport mode, traveling with an average travel speed of 17 km/hour.

CASE ANALYSIS
FREIBURG LIGHT RAIL

6D

FIGURE 1+2: Above: Arriving at Bertoldsbrunnen the city centre in Freiburg - pedestrians, trams and cyclists meets in organised chaos. Below: The first impression of mulitimodality - The ligth rail is integrated just above the railway station affording easy shift between regional and local modes. (Photos by author).

THE GREEN CITY

PROLOGUE

I arrived in Freiburg by bus from Basel airport. From the train station, I got the first view of the multi-modal transport system –a 'brand' for which Freiburg is well known. The platforms for the regional trains were connected directly to the local tram network by stairs leading to the bridge above the heavy railway tracks. I saw the characteristic round building with a sign saying 'velo-station' which was intended for bike parking and rentals in connection to the railway station as a major local and regional transit hub connecting all modes. I also saw the characteristic 'blue bridge' which used to be reserved for cars but is now reserved for bikes and pedestrians. I have seen all these elements in the planning and policy documents I reviewed before my trip here, and I remember that these elements are continuously mentioned as examples of Freiburg's vision as 'a smarter travel town.' I walked towards the light rail stop above the railway station. The vehicles were a mix of old and new and they were covered with commercials. The visual identity and the aesthetic design had not been the centre of attention in this context. I followed the tram tracks which led me towards the central city square Bertoldsbrunnen–the node where all light rail lines meets in a mix with pedestrians and cyclists–it seemed like an organised chaos! The space is paved with cobblestone, creating a sense of a shared space, and the light rail travels with very slow speeds and rings the bell when a pedestrian gets in the way. I wonder if this would could be applied in all cities, or if there would be accidents happening all the time–I guess that the tram or the light rail has become a part of the transport culture and the mentality in this city, and people are used to behaving according to this mode as it has been a part of city development since the early twentieth century. (See figure 1 and 2 for first impressions, and figure 16 for overview of the light rail corridors).

QUOTE:
"Freiburg kept its tram. They reduced it a little bit, but it works, and since 20 years we built new lines and that is the basic for the good public transportation system. Until today every of the six tramlines in Freiburg had this small crossing in the heart of town at Bertoldsbrunnen". (Research interview Helmut Thoma).

The case analysis of the Freiburg light rail exemplifies a project embedded in a clear vision of sustainable mobility which has been consistent since the 1970s. The strong green political movement in Freiburg has great influence of the holistic integrated transport and transport planning approach, and as is argued in chapter 1, this is an important contextual factor which is important in understanding the successful outcome of this case in regard to minimising car traffic. Another important historical and contextual factor is that Freiburg chose to keep the old tram system when many systems were closed down in the 1960-1970s, and it currently has a successful light rail system which continues to be extended today. However, this is just a minor part of the many strategic measures taken to facilitate an urban mobility practice and culture in favour of softer modes. The analysis will illustrate how the light rail system in Freiburg has been actively used in the development of new urban areas, where in the case of the area of Rieselfeld, the light rail was integrated before the first resident moved to the area. This is indeed a case of a transit-oriented development with a strong focus on providing a mobility design that provides attractive alternatives to car traffic.

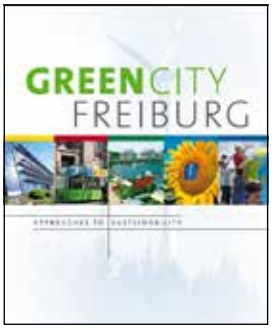
FIGURE 3+4+5: Above: Bertoldsbrunnen in 1914 and today (Peter Schick, Freiburg Municipality) - the street layout and the tram alignment is keept the same. Below: There are many signs on the stong environmental movement and mind-set in Freiburg - here and example from the district Rieselfeld. (Photos by author).

THE DISCURSIVE AND INSTITUTIONAL DIMENSION

Freiburg is a paradigmatic case of integrated and holistic mobility planning (as referred to in chapter 4). It is the case of a city which has kept the old tram network in a period where many other cities chose to close it, and this history means that the old tram network has been an integrated part of urban and transport policy for decades. The light rail system is a part of a wider transport policy that has led to a high modal share of public transport (18%), cyclists and pedestrians (50%) (Schick, 2011), and there are many supportive policy measures to learn from in this context. In the case analysis, there will be a particular focus on two new light rail extensions to the old tram network: Rieselfeld, which was built in 1997, and Vauban, which was built in 2006.

QUOTE:
"you can say that this region here is the birth region of the Greens." (Research Interview Helmut Thoma).

Persons interviewed in Freiburg were selected according to the criteria introduced in chapter 4. People were identified and contacted through a snowball sampling method and were chosen to represent a variety of perspectives on the project. Altogether, three interviews were conducted, representing a variety of perspectives on the project, covering political, administrative and external views.



Green Image Branding from the city of Freiburg (City of Freiburg, 2011).

The persons interviewed in relation to the Freiburg context were:

- Peter Schick: Engineer and planner in Department of Transportation planning in the City of Freiburg. He works with transport planning in general and has extensive knowledge of the transport policies in Freiburg.
- Helmut Thoma: Politician on the city council for 'The Green Party.' She was educated as an architect. The Mayor of Freiburg, Dieter Salomon, is also from The Green Party).
- Samuel Mössner: Researcher in geography at Freiburg University. He works with issues of social justice in Freiburg.

Furthermore, three people contributed to the empirical data through a workshop where each part gave a presentation concerning transport policies and planning. The information provided through this workshop and questions asked afterwards further contribute to the empirical data in this case analysis.

- Frank Uekermann: Traffic planner in the City of Freiburg.
- Uwe Schade: Engineer at the regional authority ZRF, which is responsible for planning and integrating n the regional network.
- Andreas Hildebrandt: Planner at the city-owned public transport company and transport operator Freiburger Verkehrs-AG (VAG).

The Genesis of the Project: Policies and Planning

Unlike many other cities in Europe, Germany has kept a relatively large number of its old tram networks built during the 1950s and 1960s. The report 'Die kommunalen Verkehrsprobleme in der Bundesrepublik Deutschland' (the traffic problems in the local authorities in Germany), which was published in 1965 (Hollatz and Tamms - as referred in (Hass-Klau, Crampton, & Benjari, 2004,p. 39)), provides some context for this decision.

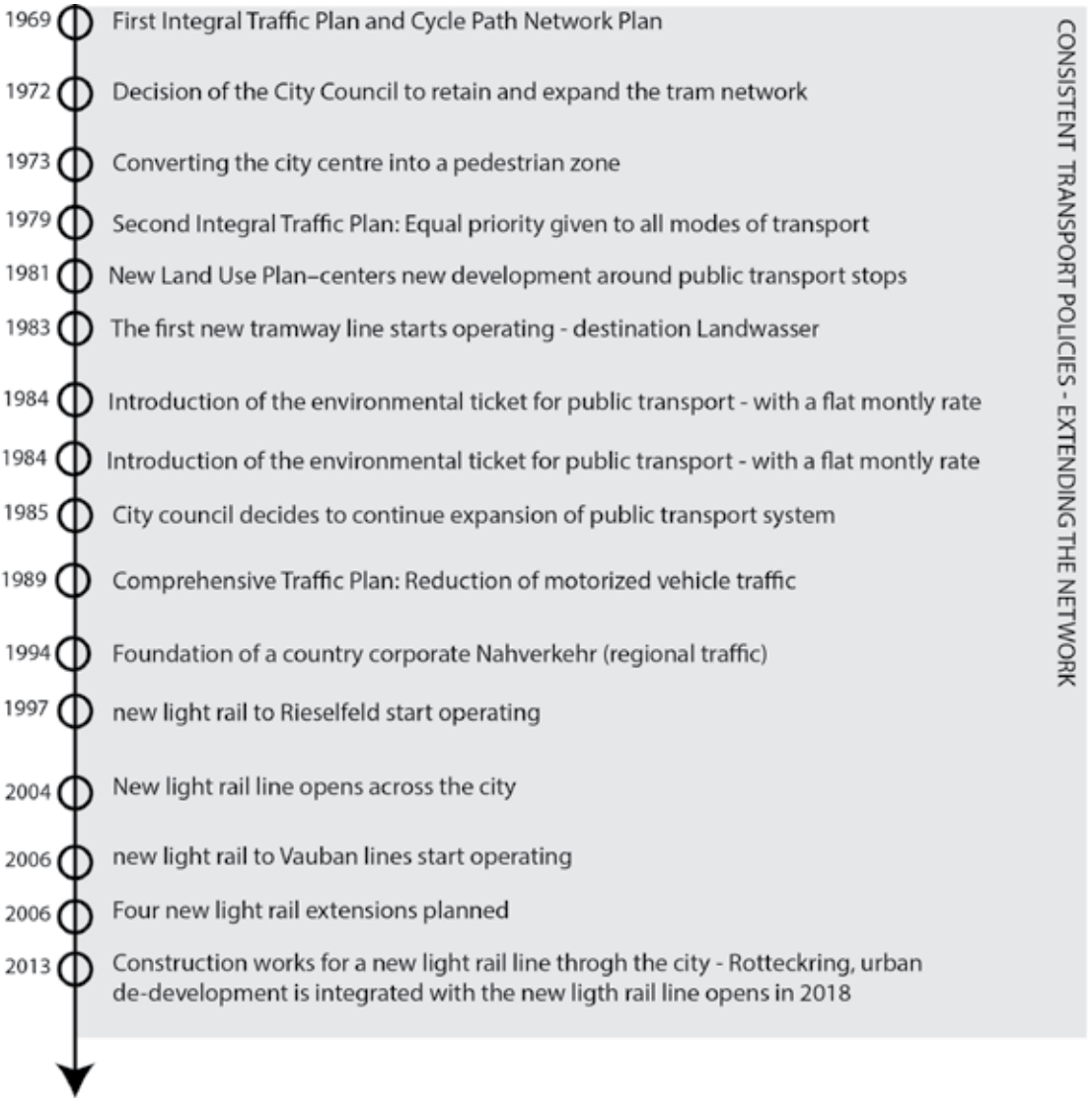


FIGURE 6: Key events in the Transport Policy in Freiburg.

One of the central themes in this report was that cities with more than 300.000 people should rely on their city centre's tram network (which was suggested to be placed underground in the city-centre–working merely as an efficient transport mode). As is the case in Freiburg, most of the systems today are a combination of the old tram network and new light rail extensions, using segregated tracks and low floor access (Hass-Klau, Crampton, & Benjari, 2004)

QUOTE:
Freiburg - A smarter travel town (slides Schick).

There are differences in the funding schemes for public transport in the different states in Germany. Baden-Württemberg, where Freiburg is located, has provided more funds than other states, and is also one of the richest states in Germany. The construction and operation of trams and light rail falls under the extensive regulation called BOStrab, which regulates all technical parts of the system with the well-known German precision. Light rail and tram investments are funded by the local authority financing law (GVFG), which has been part of financing public transport since 1971. The financing is among other resources secured by national petrol taxes, and funding is directly allocated to local authorities and transport operators. The responsibility for planning, operating and financing the urban public transport network belongs to the local authorities, who are organised in Verkehrsverbünde. The urban public transport system is nearly owned by the local authorities, and there exists a close administrative and political connection between the city-owned transport company and the city administration. The city-owned public transport authority in Freiburg is called VAG (Hass-Klau, Crampton, & Benjari, 2004).

QUOTE:
"The city of the furture is the city that strives to achive social equality, cultural diversity and resource conservation" Wulf Danseking, city planning agency in Freiburg (Frey, 2011).

In previous years, up to 60% of the cost of light rail was paid by the federal government, up to 25% by the state and the rest by the local authorities. Any city and operator that wants to receive funding for a new scheme has to present a competitive cost-benefit analysis. If the federal government finds the cost-benefit ratio unsatisfactory, the state can choose to fund the infrastructure itself if the have other political reasons for doing so. Since 1996, 80% of petrol taxes have been directly allocated to the states, and the states can then decide how this money should be re-allocated to roads and public transport (Hass-Klau, Crampton, & Benjari, 2004). In Freiburg, new light rail alignments are 80% financed by the state and the country corporate Nahverkehr (ZRF), which coordinates public transport for the local authorities Stadt Freiburg im Breisgau, Landkreisen Emmendingen und Breisgau-Hochschwarzwald finances 20% of the new infrastructure (Research Interview Uwe Schade).

At each level of government, land-use planning is explicitly coordinated with housing, transport and environmental plans, and neighbouring jurisdictions are mandated to seek input from each other, requiring states, regions and municipalities to collaborate (BMVBS 1993, 2000 in Buehler & Pucher, 2011). (see figure 6 for timeline with key event in Transport Policy).

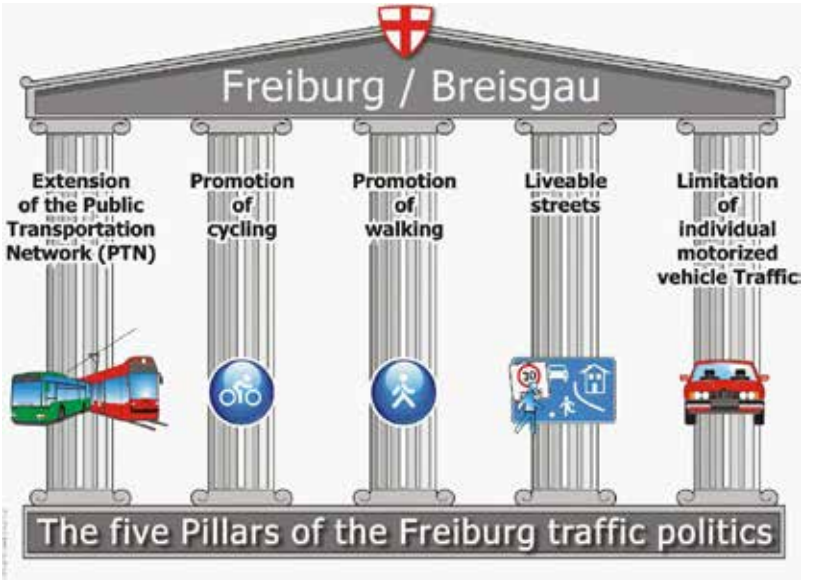


FIGURE 7+8: Avove: Representation of the five Pillars in the transport Policy in Freiburg. (Peter Schick, Freiburg municipality). Below: Visualisation of the new light rail extension through the city centre at Platz der alten Synergoe. Development of the light rail network and new public spaces goes hand in hand. (Peter Schick, Freiburg Municipality).

A Strong Environmental Discourse

Around 220.000 live in Freiburg today, and the population and economy in the city has grown faster than the German average. Freiburg is a university city with around 30.000 students. Approximately 130.000 jobs are located in the city, many of them within the area of sustainability, since Freiburg is known as 'the Green City' worldwide. In 2010 it was awarded the title of 'Green Capital of Germany' (Research Interview Frank Uekermann). The Green City image has consistently been an important brand for the city and its economy. It has furthermore been a valuable brand for attracting inhabitants. Freiburg is one of the popular cities for settlement in Germany and has some of the highest rent levels in the country (Research Interview Samuel Mössner; Frank Uekermann).

QUOTE:
"Freiburg`s land use planning: Development towards "city of short distances", Good quality of urban space, Restrictions to land use, prevent urban sprawl"
(Slides Peter Schick).

The city is known for its activist traditions and has many very engaged inhabitants who, through the years, have initiated concepts and new ways of thinking about urban and mobility planning through activist, bottom-up approaches. In this way, many green policies are pioneered in Freiburg. There is strong green lobby in Freiburg, and when new plans are made there is a great political focus on ensuring that these plans are based on sustainable, green principles (Research interview Frank Uekerman). Often the story of the green mind-set of the citizens of Freiburg is grounded in the story of the activists who won the battle against placing a large nuclear power plant just outside Freiburg in 1975. This is also linked to the fact that Germany's transport, land-use, housing and taxation policies at all government levels have increasingly promoted sustainability since the 1970s. The German federal government has provided the framework for more sustainable transport, but cities and states have played a crucial role in developing and implementing innovative policies (Buehler & Pucher, 2011).

QUOTE:
"You should think about how much tourism does explain in the developing of the train and tram system" (Research Interview Samuel Mössner).

The history of the tram network goes back to 1901, when the first horse-drawn tramlines were established in Freiburg. After the Second World War there were cutbacks in the tram network, and motor traffic was considered the new and modern transport mode in the city:
'During World War II a lot of the tram network was damaged and it was very old and slow, and the motorcars came, and then the tram was considered as old-fashioned. (...) There were discussions in the '50s; whether to abandon the whole system, or to extend. (...) It was very tight. I think that it was nearly half and half in the town council. And fortunately, they decided to keep it, and it was a little bit special to keep and to extend.' (Research Interview Peter Schick)

The decision to keep the tram was based on more than just the need for mobility; it was also discursively framed as 'the struggle for space in cities' and in terms of which activities should be prioritised in the city centre (Research Interview Andreas Hildebrandt). The decision to keep the tram was an important prerequisite for the network that Freiburg has today and the way that the city has developed along the tramlines. In the 1970s, the environmental discourse was strong in Freiburg:
'In the '70s, already the thinking of environmental consciousness in Freiburg started. (...)

PROJECT OVERVIEW (VAUBAN & RIESELFELD)

OPENING : 2006 & 1997

LENGTH: Vauban 2,6 km. Rieselfeld 1,2 km.

STOPS : 3 (Vauban Allé) 3 (Rieselfeld Allé)

TRAVEL TIME TO CITY CENTRE:
Rieselfeld 19 minutes
Vauban 14 minutes

PUBLIC TRANSPORT SHARE: 18% (1999)

FREQUENCY: Every 7.5 minutes during the day (entire network)

PRICE: Vauban - not available
Rieselfeld 7 mio euro

FIGURE 9+10: Above: Overview of key figures of Freiburg light rail project. Below: the city centre pedestrian zone at Bertoldsbrunnen - The space works almost as a shared space where pedestrians, light rails and cyclists comes together as lively chaos. (Photo by author).

The foundation of the German Green Party was in the '70s. And somehow there were a lot of environmentally friendly-thinking people in Freiburg, maybe because of the university, but also maybe because they wanted to build a nuclear power plant.' (Research Interview Peter Schick)

The representative from the Green Party on the city council, Helmut Thoma, further explains the strong green political tradition in Freiburg:
'There was a plan to build a big nuclear plant very close to here, the Kaiserstuhl, which is a small mountain to the west between Freiburg and Rhine River (...) It was in the '70s. And a big resistance was created in these villages (...) The historians are quite sure that the resistance against this nuclear plant caused the birth of the green movement in Germany. So you can say that this region here is the birth region of the greens. (...) Since then, the green ideas have been very popular here. For instance, cycling traffic has been very popular and the support of the public transportation system was high… it was not only the conviction of the greens it was common sense. (...) Other traditional big parties, the Christian party and the Social Democrats, were since the '70s quite green too. One of the reasons is surely also that we do not have big industries here. We have the university and some other high schools with more than 30.000 students. (...) The part of academics is very high. This green movement was not only here in Germany, but it had influence to France and down to Switzerland. I came here in 1977, when this had already happened. And in the last 20 years, the have tried a lot to make progress in different aspects of sustainable development, not only in transportation, but in energy and even in urban development.' (Research interview Helmut Thoma)

Since 2002, Freiburg has had a Green Party mayor, Dieter Salomon. He was the first Green mayor of a large German city, and was re-elected in 2010 with an absolute majority of votes (64.4%) (Frey, 2011). The mayor from 1982 to 2002 was Rolf Böhme of the Social Democrats, who also supported a green agenda in the development of the city. The election of mayors with a green mind-set has been an important reason for consistent policy measures on sustainability and the integration of mobility and urban development policies. Freiburg has, over more than 30 years, administered a strategy for sustainable urban and mobility development. However, many of the initiatives that were later implemented as local policies were initiated by the local residents. As Helmut Thoma describes, a green movement developed during the 1970s, and the city of Freiburg has ever since branded itself as 'the Green City of Germany' and the first mover in regards to sustainable policy measures and urban development. The green economy in Freiburg attracts industries that want to take part in the green image (Frey, 2011).

Geographically, Freiburg is located close to the Black Forrest. The city is located in a mountain landscape, but is itself flat, and therefore ideal for cycling. Today, the city is also seen as a model combination of 'soft' ecology and 'hard' economy. Environment policy, solar engineering, sustainability and climate protection concepts have become the mainstays of economic, political and urban development.

QUOTE:
"In other towns, they discuss if they build tramlines or not. And we discuss which line we build first." (Research Interview Helmut Thoma).

QUOTE:
"Well positioned for the future! The strong supply of Freiburg Transportation AG (VAG) contributes significantly to the quality of life in the city. The buses and light rail offer an attractive, high-performance and affordable alternative to individual car traffic, which encounters high acceptance of the system". (VAG, 2012)

QUOTE:
"we are in the lucky situation that we have had no real policy changes" Research Interview Peter Schick).

Social Downsides to the 'Green City'

Even though Freiburg is well known for the Green City image, it has been so successful that the city is now experiencing some opposition towards what is also framed as 'Green Capitalism'. Samuel Mössner, geographer at Freiburg University has researched this topic and explains some of the social downsides to this successful green branding strategy, which is especially visible in the very popular new districts of Vauban and Rieselfeld:

'Freiburg has the local vision of being a sustainable and an eco-city, sustainable city, green city, whatever you call it, and what we can actually witness after one year now, is that there is a huge movement coming from bottom-up, grassroots, left movements (…) where people express a disappointment regarding the green government and the whole green city thing (...) A green city becomes the mainstream in Freiburg. It was a niche before, and now it becomes mainstream. In the moment it becomes mainstream, that means that it should fit for anybody that wants this development. Not everybody can afford to live in the Vauban (...) I call the Vauban a very interesting kind of gated community (...) It gives you the impression of what it is: excluding (...) The Green Party has completely changed, and Salomon is one of the best examples of how it changed (...) The Green Party is a neo-liberal party (...) They have shifted between the social tolerant image of the green city, and the neo-liberal reality.'(Research interview Samuel Mössner)

What Samuel Mössner is referring to here is the fact that the success of the Green Party and the Green City brand have been so extensive that social justice has been set aside in many urban development decisions, in which mostly high-standard, eco-friendly housing is provided at very high prices. Samuel Mössner especially mentions Vauban as a 'gated community' where only well-off citizens can afford to live, and he explains that many apartments for social housing have been renovated with rising rent levels that make many of these apartments unaffordable for some segments of the population. Vauban was established by a strong citizens group made up mainly of academics that lobbied strongly for extensions of the tram network to support their vision of car-free living (Research Interview Samuel Mössner). A study of the economic impact of accessibility to the tram performed in 2004 showed that there is a minor difference in rent, with access to the tram corresponding to a 3% premium, but in general the tram density in Freiburg is very high, so many residents have access to the tram (Hass-Klau, Crampton, & Benjari, 2004).

Consistent Transport and Urban Development Policies

The consistency in transport and urban policies has secured a fruitful environment for implementing holistic transport planning through political stability. Peter Schick, a transport planner for the city of Freiburg, explains how consistent policies influence transport planning:

'We are in the lucky situation that we have had no real policy changes. I know from my friends in other cities, sometimes they are really afraid of the next elections, and sometimes another mayor comes and makes it the opposite. (...) On these city planning themes, the political parties are not debating so much. Of course their focus is a little bit… for

example, if we say that we want to make some new cycle path, the Green Party is voting for more money, and the others say, "Great idea, but no money". But not one of the parties says that it is not a great idea.'

One of governing rationales behind the light rail network in Freiburg is that it should be an integrated part of sustainable urban development and transport policies, and it is acknowledged that in order to attain successful outcomes there needs to be consistent, integrated, long-term transport policies:
'Sometimes I am asked how to establish some kind of environmentally friendly traffic policy, and you cannot start with that one thing. It is the combination of all, and then it gets very successful, because if the inner-cities are pedestrian zones and if you have very good public transport, then it gets combined very well. But you cannot make a normal city, from one day to another, pedestrianized. People will get upset. It will not work. Otherwise we also have another thing in Germany, that if you only set up a public transport system, that you do not make combined measurements like fees for parking and restrictions, you will not get so successful either.' (Research Interview Peter Schick)

One of the main initiatives that boosted the use of public transport in Freiburg and the entire region was the implementation of a new ticketing system with low fares on public transport and a system that was very simple to understand and use. As a consequence, the passenger levels immediately rose:
'In 1984, they set up this new regional travel pass. In those days, they called it the environmentally friendly traffic card (...) in the whole of Germany, there was a movement to modernise. But in Freiburg, they were very early at the beginning. In the '80s they set up this regional card, and then, year by year, they extended this card and made it better. (...) And they of course established new infrastructure. And this is the result of these two effects. I cannot divide those two effects. Nobody could. You can only guess. It is both figures: the tariff system, advertisement and mind-changing, but it is also infrastructure. A lot of infrastructure, millions. (...) It is so easy, like nowhere in Germany, because for the monthly ticket, there is only one price, one zone. You get the whole zone, whole region for one month for 47 Euros, and if you make it for the whole year, you get it even cheaper. And the idea is to make it cheap, to make it high numbers of passengers with cheap rates (...) opposite you can think, "How expensive can I make it, and how can I get as much money as possible?" But then it is a small number of passengers. You can look for two optimum systems (...) In Freiburg it is very inexpensive.' (Research Interview Peter Schick)

Central Discourses and Metaphors

The case of Freiburg light rail is a case in which many discourses and metaphors are deeply embedded institutionally, both politically on the city council and in the planning department. 'The Green City of Freiburg' has proved to be a powerful brand for the city since the 1970s. Its success has been so remarkable that some are framing the economic development and green branding of Freiburg as Green Capitalism, and the green image has proved to be a successful business strategy and tourism strategy for the city (Research


Landwasser

Interview Samuel Mössner). Under this green image, Freiburg has also been framed as 'a smarter travel town', and is often considered a paradigmatic case of integrated mobility and urban development. Due to this strong brand, Freiburg receives many professional visitors every year who come to learn from the city's experience. Its planning principles have become a brand for the city, and many discourses dominate in this policy and planning practice. Summarising the analysis of the political and cultural production of the light rail project in Freiburg, the central discourses and metaphors in the planning process can be done as follows (based on the analytical model introduced in chapter 3):

- Environmental discourse: This discourse started the 'Green City' discourse and image for the city and the foundation of the green movement in Freiburg in the 1970s. In 1972 the city council decided to retain and extend the old tram network, which has had a huge influence of the success of the system today.
- Urban competitiveness discourse: the light rail is viewed as a material actant in the green city image—attracting residents and businesses with a green mind-set.
- Urban development discourse: the light rail goes through the 'heart' of the city. It has been a strong guiding principle that all light rail lines should access the old city centre square Bertoldsbrunnen and integrate with urban space. This would ensure a lively environment in the pedestrianized areas. The light rail is viewed as the 'backbone' both of the public transport system but also of new urban development. Especially in Rieselfeld, this principle was used as the prerequisite for the development of the new green field area.
- Accessibility discourse: This discourse refers to the quality of urban space and the light rail is portrayed as a generator for new public spaces. Car usage should not be prioritised in the central urban areas. There is a struggle for space in cities and therefore for which whether traffic or high quality public spaces should be prioritised.
- Liveability and future-oriented city discourse: This discourse proposes preparing for the future by offering an alternative to cars. These alternative modes are highly associated with quality of life in cities.

Consistency in the political environment and 'the green mind-set' that has existed in Freiburg since the 1970s has had a strong influence on the restrictive transport policies in the city centre. There has not been the same kind of political controversy over which solution to choose as was the case in Bergen. The light rail system continues to be expanded, as does the pedestrian zone in the city centre. The economic rationality has been based on very different discourses in Freiburg than was the case in Bergen. In Freiburg, the green image proved to be a successful business strategy and brand for the city.

FIGURE 11: The light rail at Bertoldsbrunnen in the city centre - a pedestrianized area. (Photo by author).

FUNCTIONALITY BEFORE

FIGURE 12+13: In Freiburg the light rail Vehicles and stops are not a design element, as it is often the case in French cases. In Freiburg the vehicles serves as advertising pillars (Photos by Author).

DESIGN

FIGURE 14+15: Above left, many of the older vehicles still runs in Freiburg. Green traces has been implemented in the new extensions of the old system, here close to the new quarter Vauban. Below: The functional design of stops - the main function of the stop is to provide information and shelter. The Urban spaces is on the other hand often upgraded along with the implementation of a new light rail line - here in Rieselfeld a new green corridor has been implemented in the main Rieselfeld Allé (Photos by Author).

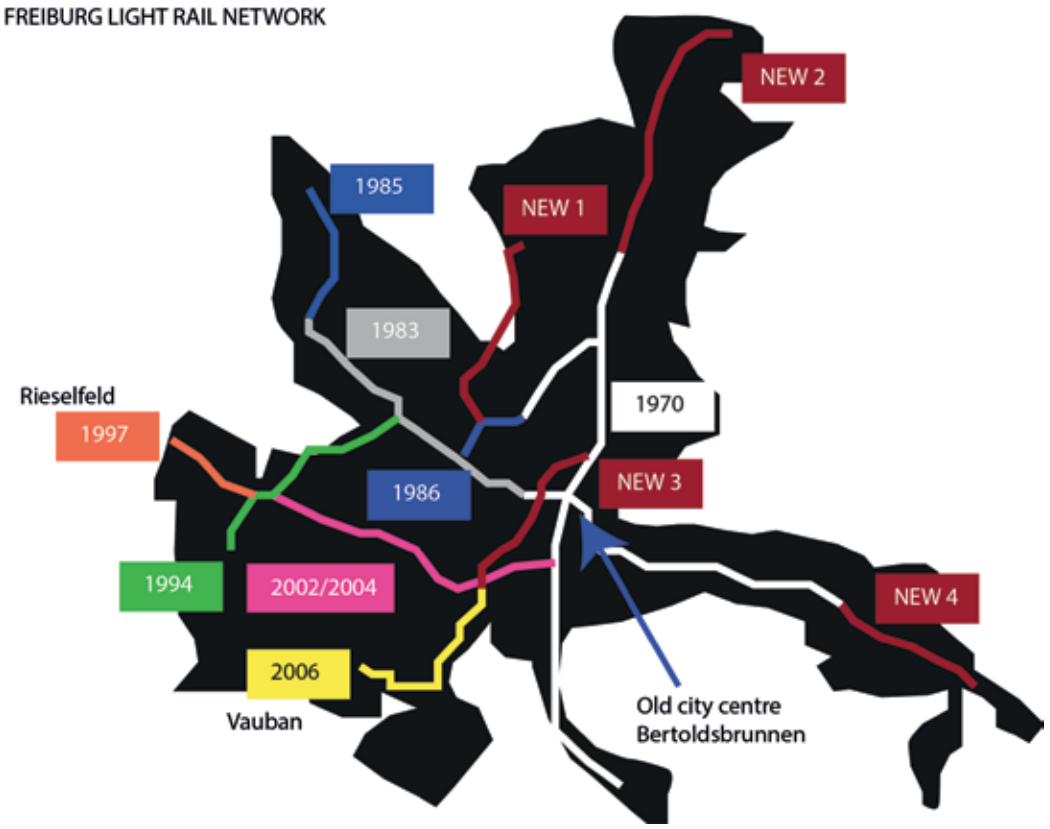


FIGURE 16:
Map of the Tram and light rail network in Freiburg

THE MATERIAL AND SPATIAL DIMENSION

Environmentally Friendly Transport Concepts

The original tram network was implemented in Freiburg in 1901. In 1972, a decision was made to keep the tram network, when many other cities chose to close down their trams, and today the city benefits from a well-integrated and expanding network. But because the light rail network is based on the old alignments, the concept has not been to provide fast travel speeds, but instead to access the very core of the city centre, and this means that the system is mainly an urban system operating within a limited radius from the city centre at slow travel speeds:

'These are the historic tracks. Of course this also means that the tram is very slow. Slow velocity, but you get direct access (...) This was also a little debate in Freiburg, but only for a short time. But in other cities—big cities such as Stuttgart, Munich—they had the same situation and they put it underground. But of course it cost them millions of euros.' Research Interview Peter Schick)

QUOTE:
"in Germany the name is Stadt Bahn for light rail, and for tram it is Strassen Bahn, but the people use these words very mixed. It is only if you make a sharp research that you make it clear what is what. And Freiburg has shifted from tram to light rail, I would say" (Research interview Peter Schick).

Expansions to the network are made on the concept of ensuring separated tracks, priorities in intersections and a higher average speed. The name of the new system is 'Stadtbahn' (urban rails) instead of 'Strassenbahn' (tramway). This underlines the modernisation of the network and indicates that this is an urban project (Beim & Haag, 2010). Subsidies for extending old tram networks were not available until the beginning of 1980s. Compared to the new light rail concepts, the old tram was perceived as old fashioned by the West German federal government. This meant that the first extensions of the network in Freiburg were not opened until 1983 and 1985 (the line to Landwasser) (Hass-Klau, Crampton, & Benjari, 2004).

The tram network covers 36.4 kilometres and transports 70% of all passengers. The modal share for public transport is 18% (last figures available are from 1999). For comparison, the bus network covers 274.3 km and covers 30% of all passengers. As these figures indicate, the tram network is integrated in the most central parts of town. The tramway departs with headways of every 7.5 minutes during the day (every 5 minutes at peak hours). In 2010, the network transported 74.4 million passengers (Innovation Academy e.V., 2013).

The success of the light rail system in Freiburg should be considered within a wider mobility perspective, since Freiburg has had a long tradition of implementing sustainable mobility measures. Hence there are various initiative which in combination that support the existence of a successful tram network. The transport policy in Freiburg is based on five main principles that provide a holistic approach to mobility planning in Freiburg. Briefly elaborated, these planning principles are (Schick, 2011):

- 1. Extend the public transport network

The light rail system works as the backbone of the public transport system, and plans

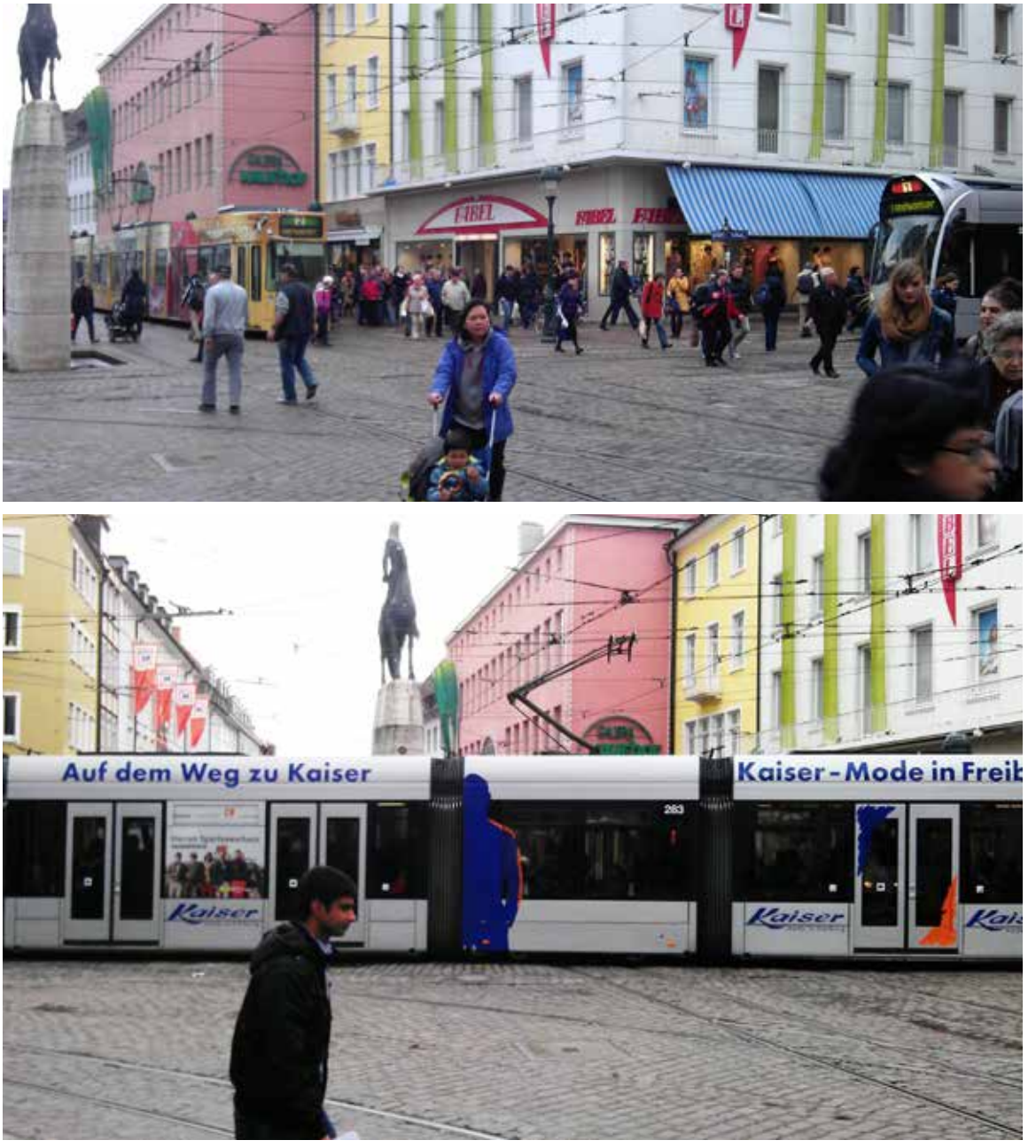


FIGURE 17+18: Bertoldsbrunnen works as a shared space where pedestrians, cyclists and light rail mix. The long light rail vehicles is a very visual part of this square and causes an temporary barriers in the urban environment as the picture to the left illustrates. (Photo by Author).

are made to extend the network to all parts of the central city. In the outer areas the tram network is integrated with feeder bus lines and regional train stops. In this way, the network functions in an integrated grid where all lines are coordinated with fitted timetables which make the journey easier for the passenger. The light rail system covers a relatively small radius in the city, which allows shorter trips. *'Is it so small that I think that every trip you can make by the Stadt Bahn, you can make by bicycle.' (Research interview Peter Schick)*

There is a general ticket for public transport, which was introduced in 1984. The principle was to reduce the zone structure, for a cheap price, to three primary zones for the entire region. The ticket is not personalised and can be used by different passengers, and it is possible to bring up to four children on the same ticket. The ticket influenced the number of passengers remarkably, precipitating a 42% increase in ridership from 1984 to 1990 (Buehler & Pucher, 2011). The ticket continues to be a successful element behind the public transport system. In 2009, 88% of the operations for the public transport system were covered by revenue from tickets, and only 12% were covered by subsidies. The modal share for public transport in 1999 was 18% (the latest number for modal shares) (Innovation Academy e.V., 2013). Today 90% of all public transport users hold a regional card, and the price of an individual ticket has been raised in order to motivate passengers to use the regional card. The price for a monthly ticket is 48 Euros, which allows passengers to travel freely in the entire region. Two million regional cards are sold on a yearly basis (Research Interview Uwe Schade).

QUOTE:
"So this is perfect conditions for using cycle, and the increasing number was also because cycling became fashionable" (Research interview Peter Schick).

- 2. Promote bicycle traffic

Freiburg is known as the cycling city, and many initiatives are made to promote cycling. Among others, these include: priority for cyclists in intersections, dedicated biking lanes and biking highways. The modal share for bikes in 1999 was 28%. In Freiburg the light rail and the bike are not perceived as competitors; each mode has a main season, and they supplement each other in this way: *'If you only focus on one system, they cannot help each other.' (Research Interview Uwe Schade).* It is not possible to bring bicycles onto the light rail since the vehicles are only 2.4 m wide and thus have a much slimmer profile than those in other cities (Research interview Peter Schick).

- 3. Traffic restraint

Different principles are used to restrain car traffic in the city. Most residential streets in Freiburg are 30 km/h zones; 90% of residents live in these areas (Buehler & Pucher, 2011). Other streets are designed on the concept of play streets, where the speed limit is 20 km/h. The concept of creating a city of short distances was introduced in order to prevent big box shopping centres from locating outside of the city centre and areas covered by public transport. The old city was reorganised in 1973 from access for car traffic to create a pedestrian zone, and plans to extend this zone have recently been made with the closure of a central street in the city (Platz der Alten Synagoge). The pedestrian area is one of the largest in Europe (Hass-Klau, Crampton, & Benjari, 2004). Some of the traf-

FIGURE 19: RIESELFELD

Urban Planning concept in the District Rieselfeld.

Orange:
Central axis - Rieselfeld Allé
Yellow:
Decreasing density from interior to exterior
Green:
District park with central infrastructure
Blue:
Gastronomy and commerce along Rieselfeld Allé
(Projektgruppe Rieselfeld in Innovation Academy, 2013).

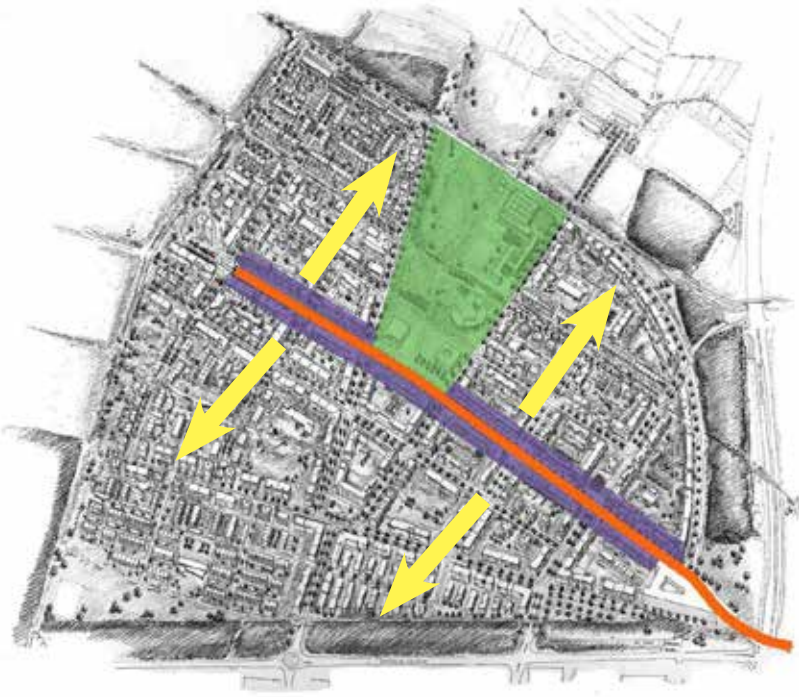
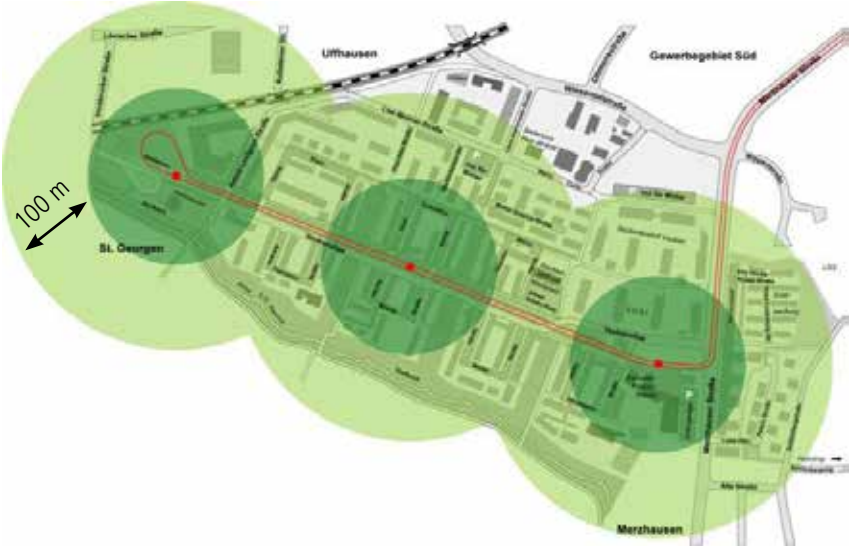


FIGURE 20: VAUBAN

Light rail coverage in the Vauban district. The light rail implemented in the central axis through the area (Innovation Academy, 2013).



fic-calming designs have been used as design features for other European cities.

- 4. Channel individual motorised car traffic

Individual car traffic is channelled to the major ring roads in the city in order to preserve most of the city as car-free or car-reduced zones. To facilitate mode shifts, several park-n-ride facilities are placed in strategic spots around the city centre at central public transport nodes.

- 5. Parking space management

Parking in the city centre is divided into zones to avoid through traffic. Furthermore, park-n-ride stations are provided outside the city centre. The concept is that parking cars outside of town is free and allows people to take the light rail on the rest of their journey into the city. An important concept behind the funding and organisation of the light rail network is that the city owns the transport operator VAG, so the mayor, Dieter Salomon, is also responsible for this company: *'The planning of the operation of the light rail is handled by the city-owned operator VAG (...) I think that is very important. And the head mayor is also the head of the operator.' (Research Interview Peter Schick)*
The public transport company is under the same organisation as the energy company, which is also city-owned. In this way, the profits from the energy company pay for the deficits in the public transport company: *'The city owns the firm that supplies the town with energy. They earn a lot of money and it is a municipal firm too, so this firm earns a lot of money, and the traffic company, VAG, needs a lot of money. So what we earn by selling electricity, gas and water, we take to organise our tram traffic. It is very simple. (...) These two companies together are one holding, so it is very good for the financial side.' (Research Interview Helmut Thoma)*

Urban Planning Principles

It is a planning principle that all tram lines should intersect at the central square in the old city, Bertoldsbrunnen (see figure 10 and 15). There are 1.000 tram and light rail crossings in this central node every day (Research interview Andreas Hildebrandt). The goal of this scheme is to get passengers into the most central part of the city to support and create life in these areas, which also serve as the central business and retail district. VAG, the local public transport operator, raised the issue of a potential bottleneck and recommended moving the intersection, but people and retailers wanted the tram in the 'heart' and centre of the city. There were discussions about this, and finally in 1999 it was decided to place the intersection in the city centre (Beim & Haag, 2010).

Visually and physically the high intensity of light rail traffic on Bertoldsbrunnen causes a mess. Trams, bicycles and pedestrians mix in what can be called a mobility hub in the narrow streets of the city centre.. This central square has reached its capacity limit, and new extensions are placed in parallel streets, to which the city centre pedestrian zones have also been extended. This new corridor is marked as NEW 3 in figure 15. This project is under implementation and includes closing down a former road for car traffic through

FIGURE 21+22+23: Above: Platz der Alten Synagoge - development of new light rail line and public spaces in the city (Photo by Author). Below: left the area Rieselfeld, right the area Vauban - the light rail is the 'backbone axis' in both areas. (Source Google Earth).

the city centre and building a light rail, together with the creation of new public spaces. To compensate for the additional car traffic, one of the central ring roads around the city is extended from two to four lanes.

The light rail network is framed as the backbone of the urban public transport network (Zweckverband, n.d.). This means that it serves the major, dense corridors in the city and is supported by feeder bus lines at end stations. Since January 2009, Freiburg's light rail system has run solely on electricity generated by solar, wind and water power. This is an important branding and identity issue that goes together with the overall green image of the city and the approach to urban and transport planning.

QUOTE:
"Public transport has to operate where people wants to go" (Research interview Andreas Hildebrandt).

Freiburg's most recent land-use and transport plans (2008) were developed simultaneously and are fully integrated. In this plan there is a focus on development along the light rail corridors. Another principle of the plan is to locate retail areas and new workplaces in proximity to the light rail network in order to create a city of short distances to daily facilities and thereby minimise the use of car traffic. Urban planning is also done based on a principle of creating a city of short distances by prohibiting the establishment of new shopping areas on the outskirts of the city and locating retail along the existing public transport network. Originally, the idea behind this concept was to ensure a lively business life in the inner city, but the concept has also had the effect of limiting the need for transport in the wider city, since retail has been spread throughout all city districts. Today Freiburg is known for its lively old city centre even though the city centre is pedestrianized and does not have easy access for private cars. The concept of pedestrianizing city centresis furthermore implemented state-wide, which is strengthening Freiburg as a regional centre. However, it is important to acknowledge that part of the success of implementing this policy has been due to the fact that Freiburg is only in competition with the Swiss city Basel (Hass-Klau, Crampton, & Benjari, 2004). Transport planner Peter Schick explains the idea behind the concept:

'They have strict regulations trying to preserve the life of the city centre. That is the main goal, and it is very successful. (...) It also has to do with a strong town council that does not want to see even one shopping mall outside the city. But it is also a little bit about the lucky position of Freiburg, because there is no other big city nearby. Because if you had several big cities nearby, they are competing, and, I know this from other regions from Germany, then it is difficult. (...) In the '70s they really debated about this, and a lot of shop owners were against the whole system of public transport (...) Many German cities set up pedestrian zones in the 70s, because of the increase of car traffic, traffic jams and air quality [problems]. And Freiburg is a little special, because many cities have it, in the following way, only one shopping street, and here already on the backside of the houses you have motorcar traffic and parking spaces. So they make only one street, which is the very nice side of the city, and in Freiburg it was a little bit more comprehensive, which is also a result of the fact that we have this historic inner-city area which not so much space.' (Research interview Peter Schick).

Politician Helmut Thoma of the Green Party explains the opposition towards pedestrianizing the city centre, and explains how this opposition changed:
'The autobahn was built and then in the '70s, the Freiburg city council decided to close it for traffic and make it a pedestrian zone. It was one of the first implemented. And the owners of the stores and shops in Freiburg were very excited and there was a big protest against it and they said: "This is just the end of inner-city shopping (...) So, the Freiburg town will be dead, and if that really happens, it is the end for all of us." Even the Münster Platz was one a big parking place. And they said, "It is necessary. If we do not offer it as a parking place, nobody will come and nobody will buy in our shops." And when the pedestrian zone was opened, nothing like that happened. If somebody gets the idea to go back, and say, "We make a parking lot here," the resistance will be the same or even bigger, because meanwhile everybody has seen that this pedestrian zone is an attraction. Many people from the whole area come to Freiburg; many come by train or by bus, then by the public tramways, and there is a measurement of how many things are sold in the town compared to the number of inhabitants.' (Research Interview Helmut Thoma)

Restrictive policies are often controversial, but in this case they created momentum for developing a lively city centre, contrary to the shop owners' expectations. Because of these policies, in combination with the principle of banning shopping areas on the outskirts of the city, Freiburg maintains an attractive and lively city centre that is well served by public transport. The pedestrian zone is being extended with the new light rail and urban development project along the Rottekring and the Platz der Alten Synagoge. The pedestrian area has become an important branding element for Freiburg as the 'Green City', and it is a major tourist attraction from which the shop owners benefit (Research Interview Samuel Mössner). Offices located in the tram corridors prove to have much higher rents than offices without light rail access. The difference is up to 15-20% (Hass-Klau, Crampton, & Benjari, 2004).

Two of the most recent new urban districts in Freiburg, Vauban (approximately 3 km to the city centre, yellow line on the figure line map) and Rieselfeld (approximately 5 km to the city centre, orange line on the figure 15) have been developed by using the light rail as a central mobility concept. Maps of the districts are shown in figure 18-19, 21-22. As in the land-use plan, the objectives behind the two areas have been to create districts of short distances by locating workplaces and public facilities in the area. The buildings are denser towards the light rail corridor and infrastructure in the area is organised so that car traffic is lowest in the mobility hierarchy. The street network has 30 km/h streets on which bicycles are prioritised over cars in the hierarchy. Furthermore, a concept of play streets has been introduced where car access is only allowed with a speed limit of 7 km/h (Research Interview Uwe Schade). In these areas parking is only for unloading goods. There are 5.100 people in Vauban and 9.000 people live in Rieselfeld. In Vauban no car parking is allowed outside the individual houses; parking is restricted to the peripherally located garages. Parking is not a standard but an option available to residents who pay a considerable amount of money to obtain a parking space. The purpose is to create a car-

free lifestyle, raise awareness of car use and change habits by ensuring that the residents, through the physical organisation of the infrastructure, reflect on all the trips that they take. The average number of cars per inhabitant in Freiburg as a whole is 35 cars/100 inhabitants; in Rieselfeld this is 28.5 cars/100 inhabitants and in Vauban it is 16 cars/100 inhabitants. A new urban district, Guleutmatten, is planned in proximity to Tram Line 5, with many of the same principles as in Vauban and Rieselfeld (Innovation Academy e.V., 2013). Furthermore, a new extension of the light rail network (NEW 1 in figure 2) will serve many new developments, as indicated in figure 5. In Rieselfeld, the tram line was opened before the area was fully developed; in this way the tram worked as a generator for investment in the area, and secured independence from the car from the beginning. Helmut Thoma from the Green Party explains:

'One of the specialties of Rieselfeld—even more than in Vauban—when the first family moved to Rieselfeld, the tram was already there. It did not run, because it made no sense to let the tram run for a hundred people. To have planned from the beginning made people get used to it, and it is very significant how many cars per thousand people there are in Rieselfeld or in Vauban or in the rest of Freiburg or in Germany.' (Research Interview Helmut Thoma)

QUOTE:
"one of the specialties of Rieselfeld - even more than Vauban was - when the first family moved to the Rieselfeld, the tram was already there" (Research Interview Peter Schick).

Peter Schick, a planner for the city of Freiburg, further describes how this area was planned by the city administration and the way that the light rail was a key actant in this new urban development project:

'Rieselfeld is a green field development. It was developed totally by the administration in the '90s. The construction began in '94, and before that it was totally planned by the administration. (...) The people who planned it decided that it is very important to make public transport access, so we made it directly through the heart. We made it at the very beginning, a very nice, perfect public transport system.' (Research Interview Peter Schick)

The city administration played a crucial role in the plans for Rieselfeld, but in the case of Vauban the initiative to create a district based on 'car-free living' came from a bottom-up movement initiated by the residents. This is also why the residents pushed for a tram in the area. Planner Peter Schick describes this process:

'Vauban was a little bit different, because this fell down from a stone from the air, because it was a military area, and after the end of the Cold War and reunification, it was free from use from the French military (...) It came with a lot of grassroots development, because in those times in the '90s, many environmental thinking people joined (...) And then these grassroots activists came together and in simple words said, "We want to make an ecological model, a utopian city." (...) There was a several year period without good access to light rail, which also made the car-free living difficult. (...) Housing prices are extremely high. You do not see any advertisement, flats for rent, because it is immediately sold to friends or something.'

Both Rieselfeld and Vauban are built around the light rail line as the central axis in both development and all activities: shops, offices, etc. are placed in the light rail corridor. In the

FIGURE 24+25+26+27+28: VAUBAN DISTRICT
Right: Above: entering Vauban Allé - the green light rail corridor as the backbone of the area. Below: Small residential streets with no access for cars - called Spielstrasse. Left: Above, the Solar garage, main parking facility at the edge of the area. The old military building in the area and the Vauban Quartier logo and landmark. Below: Kids playing in the green corridor. A small fence separates the public space from the light rail tracks. (Photos by author).

FIGURE 29+30: RIESELFELD DISTRICT

Above: Rieselfeld Allé - with the light rail as the backbone and Green corridor in the district

Below: The public square and market place with cultural house, library, church, weekly farmers markets and a integrated-stop (Photos by author).

following section, a spatial analysis of these two light rail districts is performed.

Spatial Analysis

The spatial analysis was performed by a phenomenological registration of urban space in which my own embodied experience of riding along and walking along the corridor has been used as the medium to perform the analysis of the material and spatial implications of the light rail system in the two districts of Vauban and Rieselfeld. The trip along the corridor starts at the entrance to each district.

District: Vauban

Running in the centre of the road in green tracks on Merzhauser Strasse, the light rail takes a right hand turn down Vauban Allee the central axis or 'backbone' of the Vauban district. Vauban Allee is the main path in the district, and all activities are located along this path. The light rail line is integrated in a green track that runs in the centre of the wide Allee and creates a nice green environment. Entering the area I see a large building with a sign reading 'Solar Garage'. This is the main parking facility in the area, and works almost as a landmark of the car-free living principles on which the area has been developed. I also see the characteristic old military building with the Vauban logo 'Quartier Vauban'—this is the building that is often used as the brand for the alternative lifestyle of the area—and the SUSI project, which reminds me of Christiania in Copenhagen. Many small allotments or old circus wagons are located in close proximity to the old military area along which the district originally started to develop. The first light rail stop is placed at the entrance to the public square Paula Modersohn Platz. On this square there is a

FIGURE 31+32:RIESELFELD DISTRICT

The light rail stop is integrated with the central square in the area which also contains some of the major destinations in the area, the Library and cultural house and the church. To spectacular buildings which are characteristic landmarks in the area (Photo by author).


FR VN 831
FR XB 609

school and some smaller shops, and it is possible to enter the Solar Garage. Moving along Vauban Allé I see the small, narrow residential streets, with 'play street' markings on the pavement where apartment blocks with four to six floors are located. The buildings have a very diverse look—many different building styles are present in the area, which shows the variety in building styles that has been created by organising the development of the district in individual 'Baugruppen'. Green elements are integrated everywhere and provide a scenic environment. There is not much traffic in this area, and even though it is November there are many people outside. Kids are playing in the streets.

District: Rieselfeld

The light rail enters the district of Rieselfeld, where it runs in a segregated green tracé in Rieselfeld Allee the central axis and backbone of the area. Moving along the green light rail corridor I see dog walkers using the green corridor as a communal and public space, untroubled by the light rail that slowly moves down this central corridor every 7.5 minutes.

The apartment blocks are drawn towards this central path and are up to six storeys. They decrease in density the further I move away from the light rail corridor. The main floor in many of the blocks has a transparent facade and contains shops, office space and other amenities that have been strategically placed in this central corridor. On both side of the green Allee there is a lane for car traffic that is regulated as a 30km/h zone, affording slow speeds in the corridor. There is space allocated for parking on both sides of the road. Smaller residential streets are connected to the main Rieselfeld Allee, and many houses have a small private garden in front. Besides, there are also many common green areas. As in Vauban, these streets are regulated as play streets where pedestrians and cyclists are prioritised over cars. The residential streets are very narrow to ensure a safe environment with slow travel speeds. The concept behind the area is very similar to Vauban and it is obvious to see that these two areas are developed on the same principles.

The central node in the area is the main public square located at the stop at 'das Glashaus', which is the cultural house and library, a landmark and central node in the area. This is also where the 'green belt' that enters the district ends (see map Rieselfeld). A big church, the 'Ökumenische Kirche', dominates the area as a central landmark in this node. The building, which is made of concrete, is a massive element in this new public space. Every week the city square is used for a farmers' market that moves around in the city. This public space offers a place for outdoor communal activities in the district. One of the three light rail stops has been strategically placed at this central node, and I only wait a few minutes to catch the next tram back to the city centre.

FIGURE 33:RIESELFELD DISTRICT: Dog-walker in the light rail trace (Photo by author).


30
ZONE

FIGURE 34+35+36:RIESELFELD DISTRICT: Left: 30 km/h zones are implemented along Rieselfeld Allé and parking in the area is limited. Below: The light rail and the bus shares the same stop in Rieselfeld Allé. Right: The new public square integrated with the light rail stop: Geschwister Scholl Platz - shops, cafés and other activities are centralised in arround Rieselfeld Allé. (Photos by author).

CASE STUDY FINDINGS

The case analysis of Freiburg light rail proved that the light rail has played an important role in urban development strategies and restrictive car policies since the 1970s, when the 'Green City' discourse began dominating policies and planning initiatives, providing an attractive brand for the city and attracting green businesses. This is also a major contextual explanatory factor behind the success of the system. The implications of the light rail in Freiburg must therefore be understood as part of a wider policy package with many initiatives supportive of public transport usage. The analysis furthermore showed that the preservation of the old tram system has greatly influenced the design principles of the new light rail extensions. Until the newest extension, all lines met in the heart of the old city and pedestrian area Bertoldsbrunnen. This is a key principle in the system design that secures high accessibility to the city centre, which is closed off to cars. The aim to extend the public transport network is just one of five pillars in the transport policy, which works in favour of supporting soft modes and restricting individual motorised traffic in the city centre. Furthermore, the introduction of the general ticketing system called the environmental ticket is a major explanatory reason for the increase in passengers.

In relation to the material and spatial dimension in the analytical model, the light rail system in Freiburg is a narrow urban system, meaning that the system does not cover much more than a 5 km radius and is thus not designed as a fast mode connecting destinations far away from the city centre. This also makes it a system that competes with bikes on these shorter urban trips, and the number of passengers in the light rail system is thus highly dependent on the season—ridership is much higher in winter, when cyclists are more prone to using the light rail system. The 'backbone of urban development and the public transport system' has been a guiding principle in the design of the light rail corridors and their integration with new urban developments. The new areas, Rieselfeld and Vauban, are centred on the light rail line. In the case of Rieselfeld, the light rail was there before the first citizen moved in. The car-free living provided in Vauban and Rieselfeld has proved to be very attractive, even though these urban areas are some of the most expensive in Freiburg. The aesthetic design of the system has not been as evident in the case of Freiburg as it was in Angers and Bergen. In Freiburg the light rail vehicles work as commercial pillars, and the stops have a functional, informative design that does not mediate any particular identity. This indicates that the light rail has not been practised intentionally as an aesthetic image creator. It has, through Freiburg's history as a tram city, been an integral part of the identity and cultural practices of the city, and the system has wide public acceptance. In general, the design practice has not been performed in the same way as in many of the French cases.

The case analysis furthermore showed that there are some potential social downsides to the 'Green City' brand of Freiburg. The city has become so popular that house prices and rent levels are too high for many people to afford living in the city centre, causing patterns of social exclusion. Seen from a sustainability perspective, the economic and environmental aspects are thriving, but there are some social downsides. Since the light rail system

only serves the city centre, it could also be perceived as socially exclusive, for shorter urban distances, and not as a mode that facilitates connections to city's catchment areas.

CROSS-CASE ANALYSIS

7

7. CROSS-CASE ANALYSIS

7.1 PROLOGUE

In this chapter some of the central themes that are found in the case analysis in chapter 6 will be analysed and compared across the cases. The themes will be structured around the two dimensions in the analytical model introduced in chapter 3, which has also been guiding the structure for the case analysis. The study covers the discursive-institutional dimension as well as the material-spatial dimension. Furthermore, the conclusions derived from the cross-case analysis have formed the basis for the two journal articles presented in chapters 8 and 9, and as such, these chapters should also be considered an outcome of the cross-case analysis and findings. With regard to the decision-making process and the process of making light rail mobilities, it will be discussed how the four cases that were analysed all prove to have some very central process-related differences creating a more or less linear decision-making process. The process of implementing the light rail project and creating a clear storyline from the visionary phase to the planning and implementation is very different in all four cases, and the process has influenced the final material and spatial design of the project. In addition to the arguments presented in the two journal articles, some of the main lessons from this chapter are taken into a model for a future decision-making process introduced in chapter 10.

7.2 CENTRAL THEMES

The case analysis in chapter 6 provided central findings from which future light rail projects can extract experiences. This chapter explores some central findings from each case and is structured using some core themes that have been derived from the research questions and the analytical framework introduced in chapters 1 and 3. The four case analyses show the differences and similarities by which light rail mobilities are produced -both politically and culturally- and practiced -materially and spatially- in mid-sized European cities. In all cases it is clear that light rail projects are much more than public transport projects; they are strategically framed as urban projects and tools in strategic urban development. The findings across the cases will be summarised according to the following central themes, which will be elaborated in the following sections:

- The Political and Cultural Production of Light Rail Mobilities: This theme focuses on the discursive production of light rail mobilities and the extent to which they are culturally and politically embedded in each context studied.
- The Material and Spatial Concepts of Light Rail Mobilities: These concepts focus on the main idea and vision behind the project and how the vision (discourses and representations) materialised in the urban environment and facilitated new cultural practices and spatial links in the city.
- The Process of Making Light Rail Mobilities: This theme focuses on the importance of political leadership and a clear storyline in all phases of the project - from the vision, to the plan and finally the project's implementation.

7.3 THE POLITICAL AND CULTURAL PRODUCTION OF LIGHT RAIL MOBILITIES

The analysis of the political and cultural production showed that light rail projects are deeply embedded in the production of the future-oriented sustainable city image and the strategic urban development. It could be argued that the city itself shapes the light rail project but that the light rail project also reconfigures and shapes the urban structures and planning practices. To exemplify this point, Angers light rail project has completely reconfigured the central urban areas in Angers by providing a new public transit link to the most central urban areas. The light rail has facilitated a new use of urban space with the most extreme example being Place du Ralliement where a completely new pedestrian area and public space has been released by the implementation of the light rail. In Bergen, the light rail system has been part of enacting new planning practices with a new strategic focus on densification in the light rail corridor. The project in Bern West has partly emerged due to the need to extend the city to the west and the connection of the light rail to new urban developments has thus been a central element in shaping this project. Furthermore, a physical principle that has shaped the layout of the light rail line in Bern West has been the need to fit the light rail alignment into the existing street scape to avoid expropriations to the existing urban environment. This is also why the light rail runs in shared traffic in large parts of the line. In Freiburg the light rail system has been a material actant in the vision of developing a green city, a principle guiding urban planning for the last four decades. In this sense, the light rail lines have been an active part of shaping urban development in Freiburg, and this is specifically evident in the district Rieselfeld, where the light rail was implemented before construction of the area began. Likewise, the light rail has been an important tool to secure high mobility to the city centre when it was closed to car traffic, and the latest new light rail extension enables a further extension of the pedestrian zone.

The cross-case analysis proves that there is a strong political motivation behind the light rail projects in the four cases and this motivation is not grounded in technical details of travel time savings and optimisation of costs (see Olesen & Nicolaisen, forthcoming). The political motivation is guided by a strong vision for future urban development and the strong competition of growth that exists between cities. The light rail is a strategic piece in a larger ideological battle of visions for future urban development, as well as a manifestation of the will to focus on alternatives to automobility in the most central parts of city centres. In this sense, creating a light rail system has a powerful attraction in support of this urban development vision because the large investments in the construction of tracks and the extensive reconfigurations of the urban environment makes it more difficult to abandon this solution if the political will to support public transport suddenly changes. Buses are more flexible but are also easier to downgrade. The connection between vision, passion and power is central in the discursive production of light rail mobilities, meaning that the light rail project goes beyond transportation. A light rail project can be an active tool for shaping new strategies for urban development and for creating the branding of a sustainable and future-oriented city. Comparing the findings in the four cases highlights

the importance of political leadership and momentum to implement a light rail project, especially when arguments are not to be found in the rational decision support tools such as socio-economic analysis and transport models.

The discourses of light rail mobilities, identified through the case analysis, can be characterised as 'general'. The reason behind this is two-fold. Firstly, most of the discourses and metaphors that support the light rail project are present in all cases in more or less the same character. Secondly, most of the discourses are not directly connected to the local context but could be relevant arguments in most light rail projects. The discourses are thus more connected to the technology than the context. The discourses identified can be characterised as a 'visionary language of light rail mobility' and shed light on interesting perspectives about the ideologies that the light rail project shapes in both a local and global perspective. In article 1, chapter 8, this finding is further elaborated upon in order to explain how light rail can be seen as a 'travelling' idea within spatial planning as has been previously argued by Tait and Jensen (2007). The article analyses the historical background and political framing of light rail mobilities based on examples from three of the four case examples: Bergen, Angers and Bern. The analysis of frameworks behind light rail projects draws on the concept of 'travelling' ideas introduced by Tait and Jensen (2007). The concept of 'travelling' ideas is used to explain how certain planning ideas, such as light rail mobility, circulate between different contexts and translate into new spatial settings and as a means of re-envisioning the city. These planning ideas propagate particular visions of space and place; experiences from similar projects in other parts of the world or other alternatives are often of great importance, whether they have proved problematic or successful elsewhere (Hughes, 1998). The local translations (Callon, 1986) of light rail mobilities are dependent on the actants involved in the process of producing a local framework for the light rail vision and the particular objectives that the light rail vision was set to solve. The understanding of discourses of light rail mobilities as 'general' is central to explaining the political awareness that has occurred around light rail mobility on a global level and how this awareness has created new 'trends' in spatial planning. These are trends that are influencing spatial practices in different national contexts and enrolling more cities in this light rail vision. As the case analysis proves, the ideas of light rail mobility do indeed travel from context to context and, as was exemplified in the case analysis, experience from other light rail projects are important in the planning process in order to visualise and concretise the project for planners and decision makers. In this regard, study trips to other light rail cities are key in raising political awareness of the potential spatial impact of light rail (as argued in chapters 6 and 8).

The political and cultural production of a light rail practice is grounded in the visionary phase of the project, where the light rail vision is performed discursively by various actors. As the case of Bergen light rail exemplifies, there can be many competing rationales present in such a decision-making process. Differences can make it a challenging task to create a common understanding of the project. The discursive production imposes different realities on such a project. Many different actors are seeking to gain ownership of the

project and creating storylines that relate the project to wider societal discourses as well as the local context and challenges. In Bergen one of the important battles was between the light rail as an 'environmental project' with high travel speeds, or an 'urban project' with frequent stops and integration into the urban environment. It was also a battle between economic realities, particularly, the quantitative and qualitative value created by such a project. In this sense the light rail system is embedded in a wider societal context, and actors use this technology to project their various views on the world. Is the light rail project an urban development project, a new brand for the city, a fast and efficient transport mode or a waste of money that could have been spent more efficiently on alternative transport modes? (see also the light rail vs. bus rapid transit debate elaborated upon in chapter 2). The discourses identified through the case analysis are summarised in figure 11 providing a picture of the discourses that have dominated the political production of light rail projects. Both discourses for and against the light rail vision are included in the table providing an overview of the most central arguments.

7.4 THE MATERIAL AND SPATIAL CONCEPTS OF LIGHT RAIL MOBILITIES

As argued in the previous section, the discursive production of light rail mobility can be characterised as being general in the visionary phase of a light rail project. As described in chapter 3, discourses are an ensemble of ideas, concepts and categories that are part of actualizing visions and mental images of the meaning and ideologies behind light rail mobilities. In the visionary phase, the discourses do not necessarily relate much to the actual local design of the light rail system, but can be characterised more as a universal language of light rail mobilities. The light rail project can be a brand for the city, it can structure urban development, and it is the backbone of the public transport network. All examples of the discursive production of light rail mobilities are present in all cases analysed. As we compare the findings of the material and spatial layout of the four light rail projects, it is evident that the light rail vision has materialised differently in each context, and as a result, the arguments for implementing light rail vary from city to city. This means that local contextual differences have guided the 'translation' ((Callon, 1986) see also chapter 3) from vision to plan and the actual implementation and design of the system. These different contextual translations of the light rail vision can be termed as 'the concept' behind the project as has also been argued elsewhere (Olesen, 2012). The concept is the main ideas behind the layout and marketing of a given project. The case analysis showed that the central idea and concept behind the four cases analysed has some important differences to consider (see also figure 12). The idea and objectives behind the project is central to the definition of the material and spatial design of the system. As found in chapter 6, in both Bern and Angers the social balance of the urban districts connected by the light rail has been a central concern in the concept and design of the system, and it has been a central objective to integrate the light rail directly in the urban areas and not on tracks segregated from urban space. The aim has been to use the light rail as a tool to upgrade deprived urban areas and to make these areas visually equal by introducing different design initiatives in the light rail corridor. In Angers the APS system and the consistent redesign of the entire corridor made the district connected

DISCOURSES SUPPORTING LIGHT RAIL	THE LIGHT RAIL AS A SYMBOL OF:
Liveable and future-oriented city discourse	• Modernity • Quality of life—facilitating a new style of urban living • Regaining public space • Behavioural change providing a real alternative to automobility • Regeneration of urban areas • Urban transformation • Urban competitiveness—transformation from mid-sized to 'major' city vision • Political will and leadership—'the fathers, mothers, sisters and brothers of the light rail'
Urban design discourse	• Creating new urban spaces • Facade to facade renovation • A new mobility design and practice in favour of softer modes
Urban competitiveness discourse	• Image and identity mediated through the light rail project • Mediating the local culture • Renewing the city image • The light rail as an emblem of modernity • Culture and experience (new cultures for urban mobility, city life and urban living)
Social inclusion discourse	• Accessibility for all • A collective and engaging mode of transport • Connecting and renewing socially diverse districts
Accessibility discourse	• Struggle for space in the cities • Public transport structures future urban development, Transit oriented development • Restricting car use in the cities
Urban development discourse	• Metaphorically framing of the light rail as 'the backbone' in urban development and the public transport network. • Transit-oriented development • Quality in public transport—attractiveness • Economic vitality—attracting business • Shows investment in public transport
Economic discourse	• Attractive and affordable public transport for smaller cities • Cities as engines for economic development—indirect economic effects of urban development

DISCOURSES SUPPORTING LIGHT RAIL	THE LIGHT RAIL AS A SYMBOL OF:
Technology discourse	• Citizens preferences for rail transport • The indirect effects of rail (economic development in corridor, symbolic value) • More than a transport system (consumption of transport forging personal identity) • Cultural perceptions of public transport systems
Environmental discourse	• The beginning of the environmental movement in the 1970s - the light rail as a symbol of a 'green urban mode' • Reduce CO_2 emissions, and other damaging particles • Urban environment - city life • Reduce car-usage • Reinvest in public transport

Figure 11: General discourses around light rail mobilities

DISCOURSES OPPOSING LIGHT RAIL	THE LIGHT RAIL AS A SYMBOL OF:
Economic discourse	• Not cost effective (high construction and operation costs) • More expensive than similar systems • Likely to cause restrictions for car accessibility to the city centre • Not a reason for upgrading the public transport infrastructure, capacity problems should be.
Accessibility discourse	• In opposition towards the principle of restricting car use in city centres • Lacking in flexibility of the light rail system, busses as more flexible and cost efficient
Choice of technology	• Just one of many other relevant transport technologies. Other solutions are more efficient and the most cost - efficient transport solution should be chosen.

CASE	THE LOCAL CONCEPT	INITIATIVES
Bergen, Norway	Life in the 'collective city' - the suburban connection Local image: 'Best in the world' Urban development and city branding Urban and suburban combination	• An urban alignment that has higher frequency of stops towards the city centre. In the suburban parts, the light rail is, to a higher degree, segregated from the city. • Densification around stops (Transit Oriented Development) • Higher travel speeds on suburban parts—with the vision of connecting the airport with the city centre in the longer term. • Iconic character—Image—materiality designed to reflect the local identity (but to a lesser degree than in the case of Angers)
Angers, France	Urban design - redevelopment Local image: 'Mission Tramway' An aesthetically beautiful urban network Image, branding and urban design A socially inclusive network	• New urban design in corridor (Wall to wall redevelopment). • An urban alignment with frequent stops, integrated with the city in all parts of the alignment. • 'Shared space'—creating of new public spaces. Transit space as public space • Iconic character—Image—the materiality is designed to reflect the local identity.
Bern West, Switzerland	Urban regeneration and Multi-modality Local image: From Haupt Stadt to Tram Stadt—integration of regional and local transport Regeneration of a deprived housing area Integrating mobility and urban development	• Facade to facade renovation in Bern West—upgrading a deprived district—creating a new mental and physical link • Construction of a shopping mall as urban attractor in Bern West (the final destination for the new light rail line). • The light rail as a tool in urban development, need to upgrade public transport when new urban areas are built. • Ticketing systems— high frequency of service supports the attractiveness of public transport
Freiburg, Germany	Multi-modality - reduce individual motorised transport Local image: The green city—multi-modality The city of short distances	• Transport hubs—connecting modes • Car-free living districts centred around the light rail line • Pedestrian zones—restrictive policies for car traffic • Ticketing systems—high frequency of service supports the attractiveness of public transport

Figure 12: Different conceptual approaches to light rail mobilities

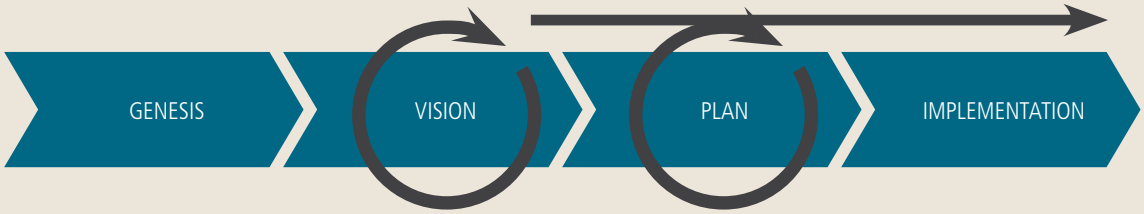
by the light rail alignment visually equal. Thus is creating a possibility of integrating the transport function of the system with design considerations and thus converting transit space into urban space. Contrary to these main aesthetic considerations, travel times were not central in the conceptual approach, and lower speeds were a trade-off necessary to fulfil the design concept and the vision of a central urban alignment. In Angers a large part of the budget was allocated to street renewals and aesthetic design elements, which were an important part of the concept. In Freiburg there has not been the same attention to these aesthetic elements in the concept and this suggests some important conceptual differences of the systems and the way that the system integrates with the urban environment. In Freiburg multi-modality has been a key idea guiding the light rail concept and many supplemental initiatives have been taken to secure the priority of sustainable transport modes in the city centre. The material design and aesthetic expression of the system has not been given the same attention in Freiburg, as has been the case in Angers. Thus, vehicles and stations are standard solutions more than being an integrated design element in the corridor. Access to the most central urban areas has, however, been a guiding principle for both the existing network and new extensions.

Figure 12 summarises the most central ideas behind each of the four cases analysed, as well as the conceptual, material and spatial initiatives taken in support of each local light rail concept. Each concept represents the local, material and spatial translation of the light rail vision and provides different perspectives of the role that a light rail system has played in its respective local context. The concept behind each system is thus important to understanding the implications that the light rail system has had on factors such as travel speeds, passenger levels, urban development effects, city branding, economic impact, and social impact. Seen from a future planning perspective, the conceptual approach should be a central element in the decision-making process in order to explain the important trade-offs that can be connected to each conceptual approach depending on the specific objectives behind the project.

7.5 THE PROCESS OF MAKING LIGHT RAIL MOBILITIES

Political leadership proved to be an important factor behind the light rail project in all cases analysed. This has been especially evident, because the projects have been considered as more than transport projects, and have, to a large extent, been guided by a spatial vision of the light rail as a driver in future urban development. In each case analysed, the process of implementing light rail mobilities has been very different and obstacles have occurred in different phases of the projects. The results from each case are evaluated on the basis of figure 1 introduced in chapter 1, which represents the different stages in the implementation of the project. Figure 13 (repetition of figure 1) illustrates the different implementation processes from each case and comments on the different factors that have influenced the decision-making process.

BERGEN



ANGERS

Figure 13: Illustrates the different implementation processes from each case and comments on the different factors that have influenced the decision-making process

BERGEN

Since Bergen was the pioneering city of light rail in Norway, the initial project was politically controversial and the rail-borne urban transit vision was introduced in many different versions represented by different technologies and alignments. The light rail vision was initially rooted in the environmental discourse, when it was introduced by the environmental movement in 1989. It was, however, not politically accepted until 2006, when responsibility for urban transit was transferred from the regional authorities to municipalities. As a result of this organisational shift, the light rail project was translated into an urban development project anchored in the municipal light rail office. Until this urban vision was politically accepted, there were several obstacles in the political process. The initial light rail vision was not politically initiated; it was introduced by an interest organisation (the Environmental Union), and thus the project from the beginning was lacking political leadership. There were many controversies and conflicting opinions in the discussion of the possibility to implement a light rail. Debate even took place across parties. These debates were deeply rooted in different practices in national/regional and local organisations such as the Highway Department and the urban planning office in the Municipality, which did not share the same vision of the role of public transport. This created two main alliances in the decision-making process with competing rationales based in the economic discourse and the perception of the value created by such a project. More specifically, there was one alliance considering the system in a conventional socio-economic perspective 'getting the most transport for the money' and the other alliance which considered the light rail as a urban development project and put a great deal of emphasis on the indirect values of such a system, such as the economic development of the city, city branding, aesthetics, life quality. The political environment also shifted during the process and as a result, many different political actors were involved in carrying the project out which made it a challenging task to communicate one clear vision.

ANGERS

The light rail project in Angers, contrary to that of Bergen be characterised as having a very linear implementation process. The main reason for this linear process was the political leadership of the mayor Jean-Claude Antonini who was in charge of the project from its beginning until the day that the light rail took its first trip through Angers. The project was placed directly in the mayor's department and was given high political priority as well as administrative priority via the establishment of the planning group 'Mission Tramway,' which was entrusted with all practical aspects of the system. The outcome of this organisational structure was a very clear storyline from vision, to plan, to implementation. The urban design and redevelopment concept has been consistent during all phases of the project and is traceable in all material and spatial aspects of the project. Controversial political decisions regarding design (closure of the central city square for car-traffic, allocating funds for communication, expensive design choices such as the Confluence bridge and the APS system) were supported politically and handled from the top of the political system. It is also important to note that Angers was not a pioneer city to implement a light rail project and therefore funding schemes and challenges regarding operation and implementation were already solved. The light rail had thus been a part of a national urban and transport planning practice for a longer period than it had been in Bergen.

BERN

FREIBURG

Figure 13 (continued): Illustrates the different implementation processes from each case and comments on the different factors that have influenced the decision-making process

BERN

The light rail extension to Bern West was guided by a strong political vision of developing the city to the west largely because the trolley busses that operated in this area were at capacity limit. This meant that the vision and the plans behind the project were clear. The main setback was a referendum by the residents of Bern West, which rejected the plans. The direct democracy in Switzerland makes it particularly important to convince the voters of the rational behind larger urban planning projects and the first project proposal was unsuccessful in this regard. As was the case in Bergen, one of the main obstacles was its purported obstacles to car traffic. Additionally, it could also be questioned if the communication about the project was clear enough for the residents affected by the potential changes. The rejection of the first proposal caused changes to the line's alignment, where the service to some major new urban developments were dropped and the project was made less expensive. Compared to the process in the two previous cases, Bern is a case in which the light rail usage is deeply rooted, both politically and culturally, and it is part of the focus that has been on upgrading public transport in both regional and urban contexts within a national Swiss context. This made the project uncontroversial in its vision and planning stages. Important lessons learnt from Bern are that ownership of the project should be secured amongst the residents even before the project is put into operation. One of the objectives in Bern West was to use the light rail as a regeneration tool in deprived urban areas which makes it even more important to communicate these major social and physical changes to the residents that it will affect.

FREIBURG

As it was in Angers, Freiburg is a case of a clear light rail vision that was present in all phases of the process. The environmental discourse has dominated transport and urban planning for decades in Freiburg, and this created a very clear concept for the light rail project that clearly materialised in planning practice, financing structures, the urban environment and the layout of the light rail network. The light rail project was an integrated part of the vision of creating a city of short distances and pedestrianizing the city centre, as well as promoting sustainable transport modes as part of the 'green city image'. As in Bern and Angers, the light rail vision was guided by strong political leadership and this has made it project without much opposition. This is an important contextual factor that can explain the strong dedication of the light rail vision and the successful outcome with regard to modal shifts and the effect on urban development.

7.6 EPILOGUE

This chapter introduced some of the major findings across the case analyses in relation to the discursive-institutional and material-spatial dimensions of the four light rail projects analysed in chapter 6. The case comparison showed that the political and cultural production and argumentation for light rail projects proves to be rooted in many of the same general discourses in all four of the cases analysed, creating a visionary language of light rail mobilities. This finding regarding the discursive framings and rationalities behind light rail projects will be further elaborated upon in article 1, chapter 8, which analyses how different framings of light rail mobilities are enacted in different urban contexts. Furthermore, the analysis showed that different conceptual approaches have guided the material and spatial translation of the light rail vision in the four cases. This argument is further developed in article 2, chapter 9. Different contextual factors have influenced the conceptual approach of each light rail project, including urban form, historical background, design approaches, legislation, choice of alignment and local policies. The conceptual approach chosen in each case has implications for the performance of the systems, and it shows that access to central urban areas has, in many of the cases, been chosen over faster travel speeds. Light rail can indeed be categorised as a strategic urban development and regeneration of urban space in the four cases analysed. In this chapter, it was further argued that an understanding of the conceptual approach proves to be important for extracting experiences for comparison of future light rail projects. Potential impacts should be evaluated based on previous experiences with similar concepts. The findings regarding the different material and spatial conceptual approaches to light rail mobilities are elaborated upon in article 2, chapter 9. Finally, the cross-case analysis proved that political leadership is of great importance for securing a linear implementation process and securing a clear storyline and conceptual approach through all phases of the project. As in any other strategic urban project, the objectives need to be clearly communicated in order to secure political and public support of the project and in order to create a project that is supplemented by supportive policy measures to enhance the possibility for reaching objectives. The success of the light rail project is deeply dependent upon supportive measures, such as design strategies for the corridor, restrictive policies for car traffic, densification strategies, and high priority and usability of the public transport network in regard to ticketing systems and integrated and frequent timetables. Therefore, light rail should not be perceived as a 'magic stick' to urban problems. Its potential strategic qualities should be enacted through an integrated planning approach focusing on the interfaces light rail has on the overall strategy for urban development.

PART 2

PAPER 1

FRAMING LIGHT RAIL PROJECTS –
CASE STUDIES FROM BERGEN, ANGERS AND BERN

This article provides insight into the political, discursive and material production of light rail mobilities in a European context. It identifies the planning rationales behind the systems and the policies that have been supportive of this light rail vision. Finally, the article identifies the practical challenges and potentials that have been connected to the different local frames of light rail mobility that can be used in future planning practices. In relation to the analytical framework provided in chapter two, this article corresponds to an analysis of the discursive and institutional dimension. The article has been accepted for publication in the journal: Case Studies on Transport Policies.

8

FRAMING LIGHT RAIL PROJECTS

– CASE STUDIES FROM BERGEN, ANGERS AND BERN

Mette Olesen
Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark.

ABSTRACT

In Europe, there has been a strong political will to implement light rail. This article contributes to the knowledge concerning policies around light rail by analysing how local actors frame light rail projects and which rationalities and arguments are present in this decision-making process. The article draws on the socio-technical approach to mobilities studies in order to reassemble the decision-making process in three European cases: Bergen, Angers, and Bern. This article provides insights into the political, discursive and material production of light rail mobilities in a European context. It identifies the planning rationales behind the systems and the policies that have been supportive of this light rail vision. Finally, the article identifies the practical challenges and potentials that have been connected to the different local frames of light rail mobility which can be used in future planning practices.

Keywords: light rail, decision making, transport policy, framing mobility, public transport

1. INTRODUCTION

Since the 1960s, transport policies in many European cities have supported automobile-oriented developments. However, the discourse of sustainable mobility has led to new policies for managing mobility in cities (Banister, 2008; Hajer & Kesselring, 1999). The trend of constructing new light rail systems (1) in medium-sized cities in Western Europe has become progressively stronger since the first modern light rail system was opened in Nantes, France, in 1985 – also called the 'tram revival' (Groneck, 2003; Bottoms, 2003). The sustainable mobility discourse has been fostered by the need to deal with increasing travel demands, struggle for space and liveability in the cities, growing CO_2 emissions from the transport sector, and the need to enhance mobility (European Commission, 2007). European cities have continually cited the flexibility of light rail systems in being able to meet a diverse set of goals despite the fact that light rail systems are a more expensive solution for smaller cities than prioritised bus systems such as bus rapid transit (BRT) (Deng & Nelson, 2011; Hodgson, Potter, Warren, & Gillingwater, 2013). There are strong discourses linked to the light rail vision which has been institutionalised in many national contexts; discourses such as 'the struggle for space', 'the backbone of the public transport network', 'the image of the city', etc. (Olesen, 2012). Light rail is therefore also often discussed as a potential tool to upgrade the public transport system in order to mitigate congestion and restructure mobility around urban centres (Mills, 2001), and it is seen as a strategic tool to support urban development (Cervero, 1984; Pagliara & Papa, 2011; Hass-Klau, Crampton, & Benjari, 2004). Furthermore, light rail can be implemented at a lower cost than metro systems. Therefore, especially in many medium-sized European cities, there has been an increased political interest in the possibility of implementing light rail (Bottoms, 2003; Mackett & Sutcliffe, 2003).

(1) Light rail is a hybrid between a bus and a train. Not only does light rail have a lighter vehicle design than metro and heavy rail, it also has a lighter infrastructure that allows the system to penetrate the city centres without such heavy investments as is the case with e.g. metro. Europe is the densest light rail continent with 170 systems in operation and nearly 100 more in construction or planning (UITP, n.d.).

In practice, light rail has strong political support and carries a branding value for cities. A previous study by Bruijn & Veeneman (2009) concluded that BRT systems lack the mythical 'allure' often linked to light rail systems which can help mobilise various actants in the support of the process. This is the bus rapid transit versus light rail systems debate concerning the choice of 'the right' technology (see also Wirasinghe, et al., 2013; Wright, 2005; Weinstock, Hook, Replogle, & Cruz, 2011). Vuchic (2000) and Hensher (2006) also pointed out that the differences considered in decision-making processes and the choice between light rail systems and bus rapid transit is not only in technology but also in the type of service, its image, and impact. The choice of whether and how to realise light rail systems can be seen as a multi-actant decision-making process (Bruijn & Veeneman, 2009) which requires the involvement of a wide range of experts and stakeholders that might have very different perspectives and rationales on the decision to implement light rail systems. Transport policies are crucial in regard to meeting objectives, especially policies restricting car access, and previous research shows that a lack of these policies will impact on the performance of the light rail (Mackett & Sutcliffe, 2003; Denant-Boeá & Mills, 1999; Babalik-Sutcliffe, 2002). As has been argued by Bruijn & Veeneman (2009), decision-making processes for light rail involve great technical and social complexity. However, there seems to be a lack of practical knowledge concerning this social complexity in various local contexts and the process of integrating the political vision for light rail into existing and new urban policies. Case studies of concrete examples of the decision-making process are, thus, valuable in filling this gap. As Bruijn & Veeneman (2009) argue similar strategies for light rail are not necessarily equally effective in different local contexts; the effectiveness of strategies is dependent on the context in which they are applied.

The performance of light rail systems is often evaluated in regards to patronage, cost effectiveness, travel time, and modal shifts, etc. (see, among others, Litman, 2012; Babalik-Sutcliffe, 2002). However, not much attention has been given to the rational basis behind the systems, asking the why questions of mobility (Cresswell, 2006), such as the reasons why the light rail is chosen and the rationales behind these decisions and the effects that these frames for light rail mobility have had. This is, however, important in the understanding of the rationales behind light rail mobilities and the challenges that these systems were set to solve. This article will, through a case study of three European light rail systems, Bergen, Angers and Bern, examine how practices around light rail translates differently in local contexts and how this makes the various light rail projects different and similar in regards to the policies, frame, and objectives around these projects. This article is structured as follows. Firstly, the conceptual approach to exploring the different frames of light rail mobility is presented. Secondly, the methodological approach is presented and a short overview of the three cases is provided. Thirdly, examples from the decision-making processes for each of the three cases are analysed, and the main elements in this process are identified. In the conclusion, this article identifies the main rationales in the three cases along with the challenges and potentials that have been connected to the implementation of the local frames of light rail mobility.

2. CONCEPTUAL APPROACH

As previously argued by Richardson, Isaksson, & Gullberg (2010), frames of mobility 'can be understood analytically as a coming together of a particular language of mobility, grounded in an underlying logic, or rationality, and applied in a certain context. The frame contains a problem to be solved, a course of action to be followed, a more or less reasoned justification for this, and a consideration of the consequences of doing so.' (p. 55) However, not only language, but also semiotics plays a role in socio-technical construction processes (Law, 1999). This article is founded in the socio-technical approach to mobilities studies which emphasises how transport systems are part of enacting certain realities of urban life, acknowledging that both human and non-human actants play a role in the socio-technical constellation of transport projects (see among others Farias & Bender, 2010; Vannini, Lucy, Jensen, Fisker, & Jirón, 2012; Jensen, 2013). Human actants, such as politicians, planners, engineers, transport operators, etc. as well as the non-human actants such as the

light rail, urban development projects, maps, policy documents, etc. are part of enacting certain frames of light rail mobility. The light rail is, in itself, a very important actant in the decision-making process since the technology is associated with certain political visions and planning decisions that are performed during the decision-making process. The tracks signal stability for developers and users and are, thus, indicators of a long-term public transport system. Furthermore, rail born transportation enacts a different political vision than do bus systems: this light rail vision is often articulated by its image, urban development potentials, and political support, as will be exemplified by the cases (see also Olesen, 2012).

The analysis of frames behind light rail projects furthermore draws on the concept of 'travelling ideas' introduced by Tait & Jensen (2007). Travelling ideas explain how certain planning ideas, such as light rail mobility, circulate between different contexts and translates into new spatial settings and as a means to re-envisioning the city. These planning ideas propagate particular visions of space and place, and experiences from similar projects in other parts of the world or alternatives that have proved problematic or successful elsewhere is often of great importance (Hughes, 1998). The local translations (Latour, 2002) of light rail mobilities are dependent on the actants involved in the process of producing a local frame for the light rail vision and the particular objectives that the light rail vision was set to solve. The cases will exemplify how ideas of light rail mobilities are translated and framed in three practical case examples (Callon, 1986).

3. METHODOLOGICAL APPROACH

The constellation of humans and non-humans enrolled in the framing of LRT systems in a European context was retraced through a case study design. The case study methodology enables a study of the decision-making process and framing of light rail mobility in its concrete practical context (Yin, 2009) and, as argued by Flyvbjerg (2006), the know-how from practical case examples has a great value, especially in the study of policy processes that are context dependent. The research questions leading this study are: Why and how are light rail implemented in European cities? What is the rational basis for this choice of transport system? Two of the cases are examples of cities which have introduced completely new light rail systems; this is the case in Bergen, where the light rail was implemented in 2010, and Angers, which implemented it in 2011. Bergen is an extreme case (Flyvbjerg, 1996) of the role that LRT has had in pushing for a change of local and national policies to support a LRT vision, since Bergen is the first LRT in a Norwegian context and the main rationale has been to structure urban development. Angers is not an extreme case in regards of changing local and national policies; it is rather an extreme case (Flyvbjerg, 1996) on the urban redesign vision associated with LRT in a French context. It is furthermore a paradigmatic case of transformation of urban space in the light rail corridor which was the major rationale behind the project. The city of Bern is an extension of an existing tram system: the line to Bern West opened in 2010 and is the first new light rail extension of the old tram network. Switzerland is often mentioned as a paradigmatic case on policies dedicated to public transport (Kaufmann, 2004). The Bern case will exemplify the policies that led a strong focus on public transport policies in urban contexts, and the rationality of urban regeneration which was an important argument behind the light rail project to Bern West. The selection of cases was made to show maximum variety in different national contexts and rationalities behind the decision to implement light rail. A further criterion was that the light rail network, or extensions, should be recently implemented in order to trace the decision-making process.

Empirical data was collected through explorative semi-structured interviews with key actants involved in the decision-making process as well as a review of the relevant policy documents produced as part of, or a supplement to, the light rail project. Furthermore, the public debate around the projects has been reviewed by the use of local media as well as previous research studies from the three cases. Altogether 13 interviews have been carried out in the three cases with politicians, planners and transport operators and researchers – a list of the persons interviewed and their role in the light rail project is provided at the end of this article. The aim of the methodological design has been to pin-point the

key moments and the actors and rationalities and decisions enacted throughout the decision-making process. Through the analysis of policy documents and interviews, the main arguments behind the chosen frame of the project have been identified. In the following section, the three cases are introduced and analysed – a synthesis of the findings across the cases is provided in the conclusion. In order to validate the findings a timeline with the key moments and actors was sent to a reference in each case who confirmed the findings. In the following sections the local frames of light rail mobilities are analysed.

4. LOCAL FRAMES OF LIGHT RAIL MOBILITIES

4.1 Bergen Light Rail, Norway

Figure 1: Picture of Bergen Light Rail at the stop 'Byparken' in Bergen city centre. The visual orange identity for Bergen Light Rail was created by a Danish architectural company, 'Kontrapunkt', who were the creative advisor for the project. The light rail materiel, stops and corridors design is a key actant in enacting the light rail as an urban project (photo by author).

Bergen is the second largest city in Norway and has approximately 250,000 inhabitants (Bergen Light Rail, 2013). Bergen was the first city to introduce a completely new network in June 2010 with the opening of the first line, which is a stretch of 9.8 km with 15 stops. Since the last tram was abolished and dumped in the fjord in Bergen in 1965, the need for the establishment of a new urban rail born transportation has been problematised politically and publicly, and many different alternative public transport solutions have been presented (Vollset, 2007). In the 1970s and 1980s, increasing automobility started to cause problems in the city: congested roads, lack of accessibility, environmental hazards, and time delays were some of the challenges (Vollset, 2007). For the Environmental movement in Bergen these problems raised the discussion of 'the liveable city': How should the city develop in the future, and how should space be prioritised (Research Interview, Håkon Rasmussen)? To deal with the lack of space in the city the urban strategy 'Gatebruksplanen' was introduced in Bergen in 1981. The aim was to argue that car-oriented planning had ignored public transport, cyclists

and pedestrians and there was a need to change this focus. In 1989 the Environmental Union in Bergen posed the idea of re-establishing a rail born solution in Bergen. The rationale behind the light rail idea was based on the environmental discourse that was particularly strong in Bergen, where an important meeting in the Brundtland Commission was held in Bergen concurrent with the launch of the light rail idea. The light rail idea was represented by the report 'Bybanehøringen 89', where ideas and experience from light rail projects in both Europe and the USA was introduced as a possible solution for Bergen. The international experiences were important actants in the interests of the project as practical experiences and alliances for the light rail solution. As a reference point, the first reintroduction of modern trams in Europe had happened in Nantes in 1985 (Groneck, 2003), and this had a great influence on the tram renaissance in Europe, where the tram vision was seen as a material concept that could solve the problems faced in Bergen. The arguments introduced in 'Bybanehøringen' was based on international experience and showed that a light rail solution would be cheaper than a suburban train or a metro and the choice of light rail would result in environmental benefits as well as a more regular and reliable transport system that was not affected by car traffic. Furthermore, the light rail would save space in the city. The main rationale behind this report was to show that the solution to the problems was not to build more roads but to look for more efficient collective alternatives by making it harder to use the car in the city (Vollset, 2007). The report, and its timing, was a major actant in putting the light rail back on the political agenda in Bergen. This was, however, not the only initiative that was made which placed the idea of a light rail on the political agenda. The American researcher and

PROJECT OVERVIEW (FIRST LINE - BYPARKEN - NESTTUN)

OPENING : June 2010

LENGTH: 9,5 km

STOPS : 15

AVERAGE SPEED: 28 km/h

TRAVELTIME: 21 Minutes

PUBLIC TRANSPORT SHARE: 18% (2012)

FREQUENCY: Every 5 minutes during peak hours

PASSENGER LEVELS: Estimate 26,000 pas. /day (actual 2013 is 31.000 pas/day)

PRICE: Around 270 mio. euro (2007 prices) 27 mio euro/km

MAJOR DESTINATIONS:

Paradis: 100 homes + offices and retail space. **Fantoft:** renewal of student housing from the 1970s + 77 new homes. **Wergeland:** redevelopment 400 new homes + 14,000 m2 offices and 8.500 m2 retail space. **Bystasjonen:** new housing and offices. **Kronstad:** Educational facilities 4.400 students and 570 employees. **Nygård:** 17,000 m2 retail space + businesses. **Florida:** the largest construction site to be developed until 2020 branded as 'the good life in the city'. **Danmarksplass:** new hospital 11,000 m2 + 3,500 new workplaces (50,000m2) + retail space. **Nesttun:** new cultural centre with smaller shops + 450 new homes under the concept of 'Plus Living', with services, community activities, and safety systems. Nesttunhagen: a project with 19 new homes.

Figure 2: Overview of characteristics of the Bergen Light Rail project

expert Vukan R. Vuchic was invited to Bergen twice to give lectures on public transport and urban development. His main message was that cities cannot stick to the solution of building more roads to solve problems since increased capacity leads to increased traffic. Therefore, cities have to prioritise public transportation in order to grow. The points presented from Europe and the USA as well as the research presented by Vuchic proved to be important and powerful actants in enrolling and mobilising support for a potential light rail solution in Bergen. It was not only at the local level where ideas of alternative solutions to road traffic were debated.

The idea of introducing light rail in Bergen caused another problem concerning the economic profitability of such a solution (Hartmann, Lampe, Monsen, & Prestmo, 2006). The debate concerned issues of how to value transportation, and getting the most mobility for the available finances. The debate also concerned whether or not the light rail was the best solution to fit the needs and problems of the city and whether it provided value for money from a socio-economic perspective (Hartmann, 2006). The road directorate and the right wing party 'Fremskridtspartiet' were especially involved in this debate and, hence, became dominant actants that managed to mobilise public and political support against the light rail project. The main opposition against the decision to build a light rail was that the stated proposal for the financing of the light rail project was made by the proponents of the light rail, which involved revenue collected through road tolls being transferred to a public transport project (Research Interview, Thomas Potter). This coalition of actors argued that congestion should be solved by building a new road infrastructure, and they realised this vision with the idea of the Ulrikstunnel, a tunnel that bypassed the city. The original intention behind the road toll in Bergen was to finance a new road infrastructure and it was thus controversial when proponents of the light rail project in the 1990s suggested that some of these funds should be allocated to public transport. It was, though, a necessity to secure financing of the light rail project locally since the state was reluctant to support the light rail idea financially.

Financing for the light rail project was secured by a political agreement in 2000 called 'Bergens Programmet'; an investment package for road and light rail in Bergen from 2002-2025 where 12.7 billion N.kr is to be invested (Statens Vegvesen, Bergen Kommune, and Hordaland Fylkeskommune, 2013). The agreement was a compromise package solution where the new road projects, the light rail, and public transport as well as pedestrian and bicycle initiatives were prioritised. Different political prioritisations of road and public transport were mobilised through the process, and therefore, the finance package ended up as a compromise between public transport and road infrastructure, which exemplifies the competing rationales in the decision-making process.

After a long period where the public transport network in the city had been de-emphasised by the region that was responsible for public transport, the need for a strengthening of the public transport network in the city became a problem. In 2001, the responsibility for public transport in the city was handed over from the region to the municipality for a trial period of four years. In this period, the 'light rail office' was established under the chief of planning in the municipality and was important in the enactment of the light rail as an urban project rather than a fast alternative to the car – this light rail office became a representative for the municipality in the process and framed the light rail project as an urban project (Research Interview, Thomas Potter). Under the leadership of the municipal light rail office the light rail project was framed as an 'urban project' integrated with plans for urban development and densification in the light rail corridor. The municipal rationale behind the light rail was that it should have an alignment that offered the most accessibility for working residents, and the light rail was metaphorically framed as the 'backbone' in the urban development close to where people lived and worked. Håkon Rasmussen, a municipal planner, described how the project fitted with the municipal strategies and how the light rail project has worked as a generator for urban life along the corridor and a tool in the municipal densification strategy (Bergen Kommune, 2008): '(…) there is a strong strategy for densification in

the municipal plan since the city, over so many years, has spread out so now there is a wish to get the city back to the central corridors (…) The urban development effects show that there are many projects that are concentrated around the stops and there has been a change in attitude; people want to live close by (the stops).' (Research Interview, Håkon Rasmussen) Inspiration from international reference cases has been important in the debate and rationalities behind the frame for the Bergen light rail: 'We usually say that we have tried to reach German precision and French design, so the contractor (red. of the vehicles) is German, but we have tried to think of design like the French, and we have visited Montpellier many times (…) when we started our project they had some good experiences and had had an incredible success, they have removed the cars from the city (…) it is a very impressive and elegant system (…).' (Research Interview, Håkon Rasmussen).

Bergen light rail has also had a strategic role in creating an image for the city and the region. In the design guide for the project it is stated that: 'The City of Bergen seeks to make the light rail transit system a truly iconic structure and the pride of the city (…) The LRT must be developed and built in a way which clearly communicates its characteristic identity.' (City of Bergen, 2005) Politically the light rail has been perceived as a symbol of the future oriented city and an important landmark and brand for the city. Gunn Vivian Eide, a local politician who has advocated strongly for the implementation of the light rail project and a remodelling of the mobility hierarchy in the city, describes how she perceives the light rail as a catalyst for a new urban lifestyle: 'It is more than transportation (…) being the first city means a great deal.' (Research Interview, Gunn Vivian Eide) As quoted, she articulates a city hierarchy where she finds it natural that the second largest city in Norway is the first to upgrade the public transport network, and then the smaller cities can learn and follow in their footsteps. This touches upon the issue of urban competitiveness and the visionary element of the big city image that the light rail mediates as a material actant in the process.

One of the practical challenges of the light rail project in Bergen has been the lack of political will to restrict car access to the city of Bergen (Research Interview, Håkon Rasmussen) and, hence, the traffic levels and congestion have not changed radically (Nilsen, 2011). It has become attractive for developers to invest in the light rail corridor, and there seems to be a great interest in getting the future stages accepted and financed, with help from state funding, so toll money should not finance the extensions (Research Interview, Marit Warncke). The light rail has reached passenger levels above what was expected. Figures from 2011 show that the light rail has 7 million passengers annually compared to an estimated 6 million (Wiederstrøm, 2012). It could be argued that the corridor has been so attractive that it also shows some potential social downsides. House prices have risen remarkably in the corridor (7% from May 2012 to 2013 (Buanes, 2013)) and a gentrification process is traceable. Many of the new homes and workplaces established in the corridor also have private parking facilities which support car ownership – one of the original rationales behind the reimplementation of the light rail vision in 1989. The light rail has provided more mobility in the public transport system which is positive from a business perspective; however, it has been harder to reduce car traffic by only providing a public transport upgrade and not using restrictive policies for car traffic.

4.2 ANGERS LIGHT RAIL

To understand the frame behind the light rail project in Angers it is necessary to understand the national context and policies which have been crucial in enacting a particular re-design and urban development thinking and rationales behind the French light rail projects. Unlike the case of Bergen, Angers light rail project is part of a wider focus on light rail in France which started in the 1980s, and has continued developing ever since. Angers is a case where the re-design vision for the light rail is taken to an extreme. As has been previously stated the trend of constructing new light rail systems had its genesis in France with the implementation of the largely successful systems in France: Nantes in 1985 and

Grenoble in 1987. As was the case in Bergen most tram systems were abandoned in France during the '50s and '60s also largely influenced by the increasing automobility which demanded space in the cities (Hass-Klau, et al., 2004). After the oil crisis in 1974, the French minister of transport announced a new policy that would encourage medium-sized cities in France to consider light rail as a viable alternative solution promising funding to underline this commitment (Hass-Klau, et al., 2004). Again the environmental discourse dominated the argument of the need to re-invest in public transport. Interest in the rail born solution in France was further supported by state funding which supported public transport projects with dedicated infrastructure – an inducement that made the light rail technology very relevant (Hass-Klau, et al., 2004). Furthermore a local transport tax was created to finance public transport in cities (Priemus & Konings, 2001). This tax was important in creating a solid base for securing dedicated funding for public transport, and in realising light rail projects. The local transport tax, versement transport, was introduced in 1982 and gives the right to regions of 10,000 inhabitants and over to introduce the tax. The transport tax provides a unique possibility for financing public transport infrastructure investments and operating deficits. If a guided right of way system is introduced such as light rail or guided bus then the tax rate can be increased. The stronger environmental priorities of the 1990s furthermore made it compulsory for cities with a population of over 100,000 inhabitants to make Sustainable Urban Mobility plans (PDU - Plan de Déplacements Urbains). The rationale behind the introduction of these plans was to create a strategic urban planning

Figure 3: Picture of Angers Light Rail at the main city square 'Place du Ralliement'. The frame behind Angers Light Rail is the strong re-design vision which is almost taken to an extreme in Angers. The rainbow identity of the vehicles and the redesign of the urban space with green tracks, new bike paths, and newly designed street furniture such as lamp posts and paper bins are all actants which are part of enacting this frame. And many new urban development projects are located in the light rail corridor (photo by author).

tool to reduce private car use and integrate urban development with public transport (Hass-Klau, et al., 2004). Since the political objective behind these mobility plans is to reduce car traffic in the urban centres, the light rail vision is enacted as a materialisation of this political goal.

Angers is the 19th city in France to enrol in the light rail vision (Johansson, 2011) and is the 16th largest city in France with 156,000 inhabitants. The planning process for the light rail project in Angers started in 2001 where the vision and report 'Mission Tramway' was established introducing the light rail vision of Angers with: 'A strong will to reclaim public space by favouring alternative modes and urban development' (Angers Loire Metropole, 2012). The system began operation in June 2011. The first line is a stretch of 12 km, with 25 stops, connecting the city centres in two out of 33 communes: the Métropole ; Angers and Avrillé (Research Interview, Olivier Sorin) (Angers Loire Métropole, 2011). The southern part of the line in Angers has replaced an existing bus line whereas the northern part partly serves a new brown field urban development area. Many new urban development projects are planned in this brown field intended for new modern and attractive housing and the light rail is visually integrated in real estate advertisements as a part of promoting this new style of urban living. The stops are placed at an average of 450 metres apart and connect all the central points of activity in the city including the university, the hospital and the central urban square 'Place du Ralliement', also metaphorically framed as the heart of the city (Research Interview, Olivier Sorin). The integration of the light rail at Place du Ralliement was a physical manifestation of the political will to reclaim public space, and it was a controversial act by the

PROJECT OVERVIEW

OPENING : June 2011

LENGTH: 12 km

STOPS : 25

AVERAGE SPEED: 18 km/h

TRAVELTIME: 37 Minutes

PUBLIC TRANSPORT SHARE: 14 % - constant since 1998

FREQUENCY: Every 6 minutes during peak hours

PASSENGER LEVELS: Estimate 36,000 pas. /day (actual pr. November 2012 is 31,000 pas/day)

PRICE: 300 million euros in 2005 prices – 25 mio euro/km (including street renewals)

MAJOR DESTINATIONS:

Avrillé: redevelopment of downtown and densification along the route (15,000 inhabitants)
Plateau Mayenne: 6.000 new inhabitants + business hub (50.000 m2)- amusement park.
Hauts de saint Aubin: 10,000 inhabitants, swimming pool, school, and kindergarten.
La Roseraie: area with state subsidies for urban renewal, 18,000 inhabitants.
Hospital: 6.000 employees, 3.000 daily visitors
Univiserity: 3.500 students, 1.500 jobs.
Train Station: 11.000 daily travellers, new business district Gare + (60.000 m2 services businesses and 200-250 new homes

Figure 4: Overview of characteristics of the Angers Light Rail project

mayor Jean-Claude Antonini because opponents argued that it would affect access for cars to this central commercial area in the city which caused a vigorous political and public debate in 2007. The alignment with frequent stops and average travel speeds at 18 km/hour underlines the frame for the light rail where the main objective has been to access

the central urban areas and redevelop urban space in the corridor.
In line with the national strategies the Mobility Plan for the Angers–Loire Métropole (the PDU) was launched in 2005. With the PDU, an integrated and holistic approach to mobility in the Angers area was introduced. One of the objectives in the plan was the upgrade of the public transport network by introducing a light rail as the new 'backbone' of the urban public transport system (Angers Loire Métropole, 2005). However, the light rail was also based on rationales that involved more than a means to create efficient transport from A to B. The light rail project was described by the Métropole as a manifestation of the strong will to reclaim public space: 'When a French city decides to build a new tramline, they not only build a tramline they also remodel all the quarters around the tram between the buildings (…)' (Research Interview, Olivier Sorin). The strong focus on design and aesthetics made the project in Angers very costly; the price was around 300 million euros at 2005 prices (Research Interview, Pierre Luc). Included in this price was the advanced technology that enabled the tram to go through the 'Place du Ralliement' the most sensitive architectural urban space in the heart of the city. The technology is called APS and was developed by the French company Alstom. The APS system affords access by the light rail without overhead wires in sensitive architectural environments. The power supply is provided via a third line positioned centrally between the tracks, an expensive solution but an important material actant in the re-design frame for the project. Furthermore, a new bridge was built crossing the river Confluence and connecting Angers with the city of Avrillé. Technically, this bridge could have been realised for the sum of 10 million euros, but the politicians decided for a more aesthetic solution that doubled the price of the bridge but created a landmark which worked as an important material actant in the realisation of the city re-design vision (Research Interview, Oliver Sorin). Finally the re-design frame for Angers was realised through the choice to construct 70% of the tracks as green tracks with grass (Research Interview, Pierre Luc). The green tracks mediate the vision of an aesthetically beautiful system but it also has references to Angers local history: 'The city is famous for agriculture and flowers and so the representatives wanted a tramline that represented this identity.' (Research Interview, Pierre Luc)

There are no two light rail designs alike in France; every city has its own identity and local material and discursive translation of the light rail vision. Each light rail system has its own colour and, in general, there is a strong emphasis on the material design and the enactment of the re-design frame. The strong focus on redesigning space and facilitating urban development in Angers is very visual in the way that the light rail appears in the corridors. The Angers frame is what can be called a façade-to-façade renovation where both the space and the mobility hierarchy in the corridor have been redesigned with new bike lanes and park & ride facilities which should feed the light rail. Besides the aesthetic design of the light rail system Angers is also well known for the public consultation process where there has been a strong emphasis on communicating the light rail vision. Other light rail cities visit Angers both to visualise the effect that the light rail design has had in the corridor and to learn from their experience with the public consultation processes (Research Interview, Olivier Sorin).

Angers light rail is an important material element in enacting the re-design vision in Angers. New public spaces have been created in the city centre and parking spaces have been placed underground in favour of the light rail and softer modes in the city square 'Place du Ralliement' (see figure 3). Also, the construction of bike lanes has been an obligatory part of the light rail project, so along the new connections made by the light rail new bike corridors have also been constructed. In regards to the reduction of car traffic, the light rail project has not caused changes. In 1998, the modal share for car traffic was 60% and for public transport was 14%. These shares have not changed. The car is still prioritised in the city with plenty of parking facilities and no major problems with congestion (Research Interview, Olivier Sorin). Another challenge, caused by the light rail project, has been the slow average travel speed of the vehicles which today is 18 km/h which is below the travel speed provided by the buses, which is 20 km/h (Research Interview, Pierre Luc). The

low travel speeds are a consequence of the frame, with frequent stops, and the implementation of the line in the most

Figure 5: The light rail to Bern West. The light rail is integrated with the new developments at Brünnen in Bern West and the Shopping and Leisure Centre, Westside, designed by the architect, Daniel Libeskind. Urban re-generation has been a major drive and rationale in the development of the light rail project and the Westside Shopping Centre is an important actant in the frame and story of the project (photo by author).

sensitive urban spaces where many activities, pedestrians, single track on parts of the route, etc., slow down the speed.

4.3 BERN WEST LIGHT RAIL EXTENSION

To understand the frame behind the light rail project in Bern it is necessary to understand the national context and policies which have been crucial in enacting a particular public transport culture and planning practice that is often framed as best practice example. The 'Swiss model' is often referred to as a paradigmatic case of public transport due to the high modal share of public transport in many Swiss cities and well-known public transport culture (Kaufmann, 2004; VÖV UTP, 2010). The political holistic approach to transport and urban planning is, in many ways, unique in Switzerland with an integrated regional and urban network. In Bern there has been a strategy to minimise car traffic in the urban centres and an important actant in this process has been the implementation of a high standard public transport system. This strategy overcame the problem of the lack of space in the city as a consequence of increasing automobility. Possible solutions to this problem have been mediated through extensions and modernisation of the old tram network by upgrading to a modern light rail system.

Bern is the capital of Switzerland. In the municipality of Bern there are 130,000 inhabitants and the greater Bern area has approximately 350,000 inhabitants (Research Interview, Ueli Müller). The light rail line to Bern West was the first new light rail line since the 1960s-70s when minor adjustments were made to the old tram network (Research Interview, Daniel Schwartz). The old tram system has existed in Bern since the beginning of the 20th century and in the 1960s parts of the system was modified to diesel buses. In the 1970s, the citizens of Bern voted against a referendum (2) that

PROJECT OVERVIEW BERN WEST LIGHT RAIL EXTENSION

OPENING : December 2010

LENGTH: 6.8 km (Total network 24 km)

STOPS : 19 (Bümplitz and Brünnen)

AVERAGE SPEED: 17 km/h

PUBLIC TRANSPORT SHARE: 26%

FREQUENCY: Every 6 minutes from 6.30 - 19.00

PASSENGER LEVELS: 21,000/day (to Brünnen/Westside); 18,000 to Bümpliz

PRICE: 124 million euros in 2006 prices 18 mio. euro/km (including urban renewals).

MAJOR DESTINATIONS:

The new Quartier Brünnen: around 4,000 new inhabitants and 7,000 workplaces, the Leisure and Shopping Centre Westside with 3.5 million visitors annually. Redevelopment of the appartment bloks in Bethlehem.

Figure 6: Overview of characteristics of the Bern West Light Rail project

suggested continuing extensions of the diesel bus system and again the environmental discourse was a strong rationale behind the need for alternative solutions. The referendum was seen as a 'turning point' in mobilising support for a new urban transport system and the beginning of the trolleybus system and modernisation of the tram system. Likewise, softer modes, such as biking and walking, were put on the agenda (Research Interview, Elisabeth Bäshlin). A general plan for urban development in Bern was made in 1995; this was the first time that the city of Bern had a general plan or a general frame for urban development which also addressed issues of integration with public transport for a longer period of time (Research Interview, Daniel Schwartz). Until 1998, the city of Bern had full responsibility for planning and financing urban public transportation. The canton, which is the regional authority, did not commit to financing and subsiding plans for improvements of public transport in the cities which resulted in a lack of resources to develop the urban public transport system (Research Interview, Daniel Schwartz). In 1998, a new law changed this practice and the cantons took over responsibility for planning and financing both regional and urban public transport and a new momentum was created for urban public transport projects. In 2006 there was also an opening to get money to finance the project from the federal level, introduced by a new federal law, the 'Infrastrukturfond'. This was the first time that road infrastructure and public transport were financed by the same budget (VÖV UTP, 2010; Research Interview, Daniel Schwartz). The 'Infrastrukturfond' was a key actant that was part of mobilising both the city and the canton in order to get the project of Bern West light rail project moving, since there was then financing possibilities available to realise the project. In the period after the enactment of the federal law, many developments and improvements of the network happened in Swiss cities with a strong local commitment to upgrade the urban public transport system and to access the national funding available for these projects. In Bern, the light rail was framed as the future for public transport and urban development

(2) In Switzerland there is direct democracy where citizens vote for larger planning decisions.

with a reference to the tram-renaissance that happened around the world, the travelling idea of light rail mobility also reached Switzerland (Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern, 2012).

The light rail line to Bern West is an upgrade of an existing bus line to this part of the city where approximately 35,000 inhabitants live and 15,000 people work. The line was opened in December 2010 and is an extension of 6.8 km (Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern, 2012). The choice of light rail has been caused, partly, by the objective to increase capacity in the system which could no longer be handled sufficiently by the buses but another strong rationale and decision for the frame of Bern West light rail was to support urban development and the regeneration of the western part of the city (Research Interview, Ueli Müller, Rolf Meyer) At the opening of the tramline to Bern West councillor Barbara Egger-Jenzer declared that: 'A tram is not just a tram. A tram means new street environments, successful squares and new urban districts. I think that Bümpliz and Bethlehem have gained in quality of life.' (Egger-Jenzer, 2010) Bern West, or Bümpliz as it is also called, was included in the Bern Municipality in 1916. After this inclusion the area and its residents were still marked by this previous spatial and organisational division and a mental barrier existed towards the rest of Bern (Research Interview, Elisabeth Bäshlin). Physically a highway separates Bern West from Bern and is a very visual and also spatial barrier. In the process of framing the Bern West light rail project the missing link between Bern West and the rest of the city and the previous administrative separation, was problematised. At the opening of the light rail municipal councillor Regula Rytz stated that: 'The light rail to Bern West has brought a rail line and thereby public transport has been implemented, but the internal cohesion of the city and the canton of Bern has also been strengthened. From tomorrow morning with the implementation of the light rail lines 7 and 8 Bern Mobil has overcome the historical rift between Bern and Bern West.' (Rytz, 2010) Due to spatial restrictions caused by the municipal boundaries of surrounding municipalities, the city of Bern has only been able to develop to the west. After the Second World War, Bern experienced a need for an extension of the city due to an increase in the population (Research Interview, Ueli Müller). The problem of the need for space to develop the city resulted in, in the 1960s, many large functionalistic apartment blocks being built in Bern West (among others Bethlehem, Gabelbach, Tschnargut) (Research Interview, Elisabeth Bäshlin, Ueli Müller). These are the areas that are, today, the subject of regeneration through the introduction of the new light rail line.

The Bern West project will extend tram coverage to a part of the city that is due for commercial and residential growth. The area is currently reliant upon buses and trolley buses which are increasingly unable to cope with demand. Brünnen is a new urban development area in Bern West and an important actant in the light rail strategy. There have been plans to develop Brünnen to a new quarter on a green field site with 30,000 inhabitants since the 1960s. In this period, there was political debate concerning urban development and urban sprawl and the need to preserve the nature around the larger cities (Research Interview, Ueli Müller). As a result of this problem the project of the urban development of Brünnen did not take place for about 20-25 years. This means that from the 1960s until the 1990s, there was a political blockade of the development project in Brünnen. After this period, a new project for urban development in Brünnen was discussed and this proposal has gained political acceptance. This project had a smaller scale, 4,000 – 5,000 inhabitants, and an important argument for the realisation of the project was that a light rail line to the new quarter would be implemented along with the new urban development. The incorporation of public transport and urban development was a requirement based on an estimate of the capacity needed for the public transport to this area but it has also been an important planning rationale in the Kanton of Bern that large urban developments should be supported by an attractive public transport system (Research Interview, Rolf Meyer). In this way, the main frame behind the light rail was divided into two arguments: the need to increase capacity, but the light rail was also a very important actant in mobilising support for the revitalisation and urban development in Bern West and the design of new public spaces along with the infrastructure

(Research Interview, Ueli Müller).

The light rail project was put up for referendum in 2004, and the first version of the project was voted down by the public. It was the votes from residents in Bern West that temporarily stopped the project due to the historical tensions between Bern West and the rest of the city. The opposition against the tram to Bern West was led by the politician Thomas Fucks from the conservative SVP party (the Swiss people's party) who managed to mobilise the inhabitants of Bern West to criticise certain aspects of the project: the project was too expensive, it would cause less accessibility for cars, and some parts of the area would lose their bus stop (Research Interview, Mirjam Bütler). This changed parts of the project and adjustments were made to the plans that, in large part, kept the original line layout with minor adjustments and the referendum passed in 2006 (Stadt Bern, 2006; Stadt Bern, 2010). The link between the urban development projects and the need for more capacity in the area was a stronger actant in the mobilisation of support for the project among the population, and the light rail was metaphorically described as the 'backbone' of the transport network and development for housing and businesses in the corridor (Stadt Bern, 2006). Today, the tram is often articulated as a new mental connection in the city: 'I think that the tramway has marked a change (…) not only in the architectural layout and the votes, but also mentally in people. Something like a new start for the whole part of the city.' (Research Interview, Daniel Schwartz) The new mental connection was supported physically since the bus line to Bern West used to be a single radial going from the rail station to Bern West, and with the implementation of the light rail this line was connected with Saali in the south eastern part of the city (Research Interview, Daniel Schwartz).

The light rail to Bern West is framed as an urban project and a generator for redevelopment of the areas through a façade-to-façade approach where the urban spaces in the light rail corridor has been redeveloped (Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern, 2012). Another important material actant in this process has been the Westside Shopping and Leisure Centre which opened in 2008 along with the construction of the tramline. This shopping centre was designed by the famous architect Libeskind and has become a landmark along with the light rail in the area. The shopping centre is the end destination of the light rail line in Bern West, and a new stop for the regional train was also established here as well, as the Centre is placed right above Bern's A1 highway to secure maximum mobility to the new activities in the area. The incorporation of the many modes of mobility with the regional character of Westside is framed under the idea of regional development 'from Tram city to Tram region' (Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern, 2012). The frame of Westside was to create a public space with day and night facilities, a self-enclosed district offering amenities and services. Many modernisations are happening in Bern West and developers have seen the realisation of the light rail plans as an important actant in this process. Also, renovations of apartments are causing rental levels to rise by up to 30% (Research Interview, Elisabeth Bäshlin).

Seen in a critical perspective the light rail in Bern West has created the potential for a re-development of the city and the establishment of new quarters and activities in this part of the city. The light rail has established a new physical and mental link in the city and this has been articulated as one of the most important results of the new light rail extension. The urban spaces in the light rail corridor have been renewed and the rental level on the apartments are rising which, potentially, could create a challenge in regards to gentrification processes which is, to some extent, also traceable in the other two cases. The upgrade of the tram/light rail network has created many new trips, however, the car level has not been reduced accordingly – in this sense, the light rail have not been successful in regards to facilitating modal shifts.

5. CONCLUSION

In this article, the frames behind three European light rail projects were analysed and the major rationalities behind the

light rail projects were identified. Even though each project has a different history, the case studies show that there are many similarities in the rationales behind the choice of light rail in the three cities. The light rail mediates some particular visions of space and places in the cities, and the practical case examples reveals the translation of these visions into the local practices of planning light rail systems. This article confirms the understanding of light rail as a 'travelling idea' (Tait & Jensen, 2007) which is associated with very specific planning ideals.

The use of the light rail as a generator for urban development seems to have had a large influence in all the projects, and the wish to support urban development is a major rationale. In this sense, there seems to be a double rationale present in all projects: upgrading the public transport network and supporting urban development and regeneration. Many metaphors were used to support the urban development rationale in the decision-making process and to create a spatial vision for the light rail frame. In all cases the light rail was framed as the 'backbone' of public transport and urban development. In Angers, the rationale was that the light rail served the 'heart' of the city and the special technology APS enabled the realisation of this vision and created a new urban space in the city centre. In all the cases, the wish to restructure and develop the urban environment has been caused by the problematisation of challenges created by increasing automobility and the struggle for space that all cities faced at the beginning of the 1970s through the 1980s. In this regard, the light rail is a material actant associated with certain planning ideals offering alternatives to the car oriented city, and the values that politicians, planners, interest organisations, etc. have incorporated into this technology have been powerful in order to mobilise support to this solution. A challenge that, especially, Bergen and Angers faced was the lack of political will to reduce car traffic. In both cities, the congestion is almost at the same level as prior to the light rail project, and in this sense, the light rail has not caused any change in itself to the transport hierarchy in the cities. Supportive policies are needed to reach these objectives.

The international experiences brought into the decision-making process have been important spatial references to visualise the spatial effects of light rail projects. The reference cities have been used as practical experiences and alliances for the light rail solution and a way of visualising the potential alternative sustainable mobility futures that is mediated through this transport technology. Based on similar findings across the three cases presented in this article, it is evident that there exist some arguments and reasoning around the light rail vision that have a global character. These arguments gain strength since a big alliance of light rail cities are mobilised in support of this argumentation and this makes the arguments powerful in the local decision-making processes. These are arguments such as redesigning the city, the struggle for space, the backbone of the public transport network and urban development, economical feasibility, the choice of technology, sustainability, and accessibility. These arguments have all been present in the three cases presented in this article. Seen as an actor network the light rail cities form powerful alliances.

Findings across the three cases, furthermore, show that the state plays an important role in the realisation of light rail projects. In all cases, it is evident that a major passage point in the projects and the prerequisite for mobilising support for the project was created when the state was committed through the financing of the projects. The city administration also played an important role in putting urban public transport back on the agenda at the end of the 1980s and the beginning of the 1990s. In Bergen, the project gained strength when the city took over the responsibility for the urban network, and in Bern the same thing happened when the regional authorities (the cantons) committed funding for urban public transport. In France, support for urban public transport infrastructure happened when the state committed funding and introduced the possibility of collecting a local transport tax in order to finance a dedicated public transport infrastructure.

RESEARCH INTERVIEWS:

- Tom Potter, Chief Engineer Bergen Light Rail May 2011
- Håkon Rasmussen, Municipal Planner Bergen May 2011
- Gunn-Vivian Eide, Politician Bergen politician in 'Venstre' – left wing May 2011
- Karl Inge Nymann, SKYSS the public Transport Company, Bergen May 2011
- Magnus Vollset, author of the book 'On Track of the Bergen Light Rail' (translated) May 2011
- Marit Warncke, Head of Bergen Chamber November 2011
- Olivier Sorin, Public Transport Policy Officer, Angers Loire Métropole, Angers November 2012
- Pierre-Luc Papin, Technical Director Keolis Angers, Transport Operator November 2012
- Mathieu Voisin, Consultant at SYSTRA, consulting the French light rail projects, Paris November 2012
- Daniel Schwarz, Regional Planner Kanton Bern November 2011
- Elisabeth Bäschlin, Lecturer in Geography University of Bern November 2011
- Rolf Meyer, Bern Mobil, Public transport company Bern November 2011
- Ueli Müller, Municipal Planner, Bern November 2011

REFERENCES

Angers Loire Métropole. (2005). Pour une agglomération, toujours en mouvement, circulons autrement!

Angers Loire Métropole. (2011). Mon Tramway! Angers.

Angers Loire Metropole. (2012). Slides provided for the Aalborg Commitee, June. Angers.

Babalik-Sutcliffe, E. (2002). Urban rail systems: Analysis of the factors behind success . Transport Reviews Vol. 22 No. 4, 415-447.

Banister, D. (2008). The sustainable mobility paradigm. Transport Policy, Vol. 15 Issue 2, 73–80.

Bergen Kommune. (2008). Kommuneplanens arealdel 2006-2017 (2025). Bergen: Bergen Kommune .

Bergen Light Rail. (2013). Bybanen Bergen Light Rail - Bergen, Norway's 2nd city, is building a new light-rail system: Bybanen. Retrieved October 2, 2013, from Bergen Light Rail: http://www.bybanen.no/privacy-policy/

Bottoms, G. D. (2003). Continuing development in light rail transit in Western Europe - United Kingdom, France, Spain, Portugal and Italy. Federal Transit Administration. 9th National Light Rail Transit Conference November 16-18.

Bruijn, H. D., & Veeneman, W. (2009). Decision-making for light rail. Transportation Reserach Part A, Vol. 43 No.4, 349-359.

Buanes, F. (2013, May 2). Størst prisvekst langs Bybanen. Retrieved October 4, 2013, from Bergens Tidende: http://www.bt.no/nyheter/okonomi/Storst-prisvekst-langs-Bybanen-2889466.html

Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and fishermen of St. Brieu Bay. In J. Law (Ed.), Power, action, and belief: A new sociology of knowledge (pp. 57-78). London: Routledge and Kegan Paul.

Cervero, R. (1984). Journal report: Light rail transit and urban development. Journal of the American Planning Association, Vol. 50 No. 2, 133-147.

City of Bergen. (2005). Design guide for architectural/ built structures, environs and equipment for: Bergen Light Rail ("Bybanen"). Bergen: Bergen Kommune, Hordaland fylkeskommune, Statens vegvesen.

Cresswell, T. (2006). On the move: Mobility in the modern Western world. London : Routledge.

Denant-Boeá, L., & Mills, G. (1999). Urban light rail: Intermidal competition or coordination. Transport Reviews, Vol. 19 No. 3, 241-253.

Deng, T., & Nelson, J. D. (2011). Recent developments in bus rapid transit: A review of the literature. Transport Reviews, Vol. 31 No. 1, 69-96.

Egger-Jenzer, B. (2010, December 11). Die Direktorin. Retrieved November 8, 2013, from Kanton Bern: http://www.bve.be.ch/bve/de/index/direktion/direktor/referate.assetref/content/dam/documents/BVE/GS/de/DIR_Referat_Er%C3%B6ffnung_TBW_VIP-Event_101211.pdf

European Commission. (2007, June 4). Towards a new culture for urban mobility - Green paper on urban mobility. Retrieved February 22, 2012, from Mobility and Transport, European Commision: http://ec.europa.eu/transport/urban/urban_mobility/green_paper/doc/2007_09_25_gp_urban_mobility_memo_en.pdf

Farias, I., & Bender, T. (2010). Urban Assemblages - How actor-network theory changes urban studies. New York: Routledge.

Flyvbjerg, B. (1996). Rationalitet of magt bind 1 - det konkretes videnskab. Aarhus: Akademisk Forlag.

Flyvbjerg, B. (2006). Five misunderstandings about case study research. Qualitative Inquiry, vol. 12 No. 2, 219-245.
Groneck, C. (2003). Neue Strassenbahnen in Frankreich - Die Wiederkehr eines urbanen Verkehrsmittels. Freiburg: EK-verlag.

Hajer, M., & Kesselring, S. (1999). Demoracy in the risk society? Learning from the new politics of mobility in Munich. Environmental Politics, 1-23.

Hartmann, K., Lampe, F., Monsen, O., & Prestmo, O. (2006, November 26). Milliardsluket Bybanen - debat. Retrieved October 9, 2013, from Bergens Tidende: http://www.bt.no/meninger/Milliardsluket-Bybanen-1822488.html

Hass-Klau, C., Crampton, G., & Benjari, R. (2004). Economic impact of light rail: The results of 15 urban areas in France, Germany, UK and North America. Environmental & Transport Planning. Bergische Universität Wuppertal

Hensher, D. A. (2006). Bus transport: Economics, policy and planning. Sydney: Elsevier.

Hodgson, P., Potter, S., Warren, J., & Gillingwater, D. (2013). Can bus really be the new tram? Research in Transportation Economics, Vol. 39 Issue 1, 158-166.

Hughes, T. (1998). Rescuing Prometheus. New York: Vintage Books.

Johansson, T. (2011). Nya spårvägar i mellanstora städer. Modern Stadstrafik nr 4.

Kanton Bern, Stadt Bern, Bern Mobil, Energie Wasser Bern. (2012). Dossier Tram Bern West. Bern: Kanton Bern, Stadt Bern, Bern Mobil, and Energie Wasser Bern.

Kaufmann, V. (2004). Social and political segregation of urban transportation: The merits and limitations of the Swiss cities model. Built Environment, Vol. 30 No. 2, 146- 152.

Latour, B. (2002). Aramis, or the love of technology. London: Harvard University Press.

Law, J. (1999). After ANT: Complexity, naming and topology. In J. Law, & J. Hassard (Eds.) Actor network theory and after (p. 1-14). Oxford: Blackwell.

Litman, T. (2012). Rail transit In America: A comprehensive evaluation of benefits. Victoria: Victoria Transport Studies Institute.

Mackett, R., & Sutcliffe, E. (2003). New urban rail systems: A policy-based technique to make them more succesful. Journal of Transport Geography, Vol. 11 No. 2, 151-164.

Mills, G. (2001). New tramways in France: The case of Montpellier. Transport Reviews, Vol. 21, No. 3, 337 - 352.

Nilsen, T. B. (2011, January 18). Bybanen bremser ikke biltrafikken fra sør. Fanaposten.

Olesen, M. (2012). Letbanens Koncept - effektivt transportsystem, generator for byudvikling eller meget mere? Proceedings from the Annual Transport Conference, 1-10.

Pagliara, F., & Papa, E. (2011). Urban rail systems investments: An analysis of the impacts on property values and residents' location. Journal of Transport Geography, Vol. 19 No. 2, 200-211.

Priemus, H., & Konings, R. (2001). Light rail in urban regions: What Dutch policymakers could learn from experiences in France, Germany and Japan. Journal of Transport Geography, Vol. 9 No. 3, 187-198.

Richardson, T., Isaksson, K., & Gullberg, A. (2010). Changing frames of mobility through radical policy interventions? The Stockholm congestion tax. International Planning Studies, Vol. 15 No. 1, 53 - 67.

Rytz, R. (2010, December 11). Einweihung Tram Bern West vom 11./12. Dezember 2010. Retrieved November 8, 2013,

from www.mm.ch: http://www.mm.directories.be.ch/files/5935/16673.pdf

Stadt Bern. (2006). Botschaften des Stadtrats an die Stimmberechtigten - Gemeindeadstimmung vom 26. November 2006. Bern: Stadt Bern.

Stadt Bern . (2010). Vortrag des Gemeinderats an den Stadtrat - Tram Bern West; überarbeitetes Projekt (abstimmungsbotschaft). Bern.

Statens Vegvesen, Bergen Kommune, and Hordaland Fylkeskommune. (2013). Bergensprogrammet. Retrieved October 4, 2013, from Bergensprogrammet: http://bergensprogrammet.no/

Tait, M., & Jensen, O. B. (2007). Travelling ideas, power, and place: The cases of urban villages and business improvement districts. International Planning Studies, Vol 12, No 2, 107-127.

UITP. (n.d.). International Association of Public Transport. Retrieved February 22, 2012, from Light rail: http://www.uitp.org/Public-Transport/light-rail/index.cfm

Vannini, P., Lucy, B., Jensen, O. B., Fisker, C., & Jirón, P. (2012). Technologies of mobility in the Americas. New York: Peter Lang.

Vollset, M. (2007). På sporet av Bybanen. Bergen: Bodoni.

Vuchic, V. R. (2000). Comparison of light rail transit with bus semirapid transit. 5th UITP Light Rail Conference.

VÖV UTP. (2010). Facts and arguments in favour of Swiss public transport. Bern: Verband ôffentlichers Verkehr.

Weinstock, A., Hook, W., Replogle, M., & Cruz, R. (2011). Recapturing global leadership in bus rapid transit: A survey of select U.S. cities. Retrieved July 2013, from www.itdp.org: http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf

Wiederstrøm, G. (2012). Bybanen lokker til seg reisende. Bergens Tidende, 26 january.

Wirasinghe, S., Kattan, L., Rahman, M., Hubbell, J., Thilakaratne, R., & Anowar, S. (2013). Bus rapid transit – a review. International Journal of Urban Sciences, Vol. 17 No. 1, 1-31.

Wright, L. (2005). Bus rapid transit. GTZ sustainable transport: A sourcebook for policy-makers. University College London

Yin, R. K. (2009). Case study research - Design and methods Fourth Edition.. Thousand Oaks: SAGE publications.

PAPER II

EXPLORING "LIGHT RAILSCAPES":
MATERIAL AND SPATIAL CONCEPTS OF LIGHT RAIL MOBILITIES

Light rail is a modernisation of the old tram system and is a popular tool in urban development strategies in many European cities. Through a case study, this article focuses on the main idea and vision behind light rail projects in two mid-sized European cities – Bergen and Angers – and how this vision has materialised into what this article calls a "light railscape". The article argues that it is important to understand the differences in materiality and spatiality of light rail systems, since this has implications for its function as a mobility mode and its integration with urban space. The article explores the concrete design of light rail systems as transit space. This is in order to create an understanding of the meaning of such mobilities, in addition to the ways in which they interact with, and reconfigure, urban space and cultures. Theoretically, the study is founded in the new mobilities paradigm. The article has been submitted to Space and Culture, January 2014.

9

EXPLORING "LIGHT RAILSCAPES":

MATERIAL AND SPATIAL CONCEPTS OF LIGHT RAIL MOBILITIES

Mette Olesen & Claus Lassen
Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark.

ABSTRACT

Light rail is a modernisation of the old tram system and is a popular tool in urban development strategies in many European cities. Through a case study, this article focuses on the main idea and vision behind light rail projects in two mid-sized European cities – Bergen and Angers – and how this vision has materialised into what this article calls a "light railscape". The article argues that it is important to understand the differences in materiality and spatiality of light rail systems, since this has implications for its function as a mobility mode and its integration with urban space. The article explores the concrete design of light rail systems as transit space. This is in order to create an understanding of the meaning of such mobilities, in addition to the ways in which they interact with, and reconfigure, urban space and cultures. Theoretically, the study is founded in the new mobilities paradigm.

Keywords: Urban transit, Light rail, Materiality, Mobility, Design

1. INTRODUCTION

One important reason for the increased interest in light rail is that light rail systems, especially those in mid-sized European cities, are simpler than metro systems: light rails often run at street level and thus have lower construction costs than metro systems. Moreover, the cost of operation for light rail is usually much cheaper. For this reason, light rail systems have been considered in many mid-sized cities, i.e. those with a population less than 100,000 inhabitants (Bottoms, 2003; SYSTRA, 2012). Prior research on decision-making for light rail systems has pointed to two criticisms: the economic irrationality of the decision to implement light rail systems; and the perceived superiority of light rail systems over bus rapid transit (BRT) in terms of regularity and image (Bruijn & Veeneman, 2009). Edwards and Mackett (1996), in their examination of the implementation of new British urban transit systems in the 1990s, show how light rail systems have been favoured in the decision-making process despite the fact that cost–benefit analyses show that BRT systems are more cost-efficient. Two of the main studies into the performance of light rail systems (Babalik, 2000; Babalik-Sutcliffe, 2002) illustrate that while some systems have been successful in achieving the desired outcomes, many systems have failed to be as successful as expected in terms of improving public transport and the urban environment. Vuchic (2000) and Hensher (2006) also indicate that the differences considered in decision-making processes and the choice between light rail systems and BRT are not only a matter of technology, but also a matter of the type of service, its image and its impacts.

In both research and practice, there has been a debate on the choice of technology, especially regarding the attractiveness of rail systems over those involving buses (see, among others, Deng & Nelson, 2011; Hodgson, Potter, Warren, & Gillingwater, 2013). This debate has been especially prominent in the European context, and especially in mid-sized cities, where the socio-economic returns of light rail has been questioned (see above). Despite this fact, cities have repeatedly cited the flexibility of light rail systems in their ability to meet a diverse set of goals, despite the fact that light rail systems are a more expensive solution for smaller cities than prioritised bus systems (e.g. BRT). A study by Bruijn and Veeneman

(2009) concludes that BRT systems seem to lack the mythical "allure" often associated with light rail systems that can help mobilise various actors in support of the process (see also Weinstock, Hook, Replogle, & Cruz, 2011; Wirasinghe et al., 2013; Wright, 2002).

The findings above indicate that, in many cases, light rail has a poor socio-economic return, while other similar modes, such as BRT, could provide the same transport function at a lower cost. However, practice shows that light rail systems continue to be built despite seemingly being an economically irrational decision. This creates an interesting paradox, and makes it relevant to question which specific qualities are associated with the materiality of light rail systems, and how these characteristics make them valuable from a strategic urban development perspective. Furthermore, it can also be asked how and why the materiality and characteristics of the light rail concept varies relative to the different local contexts, and which implications this potentially has for the mobility system and its integration with the city. This article focuses on the main idea and vision behind light rail projects in two mid-sized European cities: Bergen and Angers. The article argues that it is important to understand the differences in materiality and spatiality of light rail systems, since this has important implications for its function as a mobility mode and its integration with urban space. The article explores the concrete design of light rail systems as transit space in order to create an understanding of the meaning of such mobilities, as well as the way in which they interact with, and reconfigure, urban space and cultures. Moreover, it is argued that while the city shapes the light rail project, the light rail also reconfigures and shapes the urban structures and planning practices due to its materiality and its spatial interaction with the city. This raises a number of perspectives for future light rail research and practice, and these are elaborated upon i n the conclusions.

The article is divided into four sections. Firstly, it theoretically frames the focus on materiality and spatiality in the understanding of light rail systems. Secondly, it describes the methodology used and the sequence followed in the study. Thirdly, the article analyses the case examples of Bergen and Angers' light rail systems. Finally, the main conclusions and perspectives derived from the findings in the case analysis are discussed, and further perspectives for light rail research and practice are provided.

2. UNDERSTANDING MATERIALITY AND SPATIALITY OF LIGHT RAIL SYSTEMS

Theoretically, the point of departure for this article is the emerging interdisciplinary field of mobility research within social science, which has been framed as the new "mobilities paradigm" or "mobilities turn" (Adey, 2010; Cresswell, 2006; Kaufmann, 2002; Lassen & Jensen, 2006; Sheller & Urry, 2006; Urry, 2000, 2007). There has been a principal focus on the socio-technical production of mobility within mobilities research, as part of the "material turn" within social sciences (Jensen, 2013a). The focus on materiality, spatiality and the ways in which technologies interact with the city has previously been emphasized by Graham and Marvin (2001): *"infrastructure networks are the key physical and technological assets of modern cities. As a 'bundle' of materially networked, mediating infrastructures, transport, street, communications, energy and water systems constitute the largest and most sophisticated technological artifacts ever devised by humans"* (p.10). Furthermore, it is argued by Sheller and Urry (2006) that there has been a growing interest in *"the ways in which material 'stuff' makes up places"* (p.216) within the new mobilities paradigm. Finally, it was recently argued by Jensen (2013b) that: *"materiality and spatiality of artefacts, infrastructures, and sites hosting mobilities are often still not engaged with in a sufficiently manner. Often social sciences keep distance to the physical and material as if the social was still to be understood as a realm separate of technology, architecture, and design" (p.1). Jensen (2013b),* "under the concept of designing mobilities", further argues that: *"By exploring the very tangible and concrete designs of for example everyday life transit spaces, mobility technologies or urban sites of movement we get much closer to understanding the meaning of mobilities to social interaction and culture" (p.1).* Certain places, cultures

and societies can give particular kinds of mobility particular kinds of meaning, meanings that may even cross cultures (Adey, 2010). This shows that infrastructural moorings are critical components of light rail projects, creating immobile sights and corridors of mobilities. The immobility that the light rail tracks provides is a highly valued attribute from an investment and user perspective, since an investment in light rail physically manifests as a stable, long-lasting public transport solution (see Hass-Klau, Crampton, & Benjari, 2004), and is also a powerful strategic tool in urban development. Among decision-makers, light rail is often perceived as the "technical fix" to several urban problems. However, light rail mobilities can be designed in such a way that they not only provide a single answer to problems within cities, but sometimes several (although, conversely, sometimes none).

The socio-technical approach to mobilities research (see, among others, Vannini, Lucy, Jensen, Fisker, & Jirón, 2012) makes clear that the emergence of new mobility systems is not just a matter of creating capacity and reducing travel time. Frederiksen (1996) illustrates how many rationalities were at play when choosing the technology for what is today known as the Copenhagen Metro. The alternative technologies considered in the process were a mini-metro, tramway and light railway. Although these three options seem to have many of the same characteristics (all being rail-born modes), the decision-making process shows that very different rationalities were connected to each of these technologies. In this sense, the choice of a mini-metro has been a way to materialise the planning ideals and rationalities that went along with this mobility system. The thesis "The Design of Large Technological Systems" (Pineda, 2010) further analyses the material scripts behind the design of two large technological mobility systems: the Copenhagen Metro and the Transmilenio Bus Rapid Transport system in Bogotá. The central point made by Pineda is that the material scripts used for the implementation of new public transport systems play a crucial role in the physical reorganisation of the city and the everyday lives of the citizens. These material scripts, and the discourses linked to them, redefine space. Thelle (2013) has also argued how the old tramlines in Copenhagen (which are now closed) became guides for urban and transport planning, and an inseparable part of the urban morphology. Thelle's (2013) description of the tram as a *"medium to negotiate for the urban space in the city"* (p.115) is still very central to the role that modern light rail plays in the city today. Light rail is still a subject for aesthetic discussions of urban spaces, and is often implemented as an unavoidable element of the cityscape, since one of the central ideas behind this technology is that it runs on the front side of the city, integrated with urban space. However, today the materiality of the old tram has changed, and it now affords new enactments of the urban environment that still make it a valuable tool in strategic urban development and city design. In this sense, the tram was – and the light rail still is – produced by the interactions it has with the city, and is at the same time affected by the physical restrictions of the city. Jensen (2008) has described how everyday mobility is practised within the European metroscapes of Copenhagen, Paris and London. He defines "metroscapes" as landscapes of mobility consisting of all the software and hardware that together create a metroscape. Here Jensen (2008) emphasises that various top-down orchestrations of these metroscapes – with regard to design, planning and operations framework, etc. - come together through the everyday live performances of real passengers. The different material and spatial orchestrations of metro systems facilitate the meaningful and mobile engagement of systems, objects, humans and the city with each other, creating three very different local translations of the metro concept.

The above theoretical underpinnings suggest that the rationalities behind the material and spatial configurations of various categories of urban transit systems are different. Moreover, the above proves how various local contexts shape and configure materialities of mobility systems differently. This means that the light rail concept must be understood in its context and by its unique design.

In this article, an understanding of the material and spatial layout of light rail projects implements the notion of "scripts" and "scapes" (as argued by Jensen, 2008; see also Marling, 2013) as a theoretical framing. The term "script" (Yaneva, 2009) defines the visions that have been incorporated into an object, whereby the design and planning of infrastructure triggers certain ways of enacting the social world. A light rail holds a vision of the world that is inscribed in its material and spatial construction. A specific script can be the colour of the light rail vehicles, or the segregation of the tracks, the placing and design of stations – all elements that are important to the way this infrastructure interacts with the city and its users. The spatial embeddedness and "frozen discourses" (Dovey, 2008; see also Olesen, forthcoming) of light rail mobilities are mapped here by the use of Lynch's (1960) understanding of the city image and its elements as a kind of "check list" of issues and themes that have been used under fieldwork (elaborated further in section 3). Using Lynch´s (1960) categories, we can analyse how a certain image and vision of the space can be enacted by the implementation of a "light railscape"

Lynch (1960) categorises the physical form of the city image into five types of elements: paths, edges, districts, nodes and landmarks. These elements should not be seen in isolation, but rather in relation to one another, so as to create the full image of the urban environment. In Figure 1, Lynch´s (1960) definitions of the categories are operationalised into guiding analytical principles, which can be used to analyse the materiality and spatiality of the two light rail projects. Lynch (1960) has argued that "moving elements in a city, and in particular the people and their activities, are as important as the stationary physical parts" (p.2), indicating that the mobile artefacts are also important to our understanding of space. As Lynch (1960) argues, an analysis of the city image:

[L]imits itself to the effects of physical, perceptible objects. There are other influences on imageability, such as the social meaning of an area, its function, its history, or even its name. These will be glossed over since the objective here is to uncover the role from itself. It is taken for granted that in actual design form should be used to reinforce meaning and not to negate it. (p.46)

The spatial framework provided by Lynch (1960) is thus very much of form rather than meaning (see section 3 for the methodological use of Lynch in this article). It is important to be aware that Lynch (1960) developed his framework in order to understand citizens' mental image of the city at the individual level. Applying this approach as an analytical tool provides some central categories of urban form through which the mapping of the material and spatial layout of the light rail corridor is performed. Analytically, the link between meaning, materiality and spatiality is central to the analysis of the cases. Based on the analytical operationalization of Lynch (1960) in Figure 1, the following themes are central to the structure of our analysis:

- New mental and physical links – connecting districts and overcoming edges;
- Transit space as urban space – new nodal attractors and paths integrating with the city; and
- The new face of the city – landmarks and identity.

ELEMENT	SHORT DEFINITION BY LYNCH (1960, P.47)	ANALYTICAL OPERATIONALISATION
Path	"Paths are the channels along which the observer customarily, occasionally, or potentially moves […] for many people they are predominant elements in their image".	Exploring the role that the light rail as a new path plays in the city. Which new connections does it create, and how does it integrate with the urban environment.
Edge	"Edges are the linear elements not used and considered as paths by the observer. They are boundaries between two phases […] such edges may be barriers, more or less penetrable, which close one region off from another; or they may be seams, lines along which two regions are related and joined together".	Exploring how the light railscape is assembled in relation to the creation of boundaries and integration with main roads and backstreets of the city.
Districts	"Districts are the medium-to-large sections of the city, conceived of as having two-dimensional extend, which the observer mentally enters 'inside of' and which are recognizable as having some common identifying character".	Exploring what characterises the different districts connected along the light railscape, and the role that the light rail plays in these districts, and vice versa.
Nodes	"Nodes are the points, the strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is travelling".	Exploring the nodes created along the light railscape, and the functions of stops along the route.
Landmarks	"Landmarks are another type of point-reference, but in this case the observer does not enter within them, they are external. They are usually a rather simply defined physical object: building sign, store or mountain"	Exploring the extent to which the materiality of the light railscape works as a landmark in the urban environment, and what are the characteristics of this landmark.

Figure 1: Lynch´s definition of the categories and its operationalization in this article.

3. METHODOLOGY

The study of the materiality and spatiality of light rail mobilities is conducted through the use of a multiple case study design in which it is possible to analyse light rail in relation to local contexts (Antoft & Houlberg, 2007). The choice of cases studies for the research design enables an interpretive approach to data; this makes it possible to study "things" within their contexts (Flyvbjerg, 1991; Flyvbjerg, 2006; Yin, 2009) and consider the subjective meanings that actors bring to their design. The empirical background for this article is case studies in two mid-size European light rail cities: Bergen and Angers. Rather than being a comparative study of these two light rail systems, the article aims to explore these cities thematically in order to illustrate the differences and overlapping ways that light rail systems have materialised in the two cases. As argued by Jensen (2013b): *"by exploring the very tangible and concrete designs of for example everyday life transit spaces, mobility technologies or urban sites of movement we get much closer to understanding the meaning of mobilities to social interaction and culture" (p.2).*

The cases of Bergen and Angers are examples of completely new light rail systems implemented in 2010 and 2011, respectively. Angers is a case of the French redesign vision, and was one of the most expensive light rail projects implemented in France. The visual design and trackside redevelopment have changed urban areas remarkably, and light rail has also served as the backbone in new urban development. Furthermore, Angers is a case of a light rail system that is based on very different rationalities and objectives than that of transport efficiency. Bergen was the first light rail scheme in Norway. One of the main objectives behind Bergen's light rail was urban development objectives, which were crucial in the decision to create the system. In comparison to Angers, the materiality of Bergen's light rail shows some interesting differences with regards to integration with the city, since it large parts of the line run on tracks that are almost segregated from the urban environment. Together these two cases give insight into the framing of new conceptual approaches to light rail, and shows the ways in which light rail has given meaning in the local context. The research was carried out from February 2011 to April 2013, and is part of a larger research process around the qualitative impacts of light rail in European cities (Olesen, forthcoming). During this time, field studies were conducted in each city. This was done in order to conduct face-to-face interviews with relevant actors, as well as to study the situated mobilities in their places, be close to the field, and see the specific characteristics of spaces and material scripts in the light rail corridor. The strategic selection of which relevant persons to interview was based on three simple criteria for collecting knowledge, which were based on different views of the light rail projects studied: interviews with independent/critical local sources (such as representatives from the university or local media); interviews with central actors in the planning, implementation and operation of the system; and interviews with political actors or civil servants involved in the decision-making process. The cases were concretely analysed through a two-step approach:

- 1. Face-to-face interviews with relevant stakeholders in order to create insight into the rationales guiding the decision to implement light rail, and the concrete material and spatial design that has been chosen for the specific light rail system.
- 2. Mapping of materiality by using the categories defined by Lynch (1960) to perform this mapping of the material and spatial design of the specific light rail system.

Firstly, six interviews were conducted in Bergen, and three interviews were conducted in Angers. The interviewees represent both the political and the planning perspectives in each case. The purpose of the interviews was to unfold the rationality behind the choice of a light rail system, and how this light rail project has been integrated into the local context. Qualitative expert interviews have been an important method for uncovering the process behind implementing light rail mobilities, as it provides insight into the professional life worlds of the practitioners in each case. In the interviews, the respondents talked about their professional life worlds (Kvale & Brinkmann, 2009) on the basis of the institutions they represented, but also the logics and ways of reasoning embedded in their professional and personal backgrounds. In the end of the paper is a list of all the persons who were interviewed in the two cases, including their job titles.

Secondly, the spatial and material analysis and mapping of the corridor were performed using a walk-along/ ride-along approach in which the different urban programs and material layouts in the corridor were registered and mapped (inspired by Büscher, Urry, & Witchger, 2010; Dovey, 2008). The materiality and the spatiality of the different urban programs in the corridor were registered using photos, and maps were used to register how light rail was intended to integrate with the urban environment. More concretely, the registration of the corridors and the design and materialities of the systems were mapped by paying attention to the visual categories that Lynch (1960) uses to describe the image of the city (see Figure 1 for their operationalization). This methodological exercise is a visual examination of the materiality and spatiality of the "light railscape" used to detect the main technological and material features, such as the vehicles,

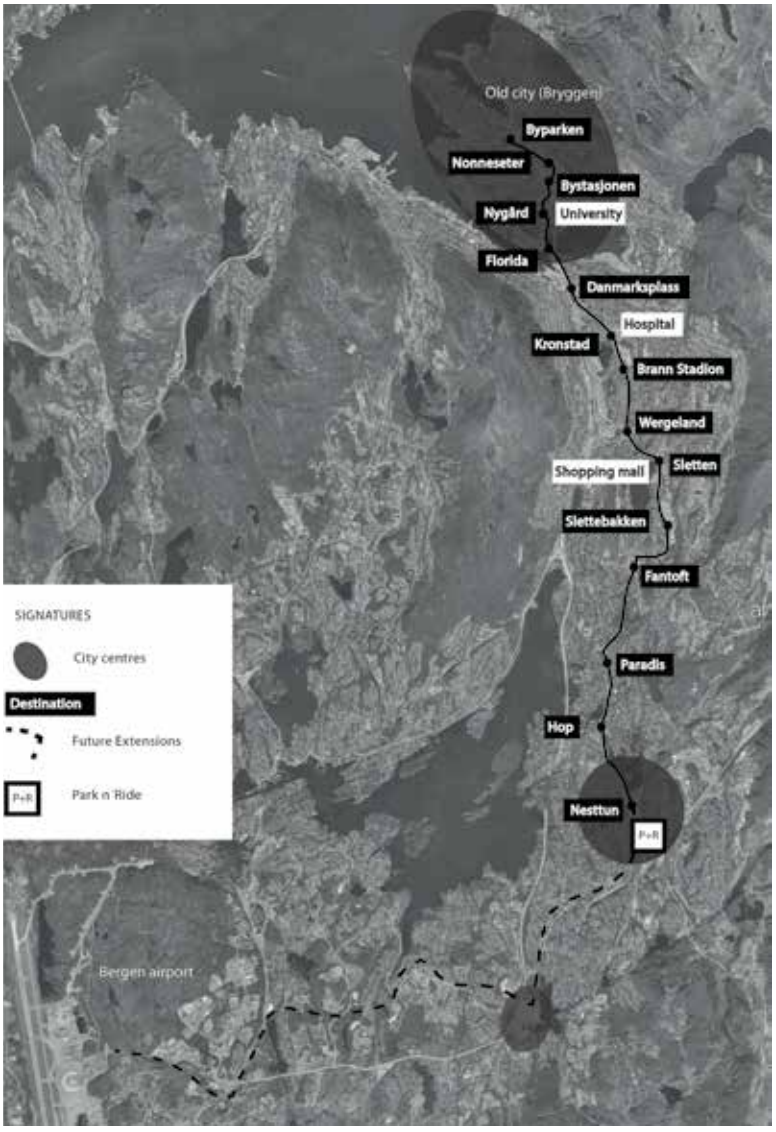


Figure 2: The first light railscape in Bergen seen from above. There are several new urban projects in the corridor: ***Paradis:*** *100 homes & offices and retail space;* ***Fantoft****: renewal of student housing from the 1970s & 77 new homes;* ***Wergeland:*** *redevelopment 400 new homes & 14,000m2 of offices and 8,500m2 of retail space;* ***Bystasjonen:*** *new housing and offices;* ***Nygård****: 17,000m2 retail space & businesses;* ***Florida:*** *the largest construction site to be developed until 2020, branded as "the good life in the city";* ***Danmarksplass:*** *new hospital (11,000m2) & 3,500 new workplaces (50,000m2) & retail space;* ***Nesttun:*** *new cultural centre with smaller shops & 450 new homes under the concept of "Plus Living", with services, community activities and safety systems; Nesttunhagen: a project with 19 new homes. (Background card: Google Earth).*

interiors, stations, tracks, depot, power supply, tunnels, bridges, etc., which together comprise the "light railscape". As a part of the analysis, maps of both Bergen and Angers were produced in order to show how the concepts behind the two lines have materialised in the two cases.

4. THE CONTEXT OF BERGEN AND ANGERS LIGHT RAIL

Before the analysis of the materiality and spatiality of the light rail mobilities is carried out, the case of Bergen and Angers will be presented individually.

4.1 Bergen light rail, Norway

With the opening of the first line across a stretch of 9.8 km and 15 stops, Bergen became the first Norwegian city to introduce a completely new light rail system in June 2010. The main idea has been to create a new corridor between the old city centre and the suburb Nesttun in the south, with step 2 and 3 aiming to create a connection to a large industrial business area and Bergen airport (Vollset, 2007). The average daily ridership is 31,000 passengers and the cost of the project was 270 million euro (2007 prices). Bergen is the second largest city in Norway and has approximately 250,000 inhabitants. Being the pioneer also implies having to fit this new infrastructure into the physical surroundings while also framing it politically and discursively, and matching it to the policies and minds of decision-makers and citizens. Like many other cities, Bergen closed its old tramlines in the 1960s due to the introduction of the automobile. The old tram took its last trip across Bergen on New Year's Eve 1965. On the 14th of January 1966, the tram was dumped in the fjord in order to manifest the beginning of a new era in urban transport: the era of automobility (Vollset, 2007; Interview with Håkon Rasmussen). Since that time, proponents of rail-born urban transportation have argued for the need for a new rail-born transit system, with many technologies having been considered in this process. The fact that Bergen possesses a tram history has been an important aspect in the argumentation for a new light rail, while the old tram routes have also structured the radial urban corridors which are seen in the city today. The light rail runs partly along the old tram tracks, which can also be seen as a symbolic act to reclaim urban space in this corridor in favour of public transport.

The Concept: A (sub)urban corridor – partly segregated from urban space (see figure 2)

Along with the light rail project, Bergen municipality has launched an urban densification strategy to facilitate a planning practice that would prioritise new practices for transit-oriented development in the light rail corridor, in an attempt to secure urban structure that would limit the need for car usage (Bergen Kommune, 2008). In the years after the implementation of the light rail, the urban space in the corridor has undergone major transformations, and the light rail project is considered a politically successful tool for attracting investments in the corridor, as well as generating many new housing, retail and business projects (Bergen Kommune, 2008; Interview with Håkon Rasmussen). Figure 2 maps the light rail line and the new development projects in the corridor. The light rail is politically framed as an urban project, which indicates that priority is given to upgrade the urban public transport system, and to use this new infrastructure as a tool to remodel the urban environment in the corridor and attract investments (Vollset, 2007; Interview with Håkon Rasmussen). As stated in the design guidelines:

The light rail should thus integrate with the city and communicate a clear modern and future-oriented image. The design of all basic elements, such as masts, shelters, etc. must clearly signal the presence of a light rail transit system […]. The LRT should contribute to a tidier, simpler visual impression of the various urban spaces through which it runs […]. The design and materials chosen for the light rail transit service should reflect simplicity and harmonious interaction. (City of Bergen, 2005)

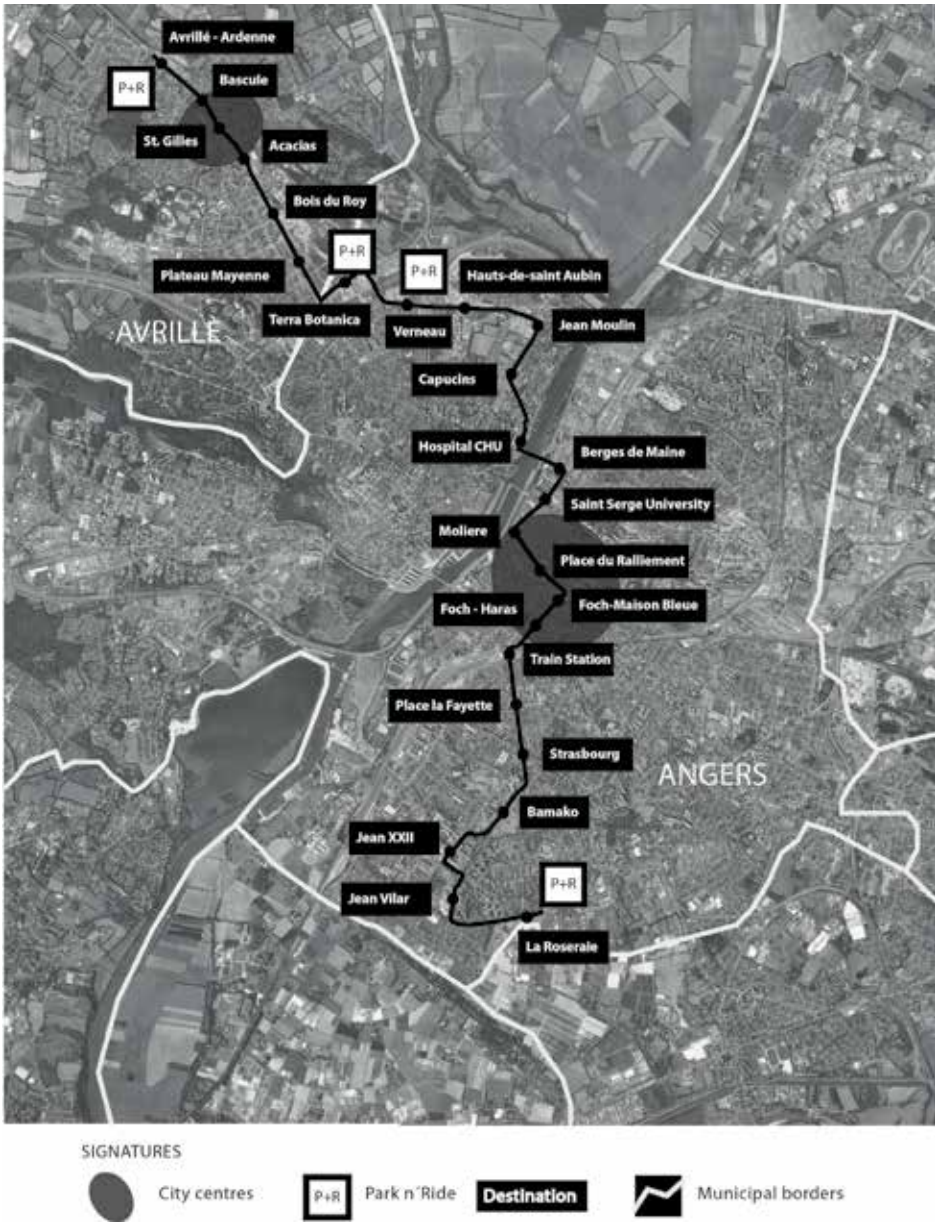


Figure 3: The light railscape of Angers as seen from above. Some of the major new urban developments are: ***Avrillé:*** *redevelopment of downtown and densification along the route (15,000 inhabitants);* ***Plateau Mayenne:*** *10,000 new inhabitants & amusement park;* ***Hauts de saint Aubin:*** *10,000 inhabitants, swimming pool, school and kindergarten;* ***La Roseraie****: area with state subsidies for urban renewal (18,000 inhabitants). (Background map: Google Earth)*

The light rail vision is deeply embedded in the history and culture of the city, and the materiality and spatiality of the light rail system are thought to clearly communicate this. Through the choice of materials, the light rail service is thought to strengthen the perception of Bergen as a modern city with a high level of environmental awareness. The choice of materials should therefore express the pioneering quality of the light rail system through the use of contemporary technology anchored in local tradition, which is intended to be supportive of "the unique Bergen character". The light rail tracks are loading the corridor with development potential and a new identity. Bergen's light rail has not only transformed the urban space in the corridor; it has also had a role in creating an image for the city and the region. In the design guidelines for the project, it is stated that: *"The City of Bergen seeks to make the light rail transit system a truly iconic structure and the pride of the city […]. The LRT must be developed and built in a way which clearly communicates its characteristic identity" (City of Bergen, 2005).* The purpose of developing a design guide for the Bergen light rail project has been to explain the nature of the light rail system, and the document was furthermore intended to reflect the identity and values of the light rail transit system. Furthermore, the design guidelines for Bergen light rail stated that:

"Bergen's light rail transit system will introduce a new, visible element in the urban landscape and provide a new transport facility. As a part of the city and its urban structure, the service should contribute to quality urban development. The LRT service will constitute the backbone of the public transport system, providing additional qualities to enhance the city's facilities. The Bergen LRT will be the first of its kind in Norway. The service will operate as a modern tram in the inner city areas, while providing the speed and capacity of a suburban railway outside the city centre" (City of Bergen, 2005).

4.2 Angers light rail, France

Angers is the 19th city in France to implement a new light rail system (or tram, which is the French term for light rail) (Johansson, 2011). Angers is the 16th largest city in France, with 156,000 inhabitants. The planning process for the light rail project in Angers started in 2001, when the light rail vision and taskforce "Mission Tramway" was established. The system began its operations in June 2011 under the political leadership of Mayor Jean Claude Antonini, who was present through the entire process. The first line is a stretch of 12 km, with 25 stops; these connect two of the 33 municipalities in the métropole (administrative unit or region), with Angers and Avrillé the city centres in the two districts (Angers Loire Metropole, 2011; Research interview Olivier Sorin). The average daily ridership is 31,000 passengers and the project is said to have cost 300 million euro (2005 prices).

The Concept: A redesign vision – reclaiming public space (see figure 3).

In 2005, the métropole's mobility plan was launched, which introduced an integrated and holistic approach to mobility in the area. One of the objectives of the plan was the upgrade of the public transport network by introducing a light rail as the new "backbone" of the urban public transport system (Angers Loire Métropole, 2005). The light rail project was described as a manifestation of the strong will to reclaim public space in favour of alternative transportation modes (walking, biking, public transport) and the prioritisation of urban development (Angers Loire Metropole, 2012). Marie-Pierre Trichet, a planner in the métropole, described this radical shift in vision for urban planning and mobility, as mediated by the light rail, from a future perspective:

"We came out of the single thought that everything had to be auto mobile. Today we must offer a real choice. Children are followed to school on foot. We take the bike to buy bread. Are we tram or bus travellers? We take the car to go windsurfing at Lac de Maine. Intermodality is the intelligent choice of transport according to means, needs and desires. It is in line with the expectations of younger generations. We have a duty to support them". (Courrierdelóuest, 2012; own translation)

The light rail has been framed as an "emblem" of the renewal of both Angers and the entire region (Angers Loire Metropole, 2011). The redevelopment and redesign element proved to be a particularly important rationale, as it had been in other French cities:

"When a French city decides to build a new tramline, they not only build a tramline they also remodel all the quarters around the tram between the buildings […]. The trams are seen as a means to remodel the city – this is why you see these green tracks and public spaces". (Research interview Olivier Sorin).

The Angers light rail concept is what is framed as "façade-to-façade renovation" where both the space and the mobility hierarchy have been redesigned. The light rail in Angers is a good example of light rail trend that has been emerging in France since Nantes opened the first modern light rail line in 1985, where there has been an emphasis on using the infrastructure as a urban development and redesign tool (Bottoms, 2003). In France there are not two light rail cities with the same material identity which is a central part in city competition and creating the most remarkable projects that will provide the city with an identity of a future oriented city (Research interview Olivier Sorin). Another important element behind the light rail project has been to integrate the light rail into the rhythm of the city and region, suggesting another important element connected to the light rail is solidarity. The new connection between the cities of Angers and Avrillé is intended to contribute to community spirit between their citizens and the territories (Angers Loire Metropole, 2011). This alignment supports a wider regional focus on renewal that is not just limited to the city centre. Finally, an equal prioritisation of technological and physical aspects in the entire corridor could be seen as a central strategic act in this project. The fact that an expensive underground power supply system (APS) was chosen as part of the alignment in both Angers centre and Avrillé is a political signal of the equal prioritisation given to the corridor in all the districts that the light rail serves. As a result, districts that were historically considered disparate are now deemed equivalent from an aesthetic and visual perspective, and APS technology was a considered an important material actant in this outcome. Figure 3 maps the light rail line and the new development projects in the corridor.

From these brief introductions of the two light rail systems, we will now engage with the research results in order to analyse how light rail mobility has materialised in the two cities, and how the materiality of light "railscapes" have been an important part of reconfiguring urban space in the two cities. This is done in relation to the three themes mentioned in section 2.

4.3 New mental and physical links – connecting districts and overcoming edges

Compared to the materiality of the "metroscape" – which either runs below or segregated from the city, and only integrating with the urban space at its stations (as described in section 2) – light rail has a very different material and spatial implication, since it potentially interacts with the urban environment along the entire alignment. This materiality has proved to be an important asset in the argumentation for the two cases' light rail visions. Furthermore, this materiality has been actively used to (re)define the corridor in the two cases. The light rails in both Angers and Bergen have a higher frequency of stops than a metro (average 450 meters in Angers and 650 meters in Bergen, compared to an average of 1000 metres on the Copenhagen Metro), which, as a consequence, means they travel at much lower speeds. To a greater extent than Bergen, Angers can be seen as a purely urban system, as the number of stops – and thus the system's integration with the city – is seen as a more important asset than travel speeds. In Angers, the light rail's higher frequency of stops means it travels with an average speed of 18 km/hour compared to Bergen's 28 km/hour. Since Bergen's light rail is framed as a suburban connection, its materiality has been fitted to this role: the stops are spaced out further towards the suburb, and the light rail is segregated from the urban environment to a higher degree than in Angers, allowing it to

reach a higher average travel speed. Drawing on Lynch (1960), the light rail is part of (re)defining 'districts' in the city; as such, the light rail corridor can be considered a district in itself, since it creates a new mental and physical image of the city in this central corridor. This implies that the light rail becomes an active part of the urban space, and redefines new mental and physical links by the "mark" it physically creates in the city.

The light rail in Bergen has been framed as a suburban connection which should enable people in the suburb of Nesttun to become better connected to the city centre by public transport. Another central idea and vision behind the alignment was to prevent people from buying a second car once accessibility to high-quality public transport was provided. Park 'n' ride facilities were established in Nesttun in order to create the possibility of a modal shift from car to light rail. The choice of light rail line is historically and culturally embedded in the area, since Nesttun was previously connected to the city centre by a suburban train (or Forstadsbanen) before it was closed. Furthermore, the old tram line was almost comparable to the new light rail alignment (Vollset, 2007). This means that the districts along the light rail line had been historically structured around transit lines, which used to be the "nerves" of the city. As a result, the city has developed in a radial structure, which makes it easier to serve districts by public transport. This vision enables the physical and mental associations between the light rail to be used actively in an urban development perspective, thus many new large-scale housing and business projects have been planned in this new central corridor or "district" (see also Figure 4).

Figure 4: The light rail in Bergen operates in-between the old tramway on the main street in the urban part of the city (left), and as a suburban train shifting to traditional heavy railway tracks in the suburban part of the city, where it is segregated from the urban environment (right). The picture to the left shows the new student housing district Fantoft; the light railscape has been an active part in (re)defining and giving this area a "young identity" with modern art at the light rail node. (Photo by author).

Angers light rail has been an active tool in physically and mentally connecting and upgrading two physically and socially diverse districts. In Avrillé, at the northern tip of the line, a completely new district is under construction around the station at Plateau Mayenne and Hauts de saint Aubin. With its proximity to public transport and amenities, this community is based on the concept of medium-density urban living. The municipal planner described the role of this new district

and its close relation to the light rail vision: *"On the Plateau de la Mayenne and Capuchins, everything goes better than expected […] we knew that the route of the tramway would encourage urbanization"* (cited in Courrierdelóuest, 2012; own translation). At the southern end of the line, in Angers, the light rail integrates with the physically and socially deprived modernistic housing district La Roseraie, where state funds have been provided for the area's urban renewal (see Figure 5). La Roseraie was previously designated for urbanisation in 1965, but became prone to levels of unemployment and social unrest often associated with French suburbs. The light rail supports the regeneration of the area, and provides a mental as well as a physical connection to this suburb through a very different physical program than the rest of the city. Many political prioritisations have been made so as to create equal social and aesthetic prioritisations in the light rail corridor. In this sense, the material interaction of the light railscape and the city has been part of redefining some of the previous mental and physical areas in the city, whereby the materialities of the light rail are actively used to redefine the districts it passes. Moreover, the common identifying character in the design of the light railscape creates a new mental and physical district, which is part of redefining the existing urban morphology.

Figure 5: Two diverse urban areas connected by the light rail in Angers. Construction of the new district around Plateau Mayenne (left) and the socially and physically deprived housing area in La Roseraie (right) has provided a physical upgrade and a new link between these two diverse districts by securing an equal aesthetic and physical upgrade or redesign (Photos by Author).

An expensive ground power supply technology (APS) was used to fit the central urban environment in both Angers and Avrillé. It is argued that avoiding overhead wires in these sensitive urban areas enables preservation of the urban heritage and history. As the main centre in the métropole, Angers could be argued to have an architectural claim over this expensive technology, whereas Avrillé is a small village that does not have the same aesthetic vulnerability. However, the APS represents a political compromise, thereby proving the equal prioritisation of these two areas (Interview with Pierre-Luc Papin) (see Figure 6). The following quote is central to understanding the symbolic meaning behind this materiality and design: *"Avrillé was a village street – it became a city. La Roseraie is also transformed, in connection with the operation of urban renewal"* (Courrierdelóuest, 2012; own translation)

Figure 6: The two parts of the light railscape where the light rail operates on the APS ground power supply system (see third line placed in-between tracks): the light rail in the small village of Avrillé (right) and the central city shopping square in Angers "Place du Ralliement" (left) – making two diverse districts equal (Photos by author).

4.4 Transit space as urban space – new nodal attractors and a path integrating with the city

The light railscape has been thought of as a public realm in the two cases, and since its materiality enables a direct integration with the urban environment, it is a powerful tool in the redesign process. In comparison to metro systems that travel underground, and BRTs that travels on asphalt, light rails are able to use very different pavements alongside the tracks, which can provide an aesthetic value to urban space (such as the green tracks in Angers and cobblestones in Bergen centre) and enable urban programs for different user groups. As seen in Figures 6 to 8, the possibility to use different pavements in the light rail alignment is a valuable and visual aesthetic element in the redefinition of transit space as public space. In this sense, the light rail becomes an integrated part of the urban environment, while its stops become central nodes of activity used actively in the planning of new urban areas). Contrary to the notion of "non-place" (Augé, 1995), which has been used to define the universal and placeless complexion of transit space, the light rail can play a significant role in transforming what was previously thought of as "transit space" into what can be perceived as "urban space". This is what is meant by the "reclaim public space vision" of Angers light rail project, where parking at the main city square (see Figure 6b) has been placed underground in order to activate the erstwhile parking spaces above ground for the activities of pedestrians, shops and cafes. In addition, car traffic is restricted in this area. The integration of the light rail at Place du Ralliement was a physical manifestation of the political will to reclaim public space. It was a controversial act by the mayor, Jean-Claude Antonini. He was a strong political profile in the implementation of the light rail project, and was in charge of the project from the initial stages in 2001 to its implementation in 2011 (Interview with Olivier Sorin). The pavement on Place du Ralliement is cobblestone and the light rail tracks are integrated into this street layout. The narrow streetscape opens up into a big plaza at the top of Röe Street. This is the commercial heart of the city and the most controversial part of the light rail project at Place du Ralliement. The light rail line runs directly through the city square and stops at the centre. The glass roof of the light rail stop is the same shape as the square, but is cut in two by the light rail line. This node is also a landmark of the square. The square is surrounded by some of

the most spectacular old architectural pieces found in the city. It is apparent that this site has always been the heart of the city and the historical façades of the buildings underline this role. The pavement is the same throughout the entire area: grey flagstone and a smaller version of the same pavement to indicate the light rail track. There are fountains and outdoor seating, which indicate that this is a public space.

The cultural difference and historical adaptation of the light rail materiality are not as obvious in Bergen as in Angers. This is caused by the fact that Bergen (and Norway in general) does not carry the same light rail history or been placed into national and local policies – or the minds of decision-makers – to the same extent as in Angers and France. This shows important cultural differences in the acceptance of light rail materialities in the urban environment, and more generally the common understanding of light rail compared to the other technological alternatives with which it is often compared. Bergen has not used the materialities of light rail as an active part of redefining urban space and mobility hierarchies in most central urban areas to the same extent as its counterpart. This is among other important arguments that arise due to the historical sensitivity of these central urban areas. Although Bryggen in Bergen is within a UNESCO World Heritage area, the reluctance to restrict car traffic in the city centre is still a controversial topic, even after the opening of the first light rail line. As a local journalist Geir Kvile (2013) argues, Bryggen is an almost holy cultural and historical site in Bergen, and the belief that new infrastructure is interacting with this place is a sensitive subject among citizens and decision-makers (even though cars and busses drive through this area every day). This argument has proven to be a downside of the light rail vision, and there are suggestions to place the light rail in a tunnel in the central urban areas in order to avoid interference with Bryggen, thereby making it more similar to a traditional metro system. Proponents of the light rail system argue that its accessibility will be lost if it is placed underground, and the visibility and constant reminder of the light rail as an alternative to the car would not be a visible choice in the urban environment. Kvile (2013) argues that: *"the light rail would create a lively environment around its stops, opposite to the busses and cars which scatters noise, pollution and a desert environment".*

4.5 The new face of the city – Landmarks and identity

As indicated in the case introductions, both cities' light rail systems are seen as a "trademark" of modernity, as well as an active part in providing a new, future-oriented identity for the city. Because the system is visual in the urban environment, all elements can become identity mediators, which create a mental, yet also very physical, image from which citizens can navigate (see Figure 7).

Mayor Jean-Claude Antonini from Angers describes the importance of the tram indicating the beginning of a new future and a next step into modernity:

"The inauguration of the Angers Loire métropole tram is a historic moment that will definitely move our city into a new modernity. There will be a before and after June 25, 2011 […]. At present, our city and its mobility is being upgraded and redesigned. Beyond a new and more efficient, more inclusive and cleaner means of transport, the tram has already helped to beautify the city and restore colour. It changes our view of the neighbourhoods it passes. It is a real link to all the inhabitants of the city. The train's rainbow identity will now benefit all Angevins of the town, as well as visitors […]. The revival of Angers is happening through the tram". (Antonini, 2011; own translation)

Politically, the light rail project in Bergen has also been perceived as a symbol of a modern, future-oriented city, as well as an important landmark and brand for the city. Gunn Vivian Eide, a local politician who has advocated strongly for the implementation of the light rail project and a remodelling of the mobility hierarchy in the city, describes how she per-


Figure 7: The light rail is in both cases framed as the new image of the city, and the material design communicates the local history and culture. Left: Angers light rail has been given a rainbow identity that is intended to lighten up the city. Right: Bergen light rail, with its orange identity, is based on the idea of a simple Nordic design with a bright colour that will works as a landmark (Photos by author).

ceives the light rail as a catalyst for a new urban lifestyle: *"It is more than transportation […] being the first city means a great deal" (Interview with Gunn Vivian Eide).*

Håkon Rasmussen, planner from Bergen municipality describes how this mental image of being a modern city has been brought in from experiences in other European countries:

"We usually say that we have tried to reach German precision and French design: so the contractor is German, but we have tried to think of design like the French, and we have visited Montpellier many times […]. When we started our project, they had some good experiences and it has had an incredible success […]. They have removed the cars from the city […] it is a very impressive and elegant system". (Research interview Håkon Rasmussen).

This shift into a modern urban image also proves to be an important trademark for the city. This has proven to be an economic asset for business in the city, which today sees the light rail as an important part of its future orientation and attractiveness. Managing director at Bergen business council, Marit Warncke commented on the positive interest derived from the light rail project in Bergen, which is seen as a positive asset for the branding of the city:

[W]e see a big interest from all over Europe to come and learn from the experiences we have made in Bergen, so that is quite positive […]. There has been a shift and everybody sees that we need to have a better public transport system. Before we had problems with congestion in Bergen […]. This has meant big challenges in relation to growth and the location of housing in relation to workplaces. (Research interview Marit Warncke).

This vision has been brought into the spatial and aesthetic design of the materiality and corridor so as to convey the

unique cultural and historical identity of the city. In this sense, the light rail has become a "landmark" in the city from which citizens can navigate, with the light rail lines being a much more visual element in the urban landscape than lines in a metro system. The stations, the vehicles and the tracks can be seen as both mobile and stationary landmarks. In comparison to the metro, the light rail enables navigation that is not simply from the stations. Furthermore, the tracks mark the urban areas and provide a constant presence of the transport infrastructure. In both Bergen and Angers, the pavement has been selected to visualise the presence of the light rail, but also to underline its shifting character along the alignment: in Angers, this is represented by green tracks; in Bergen, this is apparent in the shifting pavement types – varying from red on the urban parts of the line in shared traffic, to yellow on segregated tracks operating in the urban environment, to standard heavy rail tracks on the completely segregated tracks (see Figure 8).

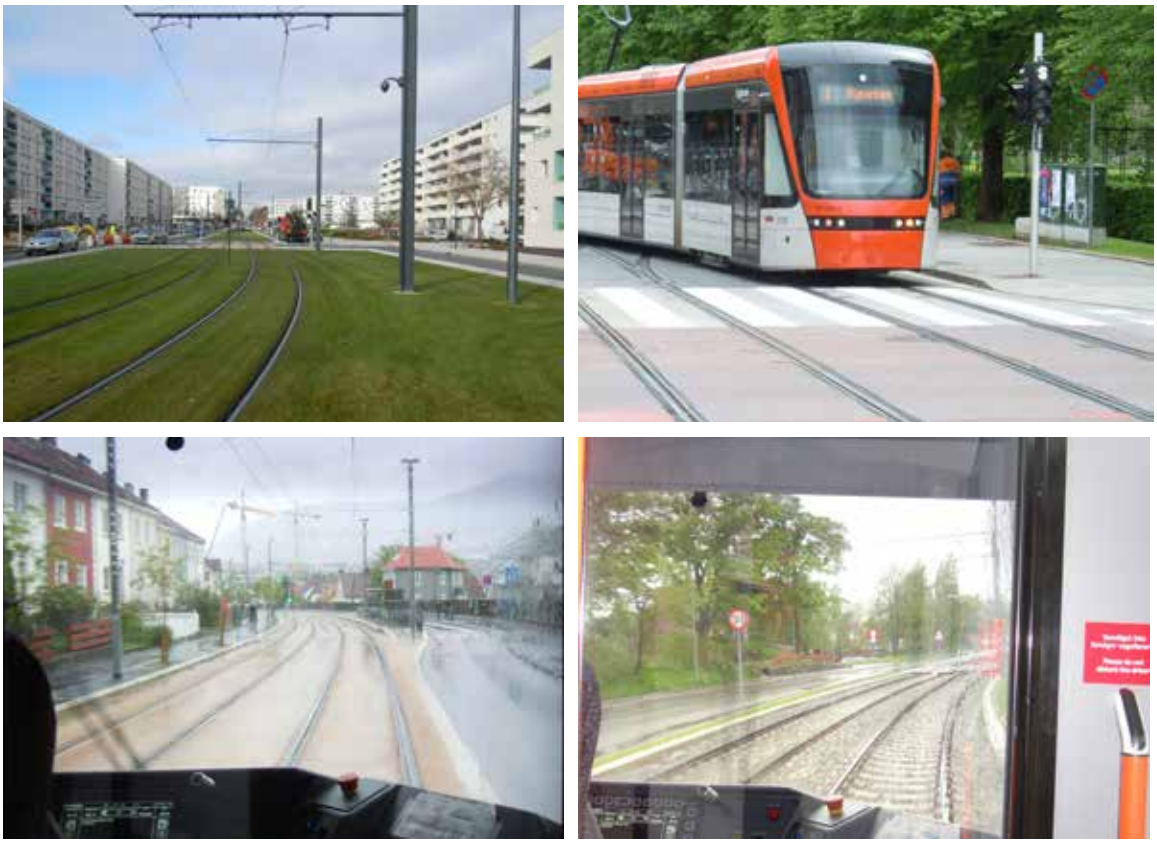


Figure 8: Different identities of the light railscape provided by a change in pavement. Above left: green tracks on 70% of the line in Angers, and on selected areas in Bergen. Above right: red pavement on the urban parts in Bergen. Below left: Yellow tracks in segregated tracks along existing infrastructure. Below right: Heavy rail tracks on the part completely segregated from the city. In this sense the materiality of the tracks and the pavement provides and mediates different identities in different districts along the line. (Photos by author).

In Angers, the light rail is framed as "the new face of the city" and it is thought to "merge with the landscape of the city and the region" (Angers Loire Metropole, 2011). Moreover, "The city is famous for agriculture and flowers and so the representatives wanted a tramline that represented this identity" (Interview with Pierre Luc Papin). Angers has a rich agricultural history, and this has also been integrated into the design of the tracks and infrastructure: 70% of the tracks are established as green tracks, and 1,600 trees have been planted in the light rail corridor (see Figure 8). In this sense, the light rail system appears to represent a green element in the urban environment. The vehicles used are a type Citadas delivered by the French company Alstom, which provides a very unique design to each city. Dominique Pierzo was the industrial designer behind the image of the Angers light rail. A rainbow identity was chosen as a bright "joining element in the city", thus creating a very visual appearance and a "mobile landmark" in a landscape dominated by grey and beige. Large window sections provide panorama views of the city, underlining the importance of creating a sensuous journey and further integrating the system into Angers' urban space. The interior mirrors the central characteristics of the city's culture and history. The ceiling and seats are decorated with flowers as a symbol of the local valleys. The stations are paved with locally extracted shale.

In Bergen, the orange colour of the light rail material and station sides creates landmarks that clearly delineate the central transit corridor (see Figure 8). The logo of Bybanen is placed at the top of the orange sides, and the word Bybanen or "urban rail" indicates that this is an urban project. The Danish Designer Kontrapunkt was responsible for the colour choice and states:

"The new light rail has in no time become a landmark of the city. It goes without saying that Bergen Bybane is our favorite track… The system and its elements are fully integrated into the social and natural landscape of the city… The rail system is well integrated and an important new layer has been added to this already culturally rich city" (Kontrapunkt, 2014).

Even though there was political and public resistance towards the project throughout the decision-making process, the project received a wide acknowledgement and prizes for its design and integration with the city.

5. CONCLUSIONS

The article has analysed the materiality and spatiality of light rail mobilities in two mid-size European cities. The article argues that it is important to understand the differences in materiality and spatiality of light rail systems, since this has important implications for its function as a mobility mode and its integration with urban space. This reflects a growing interest in, and awareness of, the importance of materialities in the social sciences (e.g. Dant, 2005; Law, 2004; Rowlands, 2005). It was shown how in addition to the city shaping the light rail project, the light rail project also reconfigures and shapes urban structures and planning practices, due to its material and spatial interaction with the city. The notion of "script" or "scape" was used theoretically to describe the landscape of light rail mobilities, and the hardware and software that have jointly enacted the specific local configuration of a "light railscape" in the two cases analysed. The interaction between politics, culture and history (the software) combined with the ways in which political visions have been incorporated into an object is central to understand the many local translations of the light rail concept. Additionally, it helps us to comprehend how the design and planning of infrastructure triggers certain ways of enacting the social world. A light rail holds a vision of the world that is inscribed in its material and spatial construction.

Clearly, an analysis of only two cases examples can appear too crude to be acknowledged as a comparative study; however, it is argued that the two cases provide insight into the production and practice of light rail systems in two

different national contexts. As discussed in the theory section, certain places, cultures and societies can give certain types of mobility particular kinds of meaning, and therefore light rail mobilities can be designed in such variable ways that it would not provide simply one answer to urban problems, but many. In Angers, the light rail is framed through a redesign vision and a reclaim of public spaces in favour of softer modes. This vision has materialised in a light railscape whose design and materiality supports the redesign and development of central districts along the corridor. Districts that are socially and physically diverse have been given the same visual and physical priority by the design of the new light rail corridor. The light rail materiality acts as an icon of modernity, and mediates the local identity and culture. In Bergen, the light railscape is configured differently from its French counterpart, but also proves to have many similarities. The light rail corridor in Bergen holds strong historical and cultural ties to when the city had a tram system and a rail-born connection to the suburb of Nesttun. This is also why the city has developed in radial structures, which in turn creates an optimal corridor for a light rail system. As opposed to Angers, the light rail project in Bergen is framed as a suburban corridor connecting the city centre with the suburbs (and subsequently the airport); this has important implications for the design, its function as a mobility mode and its integration with urban space. The light rail is largely segregated from the city, running along traditional railway tracks in order to achieve higher speeds. This implies that this system does not interact with or reconfigure the urban space to the same extent as in Angers, but does allow it to travel at higher average speeds (28 km/h compared to 18 km/h). Another important difference that has had implications for the material and spatial layout of Bergen's light rail is the acceptance of its interaction with public space and the potential restrictions on car traffic. Bergen and Norway do not possess the same light rail history as France, and has not been as accepted into the national and local policies or hearts of decision-makers. This highlights the significant cultural differences in the acceptance of the light rail materiality in the urban environment, and a more general common understanding of light rail's advantages over alternatives.

The case analysis furthermore proved that emergence of light rail as a new mobility system is not just a matter of creating capacity and reducing travel time. As exemplified in the two examples, politicians and planners' choice of corridor involves several other rationalities apart from getting people from A to B as efficiently as possible. In many light rail cities such as Bergen and Angers, accepting light rail technology can be considered a physical manifestation of change, or as a desire to return to a time before the car changed society's mental and physical landscape (see also Dennis & Urry, 2009). As a result, the system provides both mobility (as a transportation system) and immobility (with its dedicated infrastructure). In the corridors, however, the physical and mental presence of light rail tracks provides mental potentials for mobility, forming a mental map (Lynch, 1960) of new paths through the city. Consequently, they represent a visual alternative to the car.

As a specific material and spatial conceptual approach to rail-born urban transit, light rail offers a very different interaction with urban space than other comparable systems, such as metros or BRTs. Thus it was argued that material scripts for implementation of new public transport systems play a crucial role in the physical reorganisation of the city and the everyday lives of the citizens. These material scripts, and the discourses linked to them, redefine space and should be seen as inseparable parts of the urban morphology. As the findings in the article illustrate, localised light rail mobilities are based on very different material and spatial conceptual approaches, suggesting that it has been a tool in several different urban development and design strategies. In both Angers and Bergen, light rail was used in a redevelopment process of deprived urban areas, upgrading the district physically, while at the same time enhancing social balance in the city by creating new mental and spatial connections. These findings have implications for future transport and infrastructure planning and practice in general, specifically in terms of creating greater awareness of the relationship between planning, policy and materialities. As such, there is a need to "think in materialities" as a theoretical concept (see Law,

2004) within highly "material" professions such as transport and infrastructure planning, in order to increase awareness of relations between the framing of infrastructures and societal discourses, values and norms.

Moreover, future research into light rail systems should specifically focus on the social relations between light rail projects and redevelopment strategies. This is both in regards to how light rail has been integrated into area redesign and how projects are communicated to residents, which will aim to create ownership towards the area and thus a more positive image. In these cases, best practice methodologies should be developed to enhance the possibility of success in future redevelopment projects.

To conclude, this article is a first contribution to unfolding and creating a deeper understanding of the socio-technical framing of light rail as ab urban transit systems (Vannini et al., 2012). It furthermore provides the important claim that rail-born urban transit should not be seen as a uniform whole; in fact, there are important material and spatial differences that need to be considered in both future research and practice. However, as Foucault (1980) has argued in another context, it is worth noting that light rail distinctly belongs to the type of objects and phenomena that have so far been treated as having no historical or cultural relations by various professions and research areas (see above). This implies that more research is needed to understand both the politics and materiality that makes some urban transit systems more relevant than others in certain contexts. This also supports previous arguments in research that decisions relating to public transport are rarely founded using rational economic decision-support tools, but are used as active elements in a wider strategic urban focus that goes beyond the rationality of optimising flow and transport costs.

RESEARCH INTERVIEWS

BERGEN
Tom Potter, Chief Engineer Bergen Light Rail, May 2011
Håkon Rasmussen, Municipal Planner Bergen, May 2011
Gunn-Vivian Eide, Left-wing Bergen politician for "Venstre", May 2011
Karl Inge Nymann, SKYSS The Public Transport Company, Bergen May 2011
Magnus Vollset, author of the book On Track of the Bergen Light Rail, May 2011
Marit Warncke, Managing director at Bergen business council, November 2011

ANGERS
Olivier Sorin, Public Transport Policy Officer, Angers Loire Métropole, Angers November 2012
Pierre-Luc Papin, Technical Director Keolis Angers, Transport Operator, Angers, November 2012
Mathieu Voisin, Consultant at SYSTRA, Paris, November 2012

REFERENCES

Adey, P. (2010). Mobility. New York: Routledge.

Angers Loire Métropole (2005). Pour une agglomération, toujours en mouvement, circulons autrement! Angers: Angers Loire Metropole

Angers Loire Metropole (2011). depuis le 25 juin, cést Mon Tramway! Angers: Angers Loire Metropole.

Angers Loire Metropole (2012). Slides provided for the Aalborg Commitee, June. Angers: Angers Loire Metropole.

Antoft, R., & Houlberg, S. H. (2007). Det kvalitative casestudium -introduktion til en forskningsstrategi. In Håndværk og horisonter – tradition og nytænkning i kvalitativ metode (pp. 29-57). Odense: Syddansk universitetsforlag.

Antonini, J.-C. (2011, June 16). Inauguration du tramway. Retrieved November 20, 2013, from Angers Loire Metropole, http://tramway.angersloiremetropole.fr/s-informer/inauguration-du-tramway/

Augé, M. (1995). Non-places: Introduction to an anthropology of supermodernity. London: Verso.

Babalik, E. (2000). Urban rail systems: A planning framework to increase their success (Ph.D. thesis). University College London (UCL), London.

Babalik-Sutcliffe, E. (2002). Urban rail systems: Analysis of the factors behind success. Transport Reviews, 22(4), 415-447.

Bergen Kommune (2008). Kommuneplanens arealdel 2006-2017 (2025). Bergen: Bergen Kommune .

Bottoms, G. D. (2003). Continuing development in light rail transit in Western Europe – United Kingdom, France, Spain, Portugal and Italy. Paper presented at the Federal Transit Administration – 9th National Light Rail Transit Conference, November 16-18.

Bruijn, H. D., & Veeneman, W. (2009). Decision-making for light rail. Transportation Reserach Part A, 43(4), 349-359.
Büscher, M., Urry, J., & Witchger, K. (2010). Mobile methods. London: Routledge.

City of Bergen (2005). Design guidelines for architectural/built structures, environs and equipment for: Bergen light rail ("Bybanen"). Bergen: Bergen Kommune, Hordaland fylkeskommune, Statens Vegvesen.

Courrierdelóuest (2012, February 23). Angers. Jacques Landreau, le père du tramway : "L'inauguration, un grand stress". Retrieved December 13, 2012, from Courrierdelóuest.fr: http://www.courrierdelouest.fr/actualite/angers/article_-Angers.-Jacques-Landreau-le-pere-du-tramway-%20L-inauguration-un-grand-stress%20_28667-101_actualite.Htm

Cresswell, T. (2006). On the move: Mobility in the modern Western world. London: Routledge.

Dant, T. (2005). Materiality and society. New York: Open University Press.

Deng, T., & Nelson, J. D. (2011). Recent developments in bus rapid transit: A review of the literature. Transport Reviews: A Transnational Transdisciplinary Journal, 31(1), 69-96.

Dennis, K, & Urry, J (2009). After the Car. Oxford : Polity Press.

Dovey, K. (2008). Framing places: Mediating power in built form. London: Routledge.

Edwards, M., & Mackett, R. L. (1996). Developing new urban public transport. Transport Policy, 3(4), 225-239.

Flyvbjerg, B. (1991). Rationalitet og magt - bind 1 Det konkretes videnskab. København: Akademisk forlag.

Flyvbjerg, B. (2006). Five misunderstandings about case study research. Qualitative Inquiry, 12(2), 219-245.
Foucault, M. (1980). Language, Counter-Memory, Practice: Selected Essays and Interviews. Ithaca, NY: Cornell University Press. p. 139.

Frederiksen, T. (1996). Minimetro, tramway or light railway. Proceedings from Trafikdage Aalborg Universitet.Conference report Vol. 2 page 467

Graham, S., & Marvin, S. (2001). Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition. London: Routledge.

Hass-Klau, C., Crampton, G., & Benjari, R. (2004). Economic impact of light rail: The results of 15 urban areas in France, Germany, UK and North America. Environmental & Transport Planning. Berlin Heidelberg: Springer.

Hensher, D. A. (2006). Bus transport: Economics, policy and planning. Sydney: Elsevier.

Hodgson, P., Potter, S., Warren, J., & Gillingwater, D. (2013). Can the bus really be the new tram? Research in Transportation Economics, 39(1), 158-166.

Jensen, O. B. (2008). European metroscapes – The production of lived mobilities within the socio-technical metro systems in Copenhagen, London and Paris. Proceedings of the "Mobility, the City and STS" Conference. The Technical University of Denmark (DTU), Copenhagen 20/11/08 - 22/11/08

Jensen, O. B. (2013a). Staging mobilities. Aalborg: Routledge.

Jensen, O. B. (2013b). Designing mobilities – Staging materialities of mobilities. Paper for the Danish Sociology Congress "Mobilitet & By", Roskilde University, Denmark, January 14-15, 1-12.

Johansson, T. (2011). Nya spårvägar i mellanstora städer. Modern Stadstrafik, 4.

Kaufmann, V. (2002). Re-thinking mobility. London: Ashgate.

Kontrapunkt (2014). Bergen Bybane. Retrieved January 19, 2014, from Kontrapunkt: http://www.kontrapunkt.com/work/bergen-bybane

Kvale, S., & Brinkmann, S. (2009). Interview Introduktion til et håndværk (2nd ed.). Copenhagen: Hans reitzels forlag.

Kvile, G. (2013, November 26). Kampen om symbolene. ba.no, Retrived from: http://www.ba.no/meninger/article7005790.ece. 30/11/2013

Lassen, C., & Jensen, O. B. (2006). Mobilitetens sociologi på arbejde. Nordisk Samhällsgeografisk Tidsskrift, 41/42, 11-34.

Law, J. (2004). After method – Mess in social science research. New York: Routledge.

Lynch, K. (1960). The image of the city. Cambridge: MA: MIT Press.
Marling, G. (2013). Urban bike scapes in New York. Aalborg: Aalborg University.

Olesen, M. (forthcoming). Framing light rail projects – Case studies from Bergen, Angers and Bern. Case Studies on Transport Policy.

Olesen, M. (forthcoming). Making light rail mobilities period February 2011 – February 2014 (Ph.D. thesis). Aalborg University and COWI A/S, Aalborg.

Pineda, A. F. (2010). The design of large technological systems - The cases of Transmilenio in Bogotá and Metro in Copenhagen (Ph.D. thesis). Department of Management Engineering, Denmark Technical University, Copenhagen.

Rowlands, M. (2005). A materialist approach to materiality. In D. Miller (Ed.), Materiality (pp. 72-87). Durham, NC: Duke University Press.

Sheller, M., & Urry, J. (2006). The new mobilities paradigm. Environment and Planning A, 38, 207-226.

SYSTRA (2012). Comparative study on light rail transit (LRT) and bus with high level of service (BHLS) – Presentation made for the Aalborg transportation system – Denmark. Paris: SYSTRA.

Thelle, M. (2013). København 1900 - Rådshuspladsen som laboratorium for den moderne bys offentlige rum 1880-1914 (Ph.D. thesis). København: Det Humanistiske Fakultet Københavns Universitet.

Urry, J. (2000). Sociology beyound societies: Mobility for the twenty first century. London: Psychology Press.

Urry, J. (2007). Mobilities. Cambridge: Polity Press.

Vannini, P., Lucy, B., Jensen, O. B., Fisker, C., & Jirón, P. (2012). Technologies of mobility in the Americas. New York: Peter Lang.

Vollset, M. (2007). På sporet av Bybanen. Bergen: Bodoni.

Vuchic, V. R. (2000). Comparison of light rail transit with bus semirapid transit. 5th UITP Light Rail Conferenc e Melbourne, Australia. 9 October.

Weinstock, A., Hook, W., Replogle, M., & Cruz, R. (2011). Recapturing global leadership in bus rapid transit: A survey of select U.S. cities. Retrieved July 2013, from www.itdp.org: http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf

Wirasinghe, S., Kattan, L., Rahman, M., Hubbell, J., Thilakaratne, R., & Anowar, S. (2013). Bus rapid transit – A review.

International Journal of Urban Sciences, 17(1), 1-31.

Wright, L. (2002). Bus rapid transit: Sustainable Transport: a Sourcebook for Policy-makers in Developing Cities, ITDP, New York, USA. GTZ sustainable transport: A sourcebook for policy-makers.
Yaneva, A. (2009). Making the social hold: Towards and actor-network theory of design. Design and Culture, 1(3), 273-288.

Yin, R. K. (2009). Case study research - design and methods (4th ed.). Thousand Oaks, CA: SAGE Publications

FURTHER ACTIONS FOR PRACTICE

10

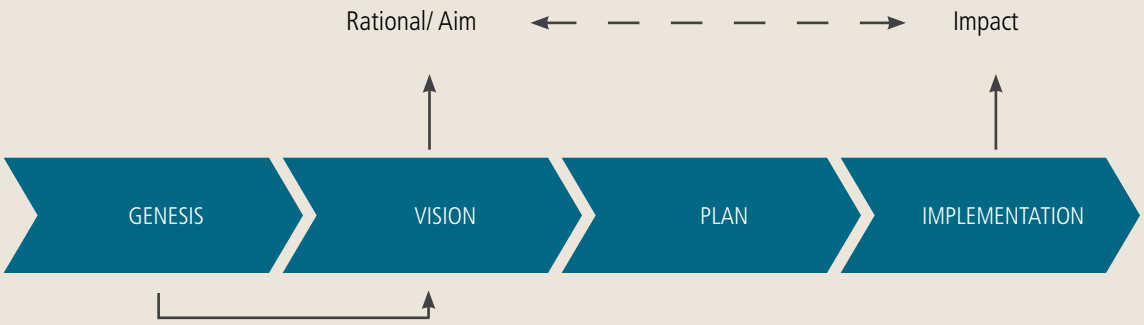


Figure 14 (repetition of figure 1 and 13): Phases in project implementation—illustration of a complex decision making and planning process that in reality is not as linear as shown the figure.

10. FURTHER ACTIONS FOR PRACTICE

10.1 PROLOGUE

In this chapter the policy and planning implications derived from the empirical findings in chapters 6 and 7 are discussed in order to create guidelines for implementing this knowledge in future practice. In this way the chapter addresses the third research question: 'How can the knowledge derived from the questions above be used in the future decision-making process for light rail projects?' (see also chapter 1). The goal of this chapter is not to develop an absolute model for how to successfully implement light rail projects in the future. As has been argued throughout the thesis, an absolute model is not possible or ideal, due to considerations of important contextual differences (as argued in chapters 5, 6 and 7). The purpose is rather to provide process-related guidelines that incorporate the relational qualitative knowledge produced through this thesis into the process of making light rail mobilities. The purpose of the chapter is twofold: it provides some basic steps to follow and consider for the strategic and practical implementation of a light rail project in the phases from vision to plan to implementation based on the central empirical findings in this thesis. This part places emphasis on creating the right level of ambition for the concrete project in relation to important contextual factors such as political will, available funds and resources, technical criteria and urban criteria. Secondly, the chapter provides a methodology to qualify and concretise the potential qualitative effects of a light rail project, which is rooted in an urban development perspective. This part is conceived as a supplement to the more quantitative rational decision support tools, such as transport models and cost benefit analysis, which evaluate the societal benefits of the project mainly in relation to travel time savings and traffic flow. The qualitative tool will provide a wider strategic perspective than these rational tools and emphasise and categorise the strategic values embedded in such projects. It will furthermore be a helpful tool in concretising and articulating the vision for a project as well as the material-spatial concept behind this vision (as argued in chapters 7, 8 and 9).

10.2. SOME BASIC STEPS

Implementing a light rail project should be understood as much more than just building a public transport infrastructure. As found in chapters 6 and 7, this is especially relevant in mid-sized European cities, where the need for extra capacity is not the main rationale behind the choice of light rail (except for the case of Bern). The choice is often grounded in a strategic urban development perspective. Light rail can be a strategic tool to reach a variety of objectives within the sustainable development, spatial planning, social development and economic development of the city. As was argued in chapter 1, the production and practice of light rail mobilities can be understood in relation to the different phases that the project enters (see also figure 14), and, as argued throughout the thesis, insight into contextual differences is important to understanding the mechanisms behind suc-

cess. In conventional transport planning approaches there has been a primary focus on the quantitative measurable impact of such systems (patronage, cost, travel time savings, etc.) in order to evaluate and justify the value of such systems. This knowledge has been based on previous experiences of impacts in similar cities. But as has been previously argued (see chapters 2 and 3), there has been a lack of understanding of the conditions under which these impacts were produced. Therefore it is also important to remember the previous phases, including the genesis of and objectives behind the project, in order to understand the close relations that these phases have to the actual spatial implications of the project as well as the meaning and objectives behind the project. In the following sections, each phase shown in figure 14 is further explained with a focus on highlighting the important considerations of each phase to the decision-making process. This elaboration will be based on the findings in the thesis.

10.2.1 Vision

In the vision phases, the discourses and rationales behind the project play an important role in the creation of a clear storyline for the project. It is furthermore important to institutionalise this storyline in all the relevant organisations that are involved in the project in order to create ownership of the vision. In all cases analysed, political leadership proved to be important, especially if the project was not based on a traditional socio-economic rationale but on a wider strategic political decision for the future development of the city. This is also why light rail projects in some cases have been placed directly under the mayor (in the case of Angers) in order to secure progress on the project and underline the political importance of the vision. As has been shown, especially in the Freiburg and Angers cases, the fact that decision makers speak the same language and carry the same perception of the project is central to creating an overall design of the system that supports these initial visions. In both Angers and Freiburg the political will and the strong leadership of the mayor were central to the implementation of a solid project from the initial ideas through the integrated planning approach and the concrete physical implementation of the project.

In the vision phase, problem definition is crucial to discussing and addressing the main issues this technology has been conceived to solve, from both a strategic and a concrete perspective. As was shown in chapter 2, especially in European cities, there has in many ways been a political bias in favour of the light rail system vs. similar systems such as Bus Rapid Transit. In the vision phase it is important to go beyond an isolated technological discussion and instead focus on the holistic perspective of the project and discuss how certain technologies may be more relevant than others. If it is a pure transport project aimed at efficient travel time, then the choice of technology, alignment and the placement of stops may prove to be very different than if it is conceived as an urban development and regeneration project. When the light rail travels at higher speeds, as is the case in the suburban part of Bergen light rail (see chapter 6), it does not allow integration into the urban environment in the same way that is possible with slower travel speeds, as is the case in Angers. In this initial phase it is the cultural, political and spatial relations that

the light rail technology are brought into that are central, because this project can be an important strategic actant in redefining the urban context and current planning practices. The conceptual layout of the project is therefore central to the wider design of the system in the later phases. As argued in chapters 7 and 9, the concept can be defined as 'the main ideas behind the layout and marketing of a given project', and, as is the case with any other business model, it is central to describing the rationale behind how the organisation creates, delivers and captures economic, social, cultural and other forms of value (see also section 8.3 of this chapter). This business model is later translated into central strategies that are reflected in planning and policy documents as well as in the material and spatial design of the system. In support of the vision, main objectives should be formulated to meet the challenges that the light rail project is set to solve. It is important to be careful about mixing objectives, since they can conflict. For example, faster travel speeds can be difficult to combine with access to central urban areas, as was the case in Angers. And redesign of the corridor can have negative effects on social inclusion because of gentrification and rising rent levels, as has been the case in some light rail corridors, e.g., Bergen and Freiburg. Examples of objectives could be:

- reducing travel times
- creating an image for the city
- redesigning the urban environment
- supporting urban development
- facilitating modal shifts from car to public transport
- restricting car use.

10.2.2 Plan

When the project enters the planning phase, visions are translated into concrete physical plans and visual representations of the objectives behind the system. As has been argued in chapters 2, 6 and 7, supportive policy measures are often crucial in meeting the objectives. Therefore the light rail project has to be considered in a wider policy packaging to understand the mechanisms behind success. It is thus important to define and consider how light rail should fit into existing policies in order to reach the central objectives of the system. Examples of such policies could be Urban Mobility Plans (as in the case of Angers), mobility management schemes, densification strategies (as in the case of Bergen), restrictive policies for car use in the city centre (as in the case of Freiburg), etc. In Bergen, a densification strategy was incorporated into the municipal plan, creating a strategic tool for placing urban development in the new corridor. There was a strategy for how to integrate each station into the urban environment and connect central destinations in the city. In Freiburg, the light rail is simply one part of an overall sustainable city vision, where there is also a focus on creating a city of short distances by banning big box shopping centres. Car traffic is restricted in the city centre, which has proved to be a successful tool in combination with an expansion of the light rail network. The success of the light rail network is thus closely related to these specific policy initiatives and concrete plans for reorganising urban development and the hierarchy of mobility in the city. Integration of

the vision and the general storyline behind the project is essential in the planning phase (and creating a linear implementation process, as argued in chapter 7), and this is also where the level of ambition for the light rail project is set, concerning objectives such as design and urban redevelopment in the corridor.. In the planning phase, communication with relevant stakeholders is central to the initial success of the system. In Angers, there was an extensive communication strategy that was supportive in all aspects of the implementation process, from creating ownership of the project for passengers, with life-sized mock-ups of the new light rail vehicle, to totems that visualised where the new stations would be placed. Dialogue with business owners was also an important part of this communication strategy in order to facilitate solutions and provide information about consequences for delivery of goods when access to certain areas was limited, a topic that has been controversial in many cases, especially in the case of Bergen light rail. Drawing on another reference case that is not included in the case analysis in this thesis, the implementation of the light rail system in Orleans, France showed how important positive communication of such a major change is. In Orleans, the construction-phase rent levels for apartments in the light rail corridor was 30% below average, and continued to be affected by these lower levels after the opening due in part to the bad image of the project, which was the result of a poor communication strategy (Hass-Klau, Crampton, & Benjari, 2004).

10.2.3 Implementation

In the material and spatial integration of the system there are several things to consider in relation to the design of the system and the corridor. Based on the findings in chapters 6 and 7, the most important factors can be summarised in the following themes:

- Technical criteria: What are traffic forecasts, urban environment, physical constraints and operation costs to consider? What are the considerations for integration with the existing public transport network?
- Urban criteria: What are the objectives for urban development, and to what extent do these objectives support the light rail vision?
- Political will: Is there political support for the light rail solution, and is it supported by policy measures that can help in meeting the objectives?
- Costs: What are the costs of the system? How is the construction and operation of the project financed? How does this fit with the level of ambition for the design of the system?

Political will is still of great influence in this phase, since this can be crucial in choosing one design over another. In the case of Angers, there proved to be a strong political focus on the aesthetic element of the design. This was also why representatives chose more expensive technical solutions such as the Confluence bridge and the APS system in order to bring about the redesign vision. Urban criteria are linked to the strategic integration of the systems with other development projects. Are there project interfaces that are important to consider? In Bergen, Angers, Bern and Freiburg, the implementation of the light rail

corridor has had a strong interface with other urban development projects, and the objectives behind these interfacing projects have had to be matched both strategically and on a very concrete physical level, down to the integration of stops at some of these new central urban hubs. The technical criteria define the material and physical limitations and challenges of the project. Which possibilities do the existing urban structures support, and which physical and mental barriers need to be considered? In the case of Bern, perspectives for future urban development were only possible in the west, and, furthermore, there was a mental separation between Bern and Bern West that had to be bridged. In Bergen there were some very concrete challenges that required the construction of tunnels to enable a certain travel speed to be attained, and in Angers the Confluence Bridge was a central material element in creating a new physical link across the river. Interfaces with existing traffic are also important to the design. How should the existing infrastructure be designed to support new mobility practices, and is there the political will to restrict car access in certain central parts of the city, as was the case in Freiburg? Interfaces with the existing public transport system are important to consider, too, since network effects are vital to a successful outcome. One example of a badly integrated network is the case of Nottingham light rail, which lost a considerable number of passengers when the light rail line was operated by a company that did not use the same tickets as the bus operators. This proved to be a very basic, but very important factor in the loss of patronage (see also Olesen, 2012a). In the following sections, a method for considering and concretising some strategic qualities of light rail projects throughout the decision-making process is introduced.

10.3 ACTIONS FOR STRATEGICALLY INVOLVING THE QUALITATIVE PERSPECTIVE IN LIGHT RAIL PLANNING

As has been argued in this thesis, multiple realities exist around light rail mobilities (see chapters 3 and 5). Furthermore, the case analysis (chapters 6 and 7) proved that the implementation of light rail projects, especially in mid-sized European cities, is often based on very different rationales than the socio-economic values of such projects, which have, from a conventional transport planning perspective, been seen as an objective and rational method for evaluating the societal value of light rail projects. However, the experiences of the four mid-sized European cities have proven that light rail projects can potentially contribute to other effects than those that are traditionally part of a socio-economic analysis (travel time savings, capacity and construction costs). These effects have previously been framed as qualitative or indirect effects (see also chapter 1) and have proven to be difficult to measure, generalise and price, since they can be viewed as strategic, aesthetic and cultural effects. These qualitative and strategic practices of light rail mobilities should thus not be handled in a rational instrumental sense; they can, however, be used as strategic guidelines for further actions in the planning of light rail.

One of the current challenges within planning light rail is that there are no methods for dealing with the potential implications of these strategic, aesthetic and cultural effects. Moreover, there is a need to understand under which mechanisms such effects/impli-

MARK
How is the potential qualitative effect understood?

ANALYSE
Where and under which mechanisms have these effects occurred elsewhere?

KNOW LIMITATIONS
Which uncertainties are potentially related to this effect, and what are some of the basic prerequisites for this effect to occur?

EXEMPLIFY
Provide concrete examples of initiatives taken in the project that will support the potential qualitative effect would occur.

Figure 15: MAKE method for involving qualitative perspectives in light rail planning.

cations occur. The strategic, aesthetic and cultural effects are often only articulated in a general sense in the vision phases of the project, and they are rarely explicitly related to concrete initiatives in the material and spatial layout of each individual project. The methodology developed in this chapter will make the connection between the visionary and the concrete (related to the phases previously introduced in this chapter) levels in order to understand the translation of qualitative effects from vision to plan to implementation, and hereby increase the probability of reaching a successful outcome and achieving the objectives behind the project.

As shown in chapters 6 and 7, the case analysis proved that the potential qualitative effects are equally as dependent on the context in which they are practised as the quantitative measurable effects, and should therefore be informed by previous experiences in comparable contexts. Therefore, this chapter provides guidelines for how to integrate awareness of the mechanisms behind the qualitative effects in future processes of creating light rail mobility. The method developed can be used to clarify the concept behind a project (as elaborated in chapter 6) and the concrete strategic and physical initiatives taken in support of this concept. If the goal is to develop a fast transport mode, as opposed to serving and redesigning central urban areas, the concrete materials and spatial initiatives required to support these concepts will be very different.

The method for including potential qualitative effects in future decision-making processes is based on four simple steps, moving from the strategic and visionary level to the concrete and practical initiatives that support these visions. This is presented in the MAKE method outlined in figure 15. In order to concretise the complexity of qualitative effects and make discussions about these more manageable for decision makers, these potential effects should be structured into rough categories. Although operating with a few delimited categories will never represent reality, this is nevertheless a practical tool for making qualitative knowledge operational. In the following sections, each step in the MAKE method is elaborated.

10.3.1 Step 1: Mark

As was previously argued, problem definition is crucial in planning and designing a light rail project, as it is in any other strategic urban project, in order to manage the concrete material and physical design of the system and create a holistic storyline for the project, from vision to implementation. Clear problem definition will also reduce the potential for conflict in the decision-making process. In the case of Bergen, there were so many conflicting perceptions and realities that the project was the most heavily discussed in Bergen in a period of 15 years. It is obvious that it is a challenging task to create a consensus around the objectives for a project. Nevertheless, discussion of them is crucial to defining the project and making important strategic decisions about the design of the project. In this first step, it is therefore important to define and describe the different potential qualitative effects that are relevant to the objectives of the project, in addition to the quantitative effects that are included in transport models and socio-economic analysis. Potential

STEP 1: MARK

POTENTIAL QUALITATIVE EFFECT	DESCRIPTION/CHARACTERISTIC
Urban development potential and quality of urban life	• The light rail as a tool to structure urban development • The light rail as an attractor for investment in the corridor—localising housing and workplaces • The light rail as a tool in regeneration processes—prioritising attractive public transport in certain urban areas • Transit space as urban space—the light rail as facilitator for new 'mobile' public spaces in the city • Light rail infrastructure potentially affords use of new materials that can be supportive in the creation of new public spaces • The light rail as a strategic tool in urban development strategies and new planning practices towards a sustainable focus—can be a physical guideline/restriction for future transit-oriented urban development. Added strategic value in existing and new policies.

Figure 16: Step 1: Mark in the MAKE method.

qualitative effects could be: quality of urban life, potential for urban development and redesign, urban branding, travel experience, etc. What are the characteristics of these potential qualitative effects and how can we define and mark such effects?
The definition of potential effects is closely related to the objectives of the vision behind the project. If one of the key elements in the project is to support urban development, then the potential of using the light rail in such a strategy should be explained. In Angers, the main objective behind the light rail project was to redesign the city, and this objective guided the project all the way from the initial phase down to the concrete implementation of the system. The special APS technology was a design chosen to assure the light rail could access the most sensitive architectural parts of the city and be a supportive tool in the redesign of the main city square, Place du Ralliement. Furthermore, the choices of alignment with central urban areas and frequent stops were not made to provide fast travel speeds. The objective behind these choices was to use the light rail alignment as the central axis in the redesign corridor and also as the backbone of a new urban development area (see chapter 6). Examples of the definition of potential qualitative effects are found in figure 16.

10.3.2 Step 2: Analyse

Since the descriptions in step one and the definition of potential qualitative effects are very general, there is a need to operationalise these descriptions by applying concrete case examples in which these mechanisms have occurred. Which strategic and concrete actions have been taken elsewhere that have been supportive of this objective? Figure 17 provides concrete examples from the case analysis, as well as experience from other relevant cases.

10.3.3 Step 3: Know Limitations

In this step, it is important to understand the uncertainties and conditions that are related to qualitative factors, since they are so closely related to other strategic decisions and societal trends that can affect the degree to which the effects occur. Therefore, it is important to reflect upon these conditions and uncertainties in order to address factors related to the successful resolution of the effect. Some of these conditions may be controversial, such as the need to restrict car access in certain areas. Nevertheless, since they can be crucial for meeting objectives, they are important to address and critically ponder. As has been illustrated in both chapters 2 and 6, restriction of car traffic when implementing light rail seems to be one of the major controversial topics, and evaluation of the performance of earlier systems has also confirmed that many cities have been reluctant to implement restrictive policies to facilitate modal shifts between cars and public transport. Failure to restrict car traffic has produced poor effects in congestion levels and has not boosted the attractiveness of public transport as expected. It is thus central to visualise the limited effect that a light rail project has on, for example, congestion levels when it is not supported by relevant policy measures. Likewise, resources and funding schemes are also central limitations that are very different from context to context. In the case of Angers, large parts of the overall budget were spent on the urban redesign process,

STEP 2: ANALYSE

POTENTIAL QUALITATIVE EFFECT	CASES, EXAMPLES AND EXPERIENCE
Urban development potential and quality of urban life	• Bergen, Norway: Municipal densification strategy and new planning practices, prioritising transit-oriented urban development in the light rail corridor. This has contributed to many new development projects in the corridor and increased the customer base for the light rail. Experience from the first years shows that the attractiveness of the corridor has gone up and house prices have increased. • Angers, France: The central square, Place du Ralliement, was redesigned, and car access and parking space were removed. This made available new urban space that was completely redesigned. The new pavement and greater security for pedestrians have created a very different urban environment, with outdoor dining and space for different events. The light rail provides mobility to this area. • Bern, Switzerland: The light rail is used to upgrade the public transport connection between Bern West and the old city centre. This is an important part of future urban development strategies in the West. The light rail is a 'mental tool' in this urban development process, where socially and physically deprived areas are upgraded. The tracks signal stability for investors in this future development and redevelopment process. • Freiburg, Germany: The light rail was used as a perquisite for developing new car-free/reduced urban districts (Vauban, Rieselfeld). These new districts are some of the most popular in Freiburg. The city centre has been regulated as a pedestrian zone, which is continuously extended and supported by new light rail lines. All light rail lines pass the very central square in the city of Bertoldsbrunnen. This is a central choice in the urban development strategy that secures direct mobility for passengers to the city centre. The city centre is a popular destination for tourists and other shoppers. Offices with access to the light rail have 15-25% higher rent levels than offices without access to the light rail, even though these offices may be closer to the city centre (Hass-Klau, Crampton, & Benjari, 2004).

Figure 17: Step 2: Analyse in the MAKE method.

STEP 3: KNOW LIMITATIONS

POTENTIAL QUALITATIVE EFFECT	DIRECT AND INDIRECT INFLUENCES ON OUTCOME
Urban development potential and quality of urban life	The success of a light rail project is determined by both direct effects and indirect effects. Direct effects are the political willingness to prioritise certain objectives and actions. Indirect effects are, on the other hand, external to the project and can be characterised as more general societal changes that have an effect on the outcome.The following parameters have proved to be of importance to attaining a successful outcome. Examples of direct effects: • Lack of strategic prioritisation of urban development in the light rail corridor • Restrictive policies for car traffic to enable the creation of new urban spaces • The degree to which strategies and resources have been allocated to support and promote a redesign process Examples of indirect effects: • Demographic changes • Financial crisis • Changes in national legislations

Figure 18: Step 3: Know limitations in the MAKE method.

STEP 4: EXEMPLIFY

IF YOUR AIM IS…	IMPORTANT ASPECTS COULD BE
To change current planning practice	• Use the light rail project actively to redefine relevant plans and strategies, as a strategic planning tool. In Angers, Bern, Freiburg and Bergen, the light rail has been an important element in redefining the spatial vision for future urban development.
To create an image and brand for the city	• Allocate funding for communication about this change project. Since some policies may be controversial, it is important to create ownership of the project and inform relevant stakeholders of the change process. Angers was successful in its communication, which made the implementation of the system easier and less controversial. • Consider whether the design of the light rail interior, trace and stations can be integrated into the unique identity and character of the corridor. In Bergen and Angers, a unique character and the story of the city and region were brought into the design for the entire system, which also secured a new brand for the cities.
To create new public spaces and improve quality of city life	• Define what is meant by 'quality of life'. If it means more secure places in the city centre without car traffic, then implement restrictive policies in support of this vision (as was the case in Freiburg and Angers). • Allocate resources to develop a strategy for new urban spaces in the corridor and activate the central areas around the stops as new activity centres in proximity to public transit. More functions could be integrated into these areas, such as shops, schools, public services, etc. (as was the case in the light rail corridor in Vauban and Rieselfeld, Freiburg).
To use light rail as a structuring element for urban development	• Make high-quality urban transit an essential and guiding element in the urban planning process. • Urban development and the urban transit infrastructure have to be coordinated, and the light rail should operate before new urban developments are brought into use (as was the case in the district of Rieselfeld, Freiburg and Angers). • Supplement the light rail corridor with densification strategies that will encourage new development in the corridor (as in Bergen) and integrate new activities actively at the light rail stops.
To use light rail to facilitate modal shifts	• Remember that the light rail is just a tool in a wider mobility chain. There is a need for supplementary initiatives that will make public transport more attractive. Create an easily understandable system! In the case of Bern and Freiburg, a smart and affordable ticketing system, nodes with good transfer opportunities, frequent departures, fitted timetables between local and regional systems and restrictions on car traffic proved to be equally important to reaching a good mobility outcome and creating incitement for modal shift. • Pay attention to short walking distances to stops, and integrate stops with everyday amenities that will encourage use of public transport for all sorts of trips (shopping, work, leisure). Freiburg has been very successful in creating a city of short distances that promotes sustainable modes.

IF YOUR AIM IS…	IMPORTANT ASPECTS COULD BE
To use light rail to promote social inclusion of deprived areas	• Use the light rail to create equal physical prioritisations of urban districts. Use the light rail as a tool in a wider physical and social regeneration process (as in Angers). • Create new physical and mental links in the city (as in Bern) and facilitate inclusive planning processes with the social groups that you want to use the system (as in Angers).
To use light rail to attract investment	• Invest in quality rapid transit to improve the image and/or identity of the city and the region. • Do not consider the light rail a 'magic stick'. The light rail is just a tool in a wider strategy for urban development, and the corridor must be fitted for this development, both physically and by relevant supportive policies (e.g. densification strategies). • Be aware of the effects of gentrification and make sure that the corridor is inclusive and not exclusive to some users and residents.
To capture increased real estate value	• Consider who wins the added value created in the corridor. Can this value be reallocated into future public investments in the city, or is it just a gain for private investors, which makes the increased value harder to justify from a public financing perspective? Be aware of methods for avoiding land speculation. • Can the increased attractiveness of the corridor be used actively to get private partners to invest in the system? • Consider taxes that can capture value, like the public transport tax introduced in France to finance high-quality public transport.

Figure 19: Step 4: Exemplify in the MAKE method.

which made Angers light rail a beautiful paradigmatic example of the redesign vision. It is, however, important to be aware of the extensive resources with which this design was carried out. Since funding schemes are very different from context to context, there are very different basic conditions for designing the systems. Figure 18 highlights some uncertainties and conditions that are connected to the potential qualitative effect used in this example. These conditions are divided into direct and indirect effects.

10.3.4 Step 4: Exemplify

The final step in the MAKE method is to relate the previous three steps to the concrete light rail project in all phases of the planning process. Many concrete choices in the planning and design of the system can affect the likelihood that the qualitative effect will occur. This step will, furthermore, allow discussion of the specific conditions of each project that may be relevant to the strategic, aesthetic, social, cultural and economic effects of the system. Figure 19 summarises examples of some objectives and the measures that need to be taken to support the successful realisation of these objectives. Figure 189can be extended with other aims and objectives that may be relevant; the following are simply examples.

10.4 EPILOGUE

The purpose of this chapter was to answer sub-research question no. 3: "How can the knowledge derived from the questions above be used in a future decision-making process for light rail projects?" This was done by introducing methods to integrate the findings of the thesis into future planning processes. Throughout the chapter it was argued that in order to learn from previous experiences in light rail projects it is important go beyond focusing only on the measurable implications of such systems (travel time savings, passenger levels, economic investment in the corridor etc.). An understanding of the conditions under which these implications were produced is equally important, to understand the conditions under which these was produced. Some basic steps were provided for considering the strategic and practical implementation of a light rail project in the phases from vision to plan to implementation. Secondly, it was argued that there is a need for supplementary qualitative tools to consider and concretise the potential qualitative and strategic values of light rail projects. The MAKE method was introduced in order to mark, analyse, know limitations and evaluate the potential qualitative effects that should be considered in each project. The method is based on the principle of using the examples of previous light rail systems to concretise the more general visions and objectives to specific political, spatial and material actions in the planning of new light rail projects. In this sense, the method translates qualitative aspects that can be seen as having a general character into a more concrete contextual frame of reference. The MAKE method should be used as a supplementary tool to the more quantitative decision support tools such as socio-economic analysis and traffic models in order to balance the quantitative and qualitative aspects of such systems in the decision-making process.

CONCLUSIONS

11

11. CONCLUSION

The basis for this thesis has been to analyse light rail mobilities as a strategic urban project that has been used as a planning tool in the visionary development towards sustainable and modern mid-sized European cities. The qualitative analytical approach of the thesis is a supplement to the more quantifiable technical and socio-economic perspectives on light rail mobilities. The qualitative approach provides in-depth, contextual insight into the strategic qualitative values of such projects in relation to less measurable outcomes such as creation of new urban environments, structuring urban development and facilitating new urban mobility practices and cultures, and to the general conceptual approach applied in each project. A review of previous research in chapter 2 highlighted a paradox saying that light rail continues to be built in spite of it from a socio-economic and conventional transport planning perspective; this seems like an irrational decision. This is especially evident in mid-sized European cities where there is often not a need for the extra capacity that the light rail can provide due to low passenger levels on public transport. Based on the review in chapter 2, it was therefore argued that the rational basis for light rail mobilities should be understood as being beyond transport issues and cost efficiency. This meant that there was a need to approach light rail mobilities from a qualitative perspective in order to analyse and discuss the ideologies, meanings and visionary politics behind these mobilities and trace the unique 'DNA' that comprises each project. Therefore, the thesis was based on the following main research question and sub-questions:

How are light rail mobilities politically and culturally produced and materially and spatially practiced in mid-sized European cities, and how can this knowledge be used in future decision-making processes for light rail projects?

- 1. Why are light rail systems implemented in mid-sized European cities, and what is the rational basis for the decision to implement them?
- 2. How have light rail projects changed urban spaces and mobility hierarchies in the selected cases of mid-sized European cities, and which factors have affected this process?
- 3. How can the knowledge derived from the questions above be used in future decision-making processes for light rail projects

The main research question has guided the research approach applied in the thesis, and the sub-research-questions correspond to certain chapters in the thesis. Sub-question 1 guided article 1, which was introduced in chapter 8. Sub-question 2 guided article 2, which was introduced in chapter 9, and sub-question 3 guided the decision support tools presented in chapter 10. The following sections will summarise the central arguments and main points in the thesis and underline the conclusions of the thesis based on the theoretical and empirical analysis. More specifically, this will be done by emphasising five central points that together will answer the main research question. After having dis-

cussed these concluding points' different perspectives, central themes for future research will be discussed based on the findings in this thesis.

Point 1: Light rail mobilities must be studied in relation to their political and cultural context. Furthermore, light rail mobilities must be considered in relation to the entire decision-making process, from vision to plan to implementation, in order fully to understand the contextual explanatory factors behind their production and performance.

In order to analyse and understand the production and practice of light rail mobilities, we must stick to the concrete, as argued in part one of this thesis. The implications of light rail mobilities cannot be explained separately from their context. Contextual political, cultural, technical and spatial differences are crucial for understanding and explaining different practices of light rail mobilities and their material and spatial implications. This approach requires in-depth qualitative methodologies to analyse the 'why and how' of light rail mobilities by using case study methodologies that make it possible to study a phenomenon within its context. A central aim in the research process has been to create a vocabulary that goes beyond universal descriptions of light rail as a technology detached from context in order to analyse the specific configuration and strategic value of a light rail project, moving beyond the perception of the light rail as a pure transport project. As stated in sub-research-question 1, it has been important to understand the rational basis behind light rail projects in mid-sized European cities in order to explain the unique DNA that comprises the specific project and has implications for its performance. As was also argued in chapters 1 and 2, previous research has not provided sufficient insight into the contextual 'meaning' of light rail mobilities, and thus misses important explanatory factors behind the rational basis for such systems and the effects that these qualitative factors has had on the performance of the system. As argued in chapter 2, previous research has never approached light rail from an interdisciplinary socio-technical mobility perspective focusing on the interplay between the political and cultural side and the material and spatial dimensions of such mobilities. Such an approach is, however, vital to understanding the role of light rail mobilities in a wider societal context.

The case study findings provided some important explanations to substantiate this first point, some of which will be used to concretise the argument in the following. In the case of Angers, the light rail moves with slower average travel speeds (18 km/h) than the busses it replaced (20km/h). This might be considered poor performance of the transport system, if the contextual background—rationality, concept and vision—is not included as an explanatory basis for this outcome. The main objective in Angers was to use the light rail as a strategic tool to redesign the corridor and redevelop the city. The material and spatial layout of the light rail was planned and designed to integrate with the city and serve central urban areas as well as supporting the creation and design of new public spaces. This objective proved to have implications for the average speed of the system, since the light rail has frequent stops, runs through shared pedestrian squares and runs on one-way tracks on parts of the line. All conceptual design elements have implications

for the average travel speed possible, and are important trade-offs to consider between travel time and design, if experiences should be transferred to future projects. In Angers, the light rail has achieved high patronage despite the fact that the light rail moves at a slower speed then the busses. Attractiveness is therefore also linked to other factors (see chapter 6). In relation to creating a new image for the city, improving urban spaces, and supporting possibilities for new mobility practices, the system can be considered successful. The corridor has been completely transformed, and the light rail has created new links between physically and socially diverse urban areas. The political prioritisation of connecting new high-end urban development with socially deprived districts has provided an inclusive alignment in which the material design of stations, tracks, etc. also provides equal political and physical prioritisation of the entire alignment. Despite the low travel speeds, the passenger levels are good, and there is strong public acceptance of the project. The light rail project has been used as a planning tool to structure urban development around transit lines, but organisational division of responsibility for public transport and placement of new urban developments between the Métropole and the municipalities has made integrated planning a challenging process.

Another example of the importance of using contextual factors to describe performance outcomes can be seen in the case study findings of Bergen light rail. In Bergen, the original light rail vision in 1989 was connected to a strong environmental discourse in which the aim was to decrease car traffic in the city centre by providing a fast public transport alternative. The performance of the system proves that the light rail has been successful in reaching passenger levels, but has failed in decreasing car traffic. The contextual explanatory factor behind this performance is that the final concept behind the system was not based on the environmental discourse, but on an urban development discourse. This means that when the light rail project was decided and funding was provided, there was no political will to restrict car use in the city centre, and it was thus not the environmental argument that moved the project forward. The main objective was to use the light rail as a central axis for future urban development that would be attractive from an investor's perspective. This created a material and spatial design with lower travel speeds and more frequent stops than the project that was first presented. It can thus be said that the project in Bergen has been successful as a tool to structure urban development, and has been an important actant in changing planning practices towards transit-oriented development and urban densification in the corridor. Nevertheless, in its first years it has not been successful in reducing car traffic. The light rail project has furthermore provided a strong brand for Bergen, and has created incentive for major companies to locate outlets in proximity to a light rail stop, creating better access to public transport alternatives for employees, and supporting new mobility practices in the longer term. Restrictive policies for car traffic may prove to enhance the use of the light rail if this policy measure is implemented later.

These case study findings illustrate the importance of including explanatory contextual factors in the understanding of performance. They further prove that qualitative values of

light rail mobilities are also important to consider if the light rail is practised as a strategic urban development project more than an efficient transport mode. Only by considering both the quantitative measurable outcomes and the strategic qualitative outcomes can we qualify and discuss perspectives and practices to consider in future projects.

Point 2: Analytically, the political and cultural production and material and spatial practice of light rail mobilities in mid-sized European cities should be understood through the interaction between 'language' and 'materiality'.

In chapter 3 it was argued that a qualitative study of the production and practice of light rail requires a relational understanding of mobilities, since light rail is always positioned in relation to something or somebody, be it government, geography, passengers, legislation, organisations, etc. No technology or infrastructure is power neutral; it is a part of a strategic local prioritisation. The theoretical position has thus been based on a socio-technical understanding of light rail mobilities inspired by 'the new mobilities paradigm' and furthermore draws on inspiration from actor–network theory (as argued in chapter 3). This theoretical approach places mobility centrally in the understanding of the social, and emphasises the important relationship between society and technological innovations and the way that these are co-producing each other. As argued in chapter 3, it is not possible to focus only on language in the study of the various socio-technical construction processes. The material does play a role in this process, and entities do achieve their form as a consequence of their relations—meaning that they are performed in, by and through these socio-technical relations. As proved by the case study findings, light rail has enacted new political and cultural practices in the mid-sized European cities analysed and has changed the urban morphology. Light rail is therefore not only understood as being a passive technology in a context; it is also part of actively reconfiguring this context and creating a foundation for new cultural and spatial practices such as pedestrianizing city centres and thereby perceiving transit space as public space (as in the case of Angers and Freiburg). The thesis explores both the political and cultural production of this technology and the spatial and material practice, and, most importantly, the interaction between these two dimensions (as argued in chapter 3). This analytical approach creates a holistic way of understanding both the political framing or 'language' and the spatial implications of the 'material' that these light rail projects are embedded in.

The case study findings provided some important explanations to substantiate this second point, some of which will be used to concretise the argument.. As made clear by the case study findings, the light rail projects have in all cases facilitated new planning practices, and have in many ways changed the understanding of public transport, from being a pure transport mode, to being a strategic and integrated element in urban spaces and the aesthetic design of mid-sized European cities. In the cases of both Angers and Bern, the light rail has also been designated a 'social role' in regards to changing the physical and mental image of socially deprived districts. This vision and discursive production of the project have been supported by a material and spatial design that support new public spaces

and activities in these socially and physically disadvantaged areas. This is an example of the interplay between the discursive visionary dimension of light rail projects as a tool in a regeneration process and the way that these discourses 'freeze' and change the urban configuration by supporting changes in the social and physical context—redefining the political and spatial status of certain urban districts. Another example is Freiburg, where the light rail has been an important strategic and physical element in the development of new urban districts (in the case of the new urban district Rieselfeld) and supporting a vision of an urban district based on the ideology of car-free living (in the case of the district Vauban). In Freiburg the light rail project is one of the many material and spatial 'traces' of the environmental discourse that has dominated policies and planning for decades. It is furthermore an important part of the 'Green City' brand that the city has successfully benefitted from in attracting residents and businesses with a green mind-set.

Point 3: Discourses of light rail mobilities have a universal character than can be understood as a 'travelling' idea within spatial planning.

As was explained in chapter 7 and 8, there is a universal language of light rail mobilities. The argumentation guiding the decision-making process for and against light rail in each of the cases analysed proves to be based on many of the same dominating discourses. These discourses provide interesting insights into the societal rationales, ideologies and meaning that are connected to light rail mobilities, from both a local and a global perspective. The understanding of the discourses for and against light rail is, furthermore, a valuable source in answering the part of the research question concerning how light rail mobilities are politically and culturally produced. It was argued that light rail mobilities are produced in the interplay between the challenges faced in the local context and the global focus on the need for more sustainable transport solutions. The modernised tram has again found its societal relevance in the need to cope with the challenges many mid-sized European cities are facing in the current society: the need for sustainable growth, attracting economic development in the global urban market and moving into the big-city league by creating a modern urban identity with attractive public transport systems and re-suburbanisation strategies.

In all four cases analysed, light rail is considered to be more than a transport project, and is discursively framed as a vision for the liveable modern and future-oriented city, a tool in urban development and regeneration, a solution to the struggle for space in cities and the lack of accessibility, a socially inclusive transport mode, just to mention a few of the discursive framings. The most central discourses used in the political framing against light rail projects, on the other hand, prove to be creating a cost-optimised transport system focusing on low construction costs and travel time savings, securing accessibility for car traffic to city centres, opposition towards technological fetishism in favour of rail-borne solutions.

The connection between vision, passion and power is central to the political and cultural

production of light rail mobilities, meaning that light rail projects are based on rationales beyond transport. A light rail project can be an active tool to envision new strategies for urban development and branding of a sustainable and future-oriented city, and politically it is often considered more as a strategic urban project than as an infrastructure project. This duality in the political framing of light rail projects makes it a challenging task to evaluate light rail projects purely from an infrastructure perspective. If other strategic considerations have guided the decision to choose a light rail over a bus solution, then these must be included in the evaluation of the project. Light rail proves to be a prerequisite for other important strategic actions, such as pedestrianizing city centres, creating new urban spaces, densification of central corridors and structuring urban development, visions integrated with the light rail project.

Point 4: Different material and spatial concepts and practices have guided the practice of light rail mobilities in mid-sized European cities and thus have different implications for urban spaces and mobility hierarchies.

As argued throughout the thesis and emphasised in point 1, light rail projects are not universal; they are shaped to materially and spatially fit the cultural and political production of such mobilities in each specific context. This means that light rail projects are never based on the exact same objectives; they are embedded in existing planning practices, the cultural production of the city and the history of urban politics and development. These are all elements that shape the material and spatial layout of light rail projects, what is also termed the 'concept' behind each project in chapter 7. When comparing the findings on the material and spatial layout of the four light rail projects, it was evident that the light rail vision has materialised differently in each context and the concept for implementing light rail thus varies from city to city. The idea and objectives behind the project is central to the definition of the material and spatial design of the system. Material and spatial concepts can be based on different ideas, such as enhancing social balance between physically and socially diverse urban areas. This can be done by creating a material and spatial design that creates new mental and physical connections between urban districts (as in Bern) and by visually upgrading the light rail corridor to underline the equal balance and strategic prioritisation of diverse districts (as in Angers). The conceptual approach can be guided by fully integrating the light rail into the central urban environment or 'the front side' of the city (as in Angers, Bern and Freiburg) or segregating the tracks from interaction with urban space and thereby securing higher travel speeds (as has been done in suburban parts of Bergen). Securing multi-modality can also be a guiding principle behind a light rail project (especially evident in Freiburg and Bern), with emphasis on creating central mobility nodes where different transport modes interact. The light rail is thus just a minor strategic part of a wider public transport system consisting of frequent and fitted timetables between regional and urban transport, attractive and easy accessible ticketing systems, integration with car-sharing schemes and park and ride facilities, etc. The many different conceptual approaches also prove to have very different implications for urban space and mobility hierarchies. For example, Angers represents a

case where the light rail has completely changed the urban environment and the districts it serves by a particular focus on both the material and spatial design of the system. It has not been successful in reducing the level of car traffic in the city centre, but an integrated conceptual approach in the project has been to implement bike paths in the light rail corridor. It has also created a street layout that induces lower travel speeds in the light rail corridor. In design encourage that mobility acts on behalf of softer transport modes in the light rail corridor. In Bergen, investors have proven very interested in locating activities in the light rail corridor, and the densification strategy has been a successful tool for dedicating development in this central urban corridor from the city centre to the airport (when the final part of the alignment is finished). The light rail has reached the expected passenger levels; it has, however, not been successful in reducing car traffic in the city.

Point 5: Qualitative methodologies must be included in planning practice for light rail projects in order to represent and concretise the expected strategic value of such projects. Both quantitative and qualitative values of light rail projects should be concretised and evaluated during the decision-making process and should work as supplements to each other.

The gap between the political visions and rationalities for implementing light rail mobilities and the results produced as the outcome of the socio-economic evaluation could call into question which factors actually determine whether the systems are built, and whether the existing quantitative decision support tools are sufficient for handling the complexity that is inherent in many larger infrastructure projects. It is a challenging task to incorporate the complexity of strategic qualitative prioritisations for light rail projects into quantitative decision support tools with fixed measurable categories. Furthermore, such an approach can be subject to many sources of error and can potentially be a black box simplifying complexity. It is, however, important to ensure consistent and transparent ways to prioritise infrastructure projects. One of the problems with the practice of including the qualitative value of light rail projects in the decision-making process is that it has not, so far, been done in a very systematic way. Whereas it is quite easy to set up concrete objectives for quantitative measures and to perform sensitivity analysis of these measures, it is a more challenging task to perform the same systematic evaluation of qualitative measures, because they are often not measurable. Chapter 9 therefore questioned whether the same systematic methodology is possible to achieve or even ideal from a qualitative perspective. As argued in chapter 10, one of the challenges with qualitative measures is that they often tend to become very general and not related to specific initiatives in the concrete project that will assure that qualitative strategic effects will actually occur. Therefore, it was argued that there is a need to develop more systematic ways to ensure that qualitative objectives are incorporated into the decision-making process and that strategies exist for achieving these qualitative objectives in the concrete project. Such a qualitative methodology would allow decision makers to make better-informed decisions based on the factors that influence the potential for reaching qualitative effects in light rail projects. These are effects such as creation of new urban environments, positive

image, modal shifts, behavioural changes, etc. In order to learn from previous experiences in light rail projects it is important go beyond the actual implications of such systems. An understanding of the conditions under which these implications were produced is equally important. Qualitative decision support tools can be used to consider and concretise the potential qualitative and strategic values of light rail projects in addition to the more quantitative effects evaluated through transport models and socio-economic analysis. Such an approach can also be used to emphasise not only the transport-related effects of such system, but also to acknowledge the urban strategies in which such projects are considered to be important perquisites. The qualitative tool will provide a wider strategic perspective on the rational quantitative decision support tools and also emphasise the strategic values embedded in such projects. It will furthermore be a helpful tool to concretise and articulate the vision, as well as the material-spatial concept behind this vision.

11.1 THEMES FOR FUTURE RESEARCH

Every research project must point towards future research areas based on its findings. On the basis of the conclusions of this thesis, some areas for future research are suggested.

Research area 1: How are light rail mobilities perceived and used by passengers; which qualitative and quantitative factors do passengers associate with such mobilities?

This thesis approached the process of making light rail mobilities from a strategic perspective and has therefore been concerned with the political and spatial practice of light rail mobilities only. In chapter 3, referring to the 'staging mobilities model' developed by Jensen (2013), it was argued that in order to fully understand the situational implications of light rail mobilities, attention should be paid to the physical setting, materials, spaces and design as well as the social interaction and embodied performances of mobilities. Important questions to answer in this regard are 1) how are light rail mobilities perceived and performed by passengers and citizens? This research field would provide both qualitative and quantitative insight into the experience of this mobility mode and the way that citizens perceive and use this new public transport mode. 2) How does it feel to travel along the light rail? How does one navigate and travel in relation to this new mode? 3) How has the light rail affected the image of public transport as well as the districts it connects? How and to what extent has the light rail changed travel behaviour and the experience of travelling? Research in this area would be especially beneficial in contexts where it is possible to conduct analysis before and after the light rail system was integrated.

Research area 2: Development of best practice methods to consider light rail mobilities in urban development and design strategies, based on different conceptual approaches

As the findings in this thesis proved, light rail mobilities have locally been based on very different material and spatial conceptual approaches. This means that the light rail

has been a tool in different urban development and design strategies. In both Angers and Bern, the light rail was used in a redevelopment process for deprived urban areas. The light rail was an integrated part not only of upgrading the district physically, but of enhancing the social balance in the city by creating new mental and spatial connections. Future research should focus on the social effect that light rail projects have had in redevelopment strategies both regarding how the light rail has been integrated into the redesign of the area and how the light rail project has been communicated to the residents in order to give them a sense of ownership of the area, thus creating a more positive image. Best practice methodologies should be developed to enhance the probability of success in future redevelopment projects.

New conceptual approaches to light rail mobilities could furthermore be analysed in order to find solutions that consider possibilities for reducing the heavy construction costs of light rail systems but still create an aesthetically beautiful design. Angers is an example of an expensive design approach. As a result of the financial crisis, the French city Besançon has planned its new light rail line on the concept of making a cost-optimised but aesthetically beautiful system. They have included different design criteria in this conceptual approach that are especially interesting for a mid-sized city. Some of these principles are briefly mentioned here: smaller vehicles creating a possibility for purchasing more vehicles and operating with higher frequencies. Choosing standard light rail material but displaying the city identity in the colours and naming of the vehicles. This is in direct contrast with Angers, which has a specific design for the 'nose' of the light rail vehicles that increased prices, and the APS system, which was already a big expense in the budget. Besançon has, furthermore, chosen a smaller design for depots and avoided the green tracks used in Angers.

Research area 3: Further development of the qualitative decision-making method MAKE

The qualitative decision-support method MAKE introduced in chapter 10 proposes some initial guidelines for how to incorporate considerations of qualitative strategic values of light rail mobilities into the decision-making process. The central argument behind the model was that it was necessary to concretise and qualify potential qualitative effects to make them more transparent for decision makers. The MAKE method is considered a supplement to the more quantitative decision support tools such as transport modelling and socio-economic analysis. There are potentials for further developing and refining the methodology used in the model. As the approach builds on previous context-dependent experiences it needs to be clear for planners and decision makers how to extract and compare results from one project to another. The model can be further developed in regards to defining more fixed qualitative categories that should be evaluated along with the quantitative aspects in the decision-making process. How qualitative values can be measured from an ex-ante perspective so that evaluation of the initiatives and follow-up is an integrated part of the planning and implementation process could also be analysed

and discussed. Guidelines should be developed for documenting and evaluating specific strategic initiatives.

REFERENCES

REFERENCES

Adey, P. (2010). Mobility. New York: Routledge.

Andersen, A. J. (2013). Urbane projekter mellem sted, diskurs og planlægning: Redskaber i strategisk byomdannelse (Ph.D. thesis). Aalborg: Aalborg University.

Angers Loire Métropole. (2005). Pour une agglomération tojours en movement circulons autrement! Angers: Angers Loire Métropole.

Angers Loire Metropole. (2007). Actors. Retrieved December 13, 2012, from angersloiremetropole.fr: http://tramway.angersloiremetropole.fr/choix-du-tram/les-acteurs/index.html

Angers Loire Métropole. (2007). Le tracé. Retrieved January 7, 2014, from tramway.angersloiremetropole.fr: http://tramway.angersloiremetropole.fr/trace-et-amenagements/le-trace/index.html

Angers Loire Metropole. (2011). depuis le 25 juin, cést Mon Tramway! Angers: Angers Loire Metropole.

Angers Loire Métropole. (2012). ANGERS URBAN COUNCIL—1st TRAM LINE—Aalborg Comittee. Angers: Power point presenation of the Angers light rail project for the visit of Aalborg light rail comitee.

Antoft, R., & Houlberg, S. H. (2007). Det kvalitative casestudium: Introduktion til en forskningsstrategi. In Håndværk og horisonter: Tradition og nytænkning i kvalitativ metode (p. 29-57). Odense: Syddansk universitetsforlag.

Antonini, J.-C. (2011, June 16). Inauguration du tramway. Retrieved November 20, 2013, from Angers Loire Metropole: http://tramway.angersloiremetropole.fr/s-informer/inauguration-du-tramway/

Arnoldi, J. (2003). Aktørnetværkteori: A-moderne (sociologisk?) teori. Dansk Sociologi, 14(3), 9-23.

Augé, M. (1995). Non-Places: Introduction to an Anthropology of Supermodernity. London: Verso.

Axhausen, K., Haupt, T., Fell, B., & Heidl, U. (2001). Searching for the Rail Bonus: Result from a panel SP/RP study. European Journal of Tansport and Infrastructure Research, 1(4), 353-369.

Babalik, E. (2000). Urban Rail Systems: A Planning Framework to Increase Their Success. Thesis submitted to the University of London for the degree of Ph.D. London: University of London.

Babalik-Sutcliffe. (2002). Urban Rail Systems: Analysis of the factors behind success. Transport Reviews, 22(4), 415-447.

Banister, D. (2008). The sustainable mobility paradigm. Transport Policy, 15, 73-80.

Beckman, S. (1994). On systemic technology. In J. Summerton, Changing Large Technical Systems (p. 311-332). Boulder:

Westview Press.

Beckmann, J. (2000). Automobilisering som mobilitetsparadigme: Refleksioner over biler, bilister og deres spatiotemporaliteter. DANSK SOCIOLOGI, 8-22.

Beim, M., & Haag, M. (2010, May 18-20). Freiburg's way to sustainability: The role of integrated urban and transport planning. Retrieved January 8, 2014, from REAL CORP 2010 Proceedings/Tagungsband - www.corp.at: http://www.corp.at/archive/CORP2010_56.pdf

Ben-Akiva, & Morikawa. (2002). Comparing ridership attraction of rail and bus. Transport Policy (9), 107-116.
Bentzen, A. (2008). Frp-lovforslag mot Bybanen . Bergen.no, http://www.nettavisen.no/ibergen/article443085.ece.

Bentzen, A. (2008). Frp-lovforslag mot Bybanen. Bergen.no, http://www.nettavisen.no/ibergen/article443085.ece.

Bergen Kommune. (2008). Kommuneplanens arealdel 2006-2017 (2025). Bergen: Bergen Kommune, Byrådsavdelingen for klima, miljø og byutvikling.

Bergen Kommune. (2013). Fakta om Bergen. Retrieved January 7, 2013, from Bergen Kommune: https://www.bergen.kommune.no/omkommunen/fakta-om-bergen

Bohman, J. (1999). Theories, Practices, and Pluralism: A Pragmatic Interpretation of Critical Social Science. Philosophy of the Social Sciences, 29, 459-480.

Bohman, J. (2002). How to Make a Social Science Practical: Pragmatism, Critical Social Science and Multiperspectival Theory. Millennium: Journal of International Studies, 499-524.

Bottoms, G. D. (2003). Continuing Development in Light Rail Transit in Western Europe: United Kingdom, France, Spain, Portugal and Italy. Federal Transit Administration. 9th National Light Rail Transit Conference, November 16-18.

Brinkmann, S. (2006). John Dewey: En introduktion. Copenhagen: Hans Reitzels Forlag.

Brinkmann, S. (2010). Mennekse og majs. Nordiske udkast, 1 & 2, 43-57.

Bruijn, H. D., & Veeneman, W. (2009). Decision makingfor light rail. Transportation Reserach Part A, 349-359.

Buanes, F. (2013, May 2). Størst prisvekst langs Bybanen. Retrieved January 7, 2014, from Bergens Tidende: http://www.bt.no/nyheter/okonomi/Storst-prisvekst-langs-Bybanen-2889466.html

Buck Consultants. (2000). LiRa Pilot 3: Light Rail, Economic Impact and Real Estate Development. Nijmegen/Amersfoort: LiRa: The Inte rnational Network of Light Rail Cities.

Buehler, R., & Pucher, J. (2011). Sustainable transport in Freiburg: Lessons from Germany's environmental capital. International Journal of Sustainable Transportation, 5, 43-70.

Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and fishermen af St. Brieu Bay. In J. Law, Power, Action, and Belief: A New Sociology of Knowledge (pp. 57-78). London: Routledge and Kegan Paul.

Cervero, R. (2007). Light Rail Transit and Urban Development. Journal of the American Planning Association, 50(2), 133-147.

City of Bergen. (2005). Design guidelines for architectural/built strucures, environs and equipment for: Bergen Light Rail ("Bybanen"). Bergen: Bergen Kommune, Hordaland fylkeskommune, Statens Vegvesen.

Courrierdelóuest. (2012, February 23). Angers. Jacques Landreau, le père du tramway : « L'inauguration, un grand stress ». Retrieved December 13, 2012, from Courrierdelóuest.fr: http://www.courrierdelouest.fr/actualite/angers/article_-Angers.-Jacques-Landreau-le-pere-du-tramway-%20L-inauguration-un-grand-stress%20_28667-101_actualite.Htm

Cresswell, T. (2004). Place: A short introduction. Oxford: Blackwell Publishing.

Cresswell, T. (2006). On the move: Mobility in the modern Western World. London: Routledge.

Deng, T., & Nelson, J. D. (2011). Recent developments in bus rapid transit: A review of the literature. Transport Reviews: A Transnational Transdisciplinary Journal, 31(1), 69-96.

Dewey, J. (1948). Reconstruction in Philosophy. Boston: Beacon Press.

Dewey, J. (1986). The Theory of Inqury, Vol. 12, The later works. Carbondale: Southern Illinois University Press.

Dewey, J. (1991). The Pattern of Inquiry. In J. Dewey, The Later Works, 1925-1953, Vol. 12. Carbondale: Southern Illinois University Press.

Dovey, K. (2008). Framing Places, Mediating Power in Built Form. London: Routledge.

Downey, G. L. (2005). Are Engineers Losing Control of Technology? From "Problem Solving" to "Problem Definition and Solution" in Engineering Education. Chemical Engineering Research and Design 83(A8), 1-12.

Duncan, M. (2011). The synergistic influence of light rail stations and zoning on home prices. Environment and Planning A, 43, 2125-2142.

Edwards, M., & Mackett, R. L. (1996). Developing new urban public transport. Transport Policy, 3(4), 225-239.

Egger-Jenzer, B. (2010, December 11). Die Direktorin. Retrieved November 8, 2013, from Kanton Bern: http://www.bve.be.ch/bve/de/index/direktion/direktor/referate.assetref/content/dam/documents/BVE/GS/de/DIR_Referat_Er%C3%B6ffnung_TBW_VIP-Event_101211.pdf

Farias, I., & Bender, T. (2010). Urban Assemblages: How Actor-Network Theory Changes Urban Studies. New York: Routledge.

Flyvbjerg, B. (1991). Rationalitet og magt: Bind 1. Århus: Akademisk Forlag.

Flyvbjerg, B. (1998). Rationality and Power: Demoracy in Practice. Chicago: The Universty of Chicago Press.

Flyvbjerg, B. (2001). Making Social Science Matter. Cambridge: University Press.

Flyvbjerg, B. (2003). Megaprojects and risks. Cambridge: University Press.

Flyvbjerg, B. (2004). Phronetic Planning Research: Theoretical and Methodological Reflections. Planning Theory and Practice, 5(3), 283-306.

Flyvbjerg, B. (2006). Five Misunderstandings About Case Study Research. Qualitative Inquiry, 12(2), 219-245.

Frederiksen, T. (1996). Minimetro, Tramway or Light Railway. Procedings from: Trafikdage Aalborg Universitet, 1-12.

Frey, W. (2011). Freiburg the Green City: Approaches to Sustainable Urban Development. Freiburg: Herder.

Gad, C., & Jensen, C. B. (2007). Post-ANT. In C. B. Jensen & F. Olesen, Introduktion til STS: Science, Technology, Society (p. 93-118). København: Hans Reitzels Forlag.

Gimmler, A. (2005). American Pragmatism: Creativity in Everyday Life. In J. a. Kristiansen, Hverdagslivssociologi. Copenhagen: Hans Reitzels Forlag.

Gimmler, A. (2012). Pragmatisme og "Practice Turn". Slagmark, 64, 43-59.

Gospodini, A. (2005). Urban Development, Redevelopment and Regeneration Encouraged by Transport Infrastructure Projects: The Case Study of 12 European Cities. European Planning Studies, 13(7), 1083-1111.

Groneck, C. (2003). Neue Strassenbahnen in Frankreich: - Die Wiederkehr eines urbanen Verkehrsmittels. Freiburg: EK-Verlag.

Hajer, M. (1995). The Politics of Environmental Discourse: Ecological Modernization and the Policy Process. Oxford: Oxford University Press.

Hajer, M. A. (2006). Doing discourse analysis: Coalitions, practices, meaning. In M. v. (ed.), Words matter in policy and planning: Discourse theory and method in the social sciences (p. 65-74). Utrecht: Netherlands Geographical Studies.

Hajer, M. A. (2013). FAQ. Retrieved October 24, 2013, from Maarten Hajer: http://www.maartenhajer.nl/?page_id=14

Handy, S. (2005). Smart Growth and the Transportation-Land Use Connection: What Does the Research Tell Us? INTERNATIONAL REGIONAL SCIENCE REVIEW, 28(2), 146-167.

Hartmann, K., Lampe, F., Monsen, O., & Prestmo, O. (2006, November 26). Milliardsluket Bybanen - debat. Retrieved

October 9, 2013, from Bergens Tidende: http://www.bt.no/meninger/Milliardsluket-Bybanen-1822488.html

Hass-Klau, C., Crampton, G., & Benjari, R. (2004). Economic impact of light rail: The results of 15 urban areas in France, Germany, UK and North America. Environmental & Transport Planning.

Hastrup, K. (2010). Feltarbejde. In S. Brinkmann, & L. Tanggaard, Kvalitative metoder: En grundbog (p. 55-80). København: Hans Reitzels Forlag.

Hensher, D. A. (2006). Bus Transport: Economics, Policy and Planning. Sydney: Elsevier.

Hildeband, D. l. (2008). Public Administration as Pragmatic, Democratic and Objective. Public Administration Review, March/April, 222-229.

Hodgson, P., Potter, S., Warren, J., & Gillingwater, D. (2013). Can bus really be the new tram? Research in Transportation Economics, 39(1), 158-166.

Hughes, T. (1998). Rescuing Prometheus. New York: Vintage Books.

Ingold, T. (2008). When ANT meets SPIDER: Social theory for arthropods. In C. K. Malafouris, Material Agency: Towards a Non-anthropocentric Approach (p. 209-2015). Boston: Springer.

Innovation Academy e.V. (2013). Sustainable urban development in Freiburg. Freiburg: Innovation Academy e.V.

Jensen, C. B. (2010). STS. In S. Brinkman, & L. Tanggaard, Kvalitative Metoder (pp. 375-388). Copenhagen: Hans Reitzels Forlag.

Jensen, C. B., Lauritsen, P., & Olesen, F. (2007). Introduktion til STS: Science, Technology, Society. København: Hans Reitzels Forlag.

Jensen, O. B. (2007). City of Layers: Bangkok's Sky Train and How it Works in Socially Segregating Mobility Patterns. Schweizerische Zeitschrift fur Soziologie, 33(3), 9-28.

Jensen, O. B. (2008). European Metroscapes: The production of lived mobilities within the socio-technical Metro systems in Copenhagen, London and Paris. Proceedings of the 'Mobility, the city and STS' Conference. The Technical University of Denmark (DTU), Copenhagen.

Jensen, O. B. (2012). If only it could speak: Narrative explorations of mobility and place in Seattle. In P. Vannini, L. Budd, O. B. Jensen, C. Fisker, & P. Jirón, Technologies of Mobility in the Americas (p. 59-75). New York: Peter Lang.

Jensen, O. B. (2013). Staging Mobilities. Aalborg: Routledge.

Jensen, O., Wind, S., & Lanng, D. B. (2012). Critical points of contact: Between urban networks and flows. In V. Andrade, S. Smith, & D. B. Lanng, Musings: An Urban Design Anthology (p. 66-73). Aalborg: Aalborg University Press.

Johannson, T. (2011). Nya Spårvagar i mellemstore Städer. Modern Stadstrafik, 4, 5-24.
Johansen, K. W., & Strand, A. (2005). MetroBuss – et likeverdig og mye rimeligere alternativ. Plan, 5, 22-25.

Jones, O. (2008). Stepping from the wreckage: Geography, pragmatism and ant-representational theory. Geoforum, 39, 1600-1612.

Kain, J. (1988). Choosing the wrong technology: Or how to spend billions and reduce transit use. Journal of Advanced Transportation, 197-213.

Kanton Bern. (2008). Gesamtmobilitätsstrategie. Bern: Kanton Bern.

Kanton Bern. (2010, December 11). Eröffnung Tram Bern West - Die Hauptstadt wird zur Tramstadt. Retrieved January 23, 2014, from Kanton Bern: http://www.be.ch/portal/de/index/mediencenter/medienmitteilungen/suche.meldungNeu.html/portal/de/meldungen/archiv/archiv9/mm_9594

Kanton Bern, Bern Mobil, Energie Wasser Bern, Stadt Bern. (2012). Dossier Tram Bern West: Stadtraume gestalten.

Kanton Bern; Stadt Bern; Bern Mobil; Energie Wasser Bern. (2012). Dossier Tram Bern West. Bern: Kanton Bern, Stadt Bern, Bern Mobil, Energie Wasser Bern.

Kaufmann, V. (2002). Re-Thinking Mobility. London: Ashgate.

Kaufmann, V. (2004). Social and political segregation of urban transportation: The merits and limitations of the Swiss cities model. Built Environment, 30(2), 146-152.

Kirkeby, O. F. (1990). Abduktion. In H. Andersen, Videnskabsteori og metodelære (3 udgave) (p. 119-149). København: Samfundslitteratur.

Knowles, R. D. (2006). What future for light rail in the UK after Ten Year Transport Plan targets are scrapped? Transport Policy, 14, 81–93.

Kvale, S., & Brinkmann, S. (2009). Interview Introduktion til et håndværk, 2. udgave. Copenhagen: Hans Reitzels Forlag.

Kvile, G. (2013, November 26). Kampen om symbolene. ba.no, p. http://www.ba.no/meninger/article7005790.ece.

Lahrmann, H., & Leleur, S. (1994). Trafikteknik & Trafikplanlægning. Lyngby: Polyteknisk Forlag.

Lakoff, G., & Johnson, M. (2008). Metaphors we live by. Chicago: University of Chicago Press.

Lassen, C. (2006). Aeromobility and work. Environment and Planning A, 38, 301-312.

Lassen, C. (2011). Det nye mobilitetsparadigme! Trafik og Veje Februar, 18-19.

Lassen, C., & Jensen, O. (2006). Mobilitetens sociologi på arbejde. Nordisk Samhâllsgeografisk Tidsskrift, 41/42, 11-34.

Latour, B. (1988). Pasteurization of France. Cambridge, MA: Harvard University Press.

Latour, B. (1996). Aramis, or the Love of Technology. Cambridge, MA: Harvard University Press.

Latour, B. (2005). Re-assembling the Social: An Introduction to Actor-Network-Theory. Oxford: Oxford University Press.

Latour, B., & Woolgar. (1986). Laboratory Life: The Construction of Scientific Facts. 2nd Edition. Princeton: Princeton University Press.

Launsø, L., & Rieper, O. (2000). Forskning om og med mennesker: Forksningstyper og forskningsmetoder i samfundforskningen. Nyt Nordisk Forlag Arnold Busk A/S 4. udgave, 1. oplag.

Law, J. (1999). After ANT: Complexity, Naming and Topology. In J. Law, & J. Hassard, Actor Network Theory and After. Oxford: Blackwell.

Law, J. (2004). After method: Mess in social science research. New York: Routledge.

Law, J., & Hassard, J. (1999). Actor Network Theory and after. Oxford: Blackwell Publishing.

Lee, S., & Senior, M. (2013). Do light rail services discourage car ownership and use? Evidence from Census data for four English cities. Journal of Transport Geography, 29, 11-23.

Lekve, M. (2013, May 27). Tilgang til infrastruktur øker boligprisene: . Retrieved June 3, 2013, from Dine penger Nærhet til bybanen «verdt» 300.000 kroner: http://www.dinepenger.no/bruke/naerhet-til-bybanen-verdt-300-000-kroner/20372982

Letbanen. (2013, September 6). Om letbanen. Retrieved from Letbanen: http://www.letbanen.dk/om-letbanen/

Levinson, H. S., Allen, J. G., & Hoey, J. G. (2012). Light Rail Since World War II: Abandonments, Survivals, and Revivals 19:1. Journal of Urban Technology, 65-79.

Lundhede, T. H., Panduro, T. E., Kummel, L., Ståhle, A., Heyman, A., & Thorsen, B. J. (2013). Værdisætning af bykvaliteter: Fra hovedstad til provins. København: Københavns Universitet.

Lynch, K. (1959). The Image of The City. London: The MIT Press.

Lynggaard, K. (2010). Dokumentanalyse. In S. Brinkmann, & L. Tanggaard, Kvalitative Metoder: En grundbog (p. 137-150). København: Hans Reitzels Forlag.

Mackett, R., & Edwards, M. (1998). The impact of new urban public transport systems: Will the expectations be met? Transportation Research, 231-245.

Mackett, R., & Sutcliffe, E. (2003). New urban rail systems: A policy-based technique to make them more succesful. Journal of Transport Geography, 11(2), 151-164.

Marling, G. (2013). Urban Bike Scapes in New York. Aalborg: Aalborg University.

Massey, D. (2005). For Space. London: Sage.

Melchior, N. (2008). Kollektiv Trafik: Forudsætninger, planlægning og eksempler. Aalborg: Aalborg Universitets Skriftserie No. 315.

Ministry for Ecology, Sustainable Development and Energy. (2012). The Tramway Revival in France. Ministry for Ecology, Stustainable Development and Energy.

Mol, A. (1999). Ontological Politics. A Word on Some Questions. In J. Law, & J. Hassard, Actor Network Theory and After (p. 74-89). Oxford: Blackwell Publishers.

Mol, A. (2002). The Body Multiple: Ontology in Medical Practice. London: Duke University Press.

MVG. (2008). The Modern Tram In Europe. München: Müncher Verkehrgesellschaft GmbH.

Neubert, S. (2001). Pragmatism and Constructivism in Contemporary Philosopical Discourse. University of Cologne, working paper.

Nilsen, T. B. (2011, January 18). Bybanen bremser ikke biltrafikken fra sør. Fanaposten.

Oldrup, H. (2000). Mod en sociologisk forskning i transportadfærd. Dansk Sociologi, 1(11), 73-80.

Olesen, M. (2012). Letbanens Koncept - effektivt transportsystem, generator for byudvikling eller meget mere? Proceedings from the Annual Transport Conference, 1-10.

Olesen, M. (2012a). Skinnefaktor eller systemfokus. Trafik og Veje, 12, 4-7.

Olesen, M., & Nicolaisen, M. S. (forthcoming). Vision vs. evaluation of light rail projects: Case studies from Denmark. Sumbitted to Journal of Transport Geography.

Peirce, C. S., Hartshorne, C., Weiss, P., & Burks, A. W. (1974). Collected papers of Charles Sanders Peirce Vol. 1-6. Cambridge, MA: Belknap Press of Harvard University Press.

Pickrell, D. (1992). A Desire Named Street Car: Fantasy and Fact in Rail Transit Planning. Journal of the American Planning Association, 58, 158-176.

Pineda, A. F. (2010). The Design of Large Technological Systems: The cases of Transmilenio in Bogotá and Metro in Copenhagen. Copenhagen: Ph.d. thesis Denmarks Technical University: Department of Management Engineering.

Polanyi, M. (1958). Personal Knowledge: Towards a Post-Critical Philosophy. Chicago: Chicago Press.

Priemus, H., & Konings, R. (2001). Light rail in urban regions: What Dutch policymakers could learn from experiences in France, Germany and Japan. Journal of Transport Geography, 9(3), 187-198.

Pulling, N. (2012). Looking back in Angers. www.tramnews.net and www.lrta.org, August, 294-298.

Richmond, J. (1998). The mythical conceptions of rail transit in Los Angelses. Journal of Architecture and Planning Research, 15, 294-320.

Rittel, & Weber. (1973). Dilemmas in General Theory of Planning. Policy Sciences, 4, 155-169.

Rytz, R. (2010, December 11). Einweihung Tram Bern West vom 11./12. Dezember 2010. Retrieved November 8, 2013, from www.mm.ch: http://www.mm.directories.be.ch/files/5935/16673.pdf

Sayer, A. (1992). Method in social science: A realist approach. London: Routledge.

Scherer, M. (2009). Is light rail more attractive to users than bus transit? TRB 2010 Annual Meeting.

Schick, P. (2011). Urban development & transportation planning in Freiburg im Breisgau - power point slides. Freiburg: Stadt Freiburg.

Sekretariatet for Fonden Aarhus 2017. (2013, September 6). Rethink 2017: Aarhus Europæisk Kultur Hovedstad. Retrieved 2013, from Rethink 2017: Aarhus Europæisk Kultur Hovedstad: http://www.aarhus2017.dk/

Sheller, M., & Urry, J. (2006). The new mobilities paradigm. Environment and Planning A, 38 , 207-226.

Sourisseau, Y. (2011, June 29). Jacques Landreau, Monsieur Tram, pose ses valises. Retrieved November 20, 2013, from AngersMag: www.angersmag.info/Jacques-Landreau-Monsieur-Tram-pose-ses-valises_a2949.html

Stadt Bern. (2010). Vortrag des Gemeinderats an den Stadtrat - Tram Bern West; überarbeitetes Projekt (abstimmungsbotschaft). Bern.

Stadt Bern. (2010a, 11-12 December). Einweihung Tram Bern West vom 11./12. Dezember 2010. Retrieved January 23, 2014, from Kanton Bern: http://www.mm.directories.be.ch/files/5935/16673.pdf

Stadt Bern. (2006). Botschaften des Stadtrats an die Stimmberechtigten: Gemeindeadstimmung vom 26. November 2006. Bern: Stadt Bern.

Statens Vegvesen. (2012, November 30). Vakre vegers pris til Bybanen i Bergen. Retrieved December 23, 2013, from Statens Vegsesen: http://www.vegvesen.no/Om+Statens+vegvesen/Media/Nyhetsarkiv/Nasjonalt/Vakre+vegers+pris+til+Bybanen+i+Bergen.403274.cms

Statens Vegvesen. (2013, October 15). På veg for et bedre samfunn. Retrieved January 8, 2014, from Statens Vegvesen: http://www.vegvesen.no/Om+Statens+vegvesen/Om+Statens+vegvesen/Om+organisasjonen

Statens Vegvesen; Bergen Kommune; Hordalands Fylkeskommune. (2013). Bergens Programmet - Transport, Byutvikling og Miljø. Retrieved December 23, 2013, from Bergens Programmet: http://bergensprogrammet.no/

Svanes, M. (2008). Fremtidens byer Bybane som problemløser - slides v. Plansjef Mette Svanes. Bergen: Bergen kommune, Klima, miljø og byutvikling.

SYSTRA. (2012). Comparative Study on Light Rail Transit (LRT) and Bus with High Level of Service (BHLS): Presentation made for the Aalborg Transportation System, Denmark. Paris: SYSTRA.

Tait, M., & Jensen, O. B. (2007). Travelling ideas, power, and place: The cases of urban villages and business improvement districts. International Planning Studies, 12(2), 107-127.

Thayer-Bacon, B. (2002). Using the "R" word again: Pragmatism as qualified relativism. Philosophical studies in education, 33, 93-103.

The National Audit Office. (2004). Improving public transport in England through light rail. London: The National Audit Office.

Thelle, M. (2013). København 1900: Rådshuspladsen som laboratorium for den moderne bys offentlige rum 1880-1914. Ph.d. Thesis. København: Det Humanistiske Fakultet Københavns Universitet..

TheTrams.co.uk. (2013, November 11). Trams in the UK. Retrieved November 11, 2013, from TheTrams.co.uk: http://www.thetrams.co.uk/tramsinuk.php

Tjeldflåt, G. M. (2013). Boom i vente for stappfull bybane. Bergens Tidende, http://www.bt.no/nyheter/lokalt/Boom-i-vente-for-stappfull-bybane-2985945.html.

Tørset, T., & Meland, S. (2002). Skinnebonus: Litteratur studium. Trondheim: SINTEF.

Urry, J. (2000). Sociology Beyond Societies: Mobilities for the twenty-first century. London: Routledge.

Urry, J. (2004). The 'System' of Automobility. Theory Culture Society 2004, 21(25), 25-39.

Urry, J. (2007). Mobilities. Cambridge: Polity Press.

Vannini, P. (2012). Ferry Tales. New York: Routledge.

Vannini, P., Lucy, B., Jensen, O. B., Fisker, C., & Jirón, P. (2012). Technologies of Mobility in the Americas. New York: Peter Lang.

Vollset, M. (2007). På sporet av Bybanen. Bergen : Bodini.

Vuchic, V. R. (2000). Comparison of light rail transit with bus semirapid transit. 5th UITP Light Rail Conference.

VÖV UTP. (2010). Facts and arguments in favour of Swiss public transport. Bern: Verband öffentlichers Verkehr.

Weinstock, A., Hook, W., Replogle, M., & Cruz, R. (2011). Recapturing global leadership in bus rapid transit: A survey of select U.S. cities. Retrieved July 2013, from www.itdp.org: http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf

Westside. (2008, October 7). Westside: A new landmark for Bern. Retrieved January 7, 2014, from http://westside.ch/Assets/Westside/936375f5-65e0-4da8-9fab-63caf87411dd.pdf

Wirasinghe, S., Kattan, L., Rahman, M., Hubbell, J., Thilakaratne, R., & Anowar, S. (2013). Bus rapid transit: A review. International Journal of Urban Sciences, 17(1), 1-31.

Wright, L. (2005). Bus rapid transit. GTZ sustainable transport: A sourcebook for policy-makers.

Yaneva, A. (2009). Making the Social Hold: Towards an Actor-Network Theory of Design. Design and Culture, 1(3), 273-288.

Yin, R. K. (2009). Case Study Research: Design and Methods Fourth Edition. Thousand Oaks: SAGE Publications.

Zweckverband. (n.d.). Mobilität für die Region. Freiburg: ZRF.

Aadland, C. (2011). Best i hele verden. Bergens Tidende, lørdag d. 8 oktober, 12.

APPENDIX /

INTERVIEW GUIDE

INTRODUCTION TO INTERVIEW

These two pages will provide you with a short outline of my PhD project and my approach to the subject of light rails. I hope that this will help you to prepare for our interview, and possibly give you some ideas of relevant material that you would recommend me to look into. This could both be related to the specific context in which you are involved, or material related to the broader subject of light rails. Deliberately I have not made a structured interview guide. The interview will be based on themes with the aim of bringing out the essential subjects related to these themes in the given context. The themes and a short elaboration of these can be found in the end of this document.

ABOUT ME AND MY PH.D. PROJECT

I am educated as a civil engineer and finished my master in Urban Planning & Management in June 2010. I started my Ph.D. project in February 2011, so I am in the preliminary stages of my research. However, I worked as a research assistant at Aalborg University since August 2010, where I also dedicated time to investigate my subject. I am an industrial PhD which entails that I work half time at the consultancy company COWI. Here I work with task related to planning of light rails and public transport to gain practical insight. The other half of my time I spend at Aalborg University dedicated to my research, and to travel to the 4-5 case cities to collect the empirical data that is crucial to my project.

Initially the cases selected for my project are:

- Bergen, Norway
- Freiburg, Germany
- Bern, Switzerland
- Angers, France
- Nottingham, England

In my empirical work I focus on the middle-sized European cities around 150.000 – 400.000 inhabitants. This is to create a basis for assessing the effects of light rail systems in these given contexts, and to understand the effects of these systems in cities where there is a smaller patronage level and different challenges than the bigger cities.

PROJECT OUTLINE

Danish and European cities are facing the challenge of being internationally competitive and concurrently securing a sustainable development of the cities. A key area in relation to this challenge is transportation. This is due to the considerable CO2 emissions from the transport sector and the continuing battle for space in the cities. In the recent years there has been an increased focus on light rails as a mean to reach the goal of a more sustainable urban transport system. In the Danish context the authorities in the larger cities explores the possibilities for establishing light rail systems. The first light rail system in Denmark is planned in Aarhus, the second largest city in Denmark, and is expected to operate from year 2015. Since the project in Aarhus is the pioneer project in Denmark within light rails, experience from other European contexts has been crucial in the decision making and implementation process. However there is a need for a more systematic collection of experiences within European cities, to generate a sound basis to consider the effects of future systems in both a Danish and European context. The aim with this PhD project is therefore to qualify the basis for decision for future light rail systems.

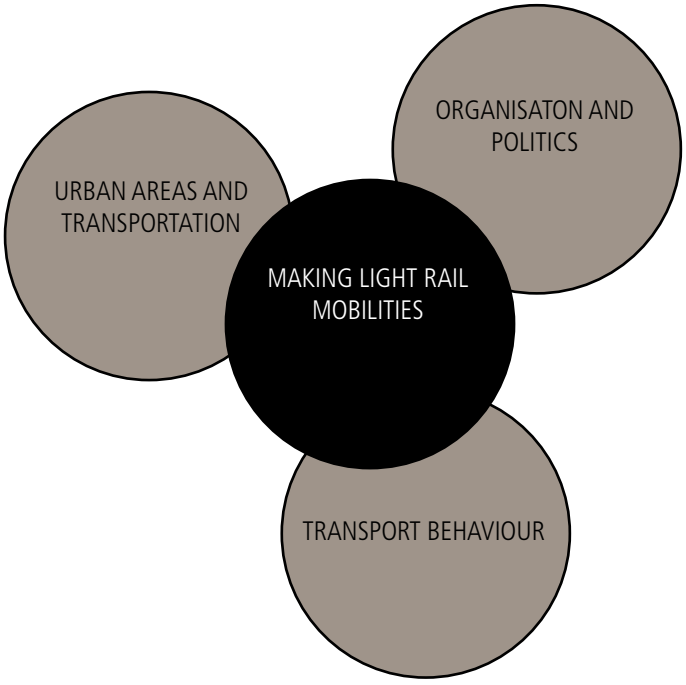
Some research has been done in this field, and there exists a sound knowledge base concerning the effects of light rail systems in different contexts. In this study I will build upon the existing knowledge base and try to look in to the more contextual differences of light rail systems in different middle-sized European cities. The objective of this approach is to create a more holistic view of the different contextual elements that affects the success of different light rail systems. Based on my analysis I will look into both the technical side and the societal side of the different light rail systems I am exploring through my study.

On the technical side I will look into the technologies in use and the challenges and experiences of implementing these technologies in the given context. Has the systems reached the expected patronage level? And what are the experiences from the implementation and operation phase?

On the societal side I will explore how public transport is organized in different national and local contexts and how this influences the decision making and implementation process of light rails. I will look into how cultural differences might influence the transport behaviour, and the different political objectives behind the construction of light rails. What can we learn from this, and how can this be operationalised to improve the foundation for future decision making processes?

INTERVIEW THEMES

The themes that the interview will evolve around are shown in the figure below. The themes overlap and should be seen as an interplay. Related to each theme are some overall questions that I want to explore. In the following some of the overall questions under each theme are elaborated. This is not an exhaustive list of questions but some of the relevant issues to rise under each theme.



Organizations and Politics

Why was this system built, and what were the arguments behind this decision? How does the organisational structure of public transport work in your context, how is it organised and has there been an organisational shift with the implementation of the new light rail system? Have there been political and organisational barriers to overcome and how has this affected the implementation and operation of the system? How is the system financed related to implementation and operation, and what are the experiences with this?

Urban Areas and Transportation

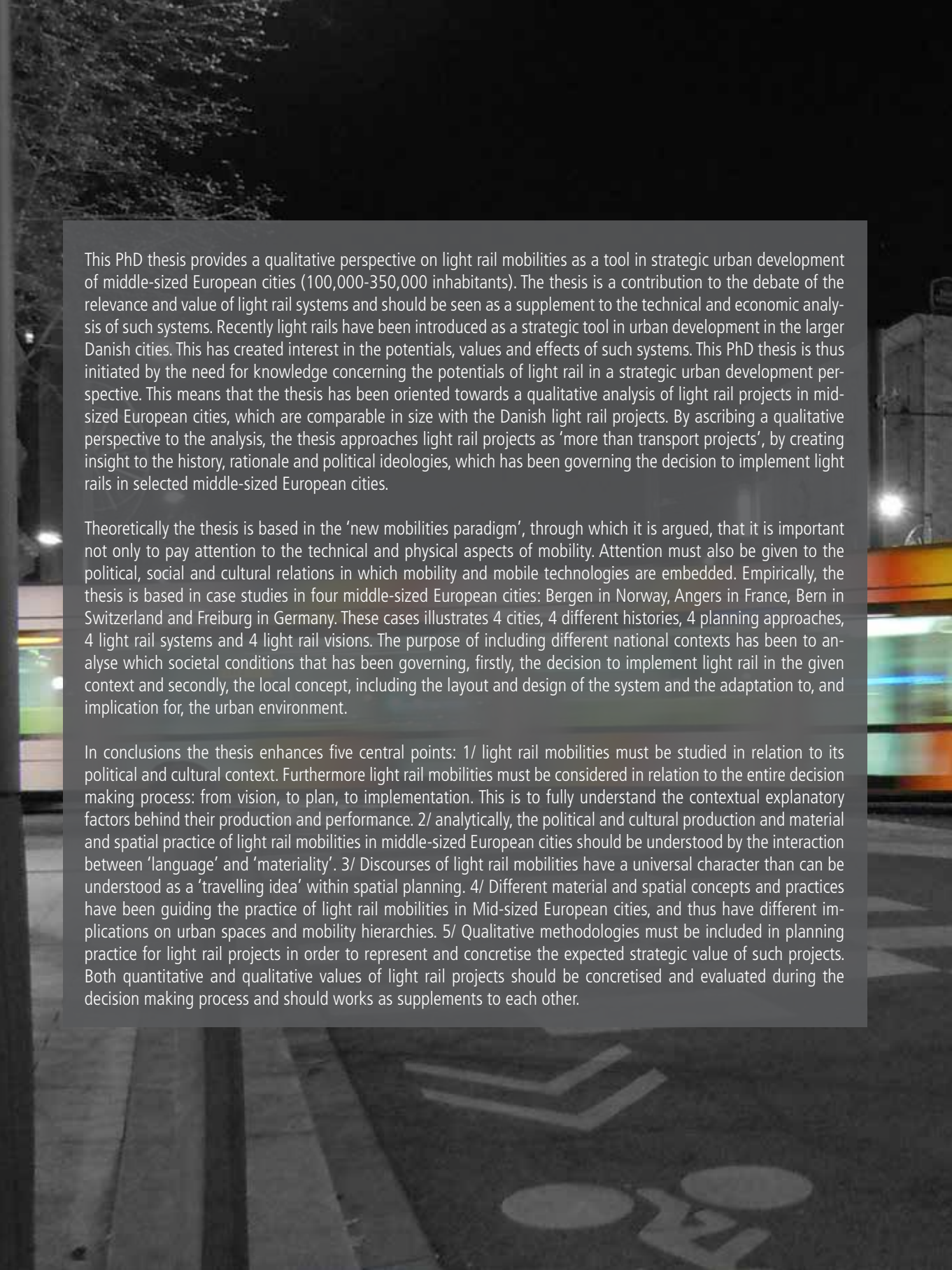
Before and after the light rail – What were the conditions for establishment of light rails, does the city have a history of trams? If yes how is this connected to the new system? Factors that influenced the layout of the systems, and factors that possibly supported the decisions to build light rails? What have the effects been for the urban environment and the urban life? What status does the light rail have in the urban environment, is it perceived as a landmark, an Image creator? Which tools have been implemented concurrent to the light rail, and how has this support/hindered the effects of the system?

Transport Behaviour

What is the culture around public transport in your context? Is there a high degree of car-ownership? How has the light rail affected the travel behaviour of the citizens? What is the perception of the new light rail system amongst the citizens? What are the experiences with modal shifts after the implementation of the light rail?

What is the culture around public transport in your context? Is there a high degree of car-ownership? How has the light rail affected the travel behaviour of the citizens? What is the perception of the new light rail system amongst the citizens? What are the experiences with modal shifts after the implementation of the light rail?

I hope that this very short outline has given you some useful insight to my project. I am looking forward to our meeting and thanks again for your time!



This PhD thesis provides a qualitative perspective on light rail mobilities as a tool in strategic urban development of middle-sized European cities (100,000-350,000 inhabitants). The thesis is a contribution to the debate of the relevance and value of light rail systems and should be seen as a supplement to the technical and economic analysis of such systems. Recently light rails have been introduced as a strategic tool in urban development in the larger Danish cities. This has created interest in the potentials, values and effects of such systems. This PhD thesis is thus initiated by the need for knowledge concerning the potentials of light rail in a strategic urban development perspective. This means that the thesis has been oriented towards a qualitative analysis of light rail projects in mid-sized European cities, which are comparable in size with the Danish light rail projects. By ascribing a qualitative perspective to the analysis, the thesis approaches light rail projects as 'more than transport projects', by creating insight to the history, rationale and political ideologies, which has been governing the decision to implement light rails in selected middle-sized European cities.

Theoretically the thesis is based in the 'new mobilities paradigm', through which it is argued, that it is important not only to pay attention to the technical and physical aspects of mobility. Attention must also be given to the political, social and cultural relations in which mobility and mobile technologies are embedded. Empirically, the thesis is based in case studies in four middle-sized European cities: Bergen in Norway, Angers in France, Bern in Switzerland and Freiburg in Germany. These cases illustrates 4 cities, 4 different histories, 4 planning approaches, 4 light rail systems and 4 light rail visions. The purpose of including different national contexts has been to analyse which societal conditions that has been governing, firstly, the decision to implement light rail in the given context and secondly, the local concept, including the layout and design of the system and the adaptation to, and implication for, the urban environment.

In conclusions the thesis enhances five central points: 1/ light rail mobilities must be studied in relation to its political and cultural context. Furthermore light rail mobilities must be considered in relation to the entire decision making process: from vision, to plan, to implementation. This is to fully understand the contextual explanatory factors behind their production and performance. 2/ analytically, the political and cultural production and material and spatial practice of light rail mobilities in middle-sized European cities should be understood by the interaction between 'language' and 'materiality'. 3/ Discourses of light rail mobilities have a universal character than can be understood as a 'travelling idea' within spatial planning. 4/ Different material and spatial concepts and practices have been guiding the practice of light rail mobilities in Mid-sized European cities, and thus have different implications on urban spaces and mobility hierarchies. 5/ Qualitative methodologies must be included in planning practice for light rail projects in order to represent and concretise the expected strategic value of such projects. Both quantitative and qualitative values of light rail projects should be concretised and evaluated during the decision making process and should works as supplements to each other.