

Sustainable Accessibility of the Randstad – six years on Popular Annual Report 2013

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FOREWORD

We are pleased to present the sixth annual report for the Sustainable Accessibility of the Randstad (SAR) programme. Although the programme will officially come to an end in autumn 2014, some of the research projects are still ongoing, and we also expect the SAR research to result in a number of publications and societal applications. This means this will not be the last annual report published for the programme and that we will likely report back next year.

During the second major conference of the Connecting Sustainable Cities research initiative – scheduled for June 2014 – we will discuss the results of the SAR up to that point. On both the day devoted to scientific research (16 June) and the day devoted to practical applications (17 June), we will be presenting a number of sessions in which the SAR researchers get the opportunity to engage in debate with the international scientific community and with Dutch professionals to discuss the knowledge they have acquired and the practical exercises in which this knowledge might be applied. At the same event, we will also be launching a special edition of the trade publication *Rooilijn*, which contains several articles outlining the achievements of SAR for a general audience.

But in the meantime, we will be looking back on the past year together with the researchers involved in the various projects. Several different projects were completed in 2013; four PhD students/research assistants obtained their doctorates – one with first-class honours, no less – while others put the finishing touches to their PhD theses and a variety of other scientific output. I should also mention the notes the researchers made on a number of topics as part of the SAR synthesis study, for which they worked closely with professionals. The research results were published by trade journals and other media and many were picked up by news outlets. In addition, a number of meetings were scheduled between professionals and researchers, some of which were held at my Ministry.

I am struck time and again by the direct relevance of the results of SAR research to national government policies, even if this relevance is not always immediately visible. Two subjects to have gained widespread media attention recently are behavioural management in its various forms and the work of our researchers at the University of Groningen's Department of Psychology. SAR scientists Steg and Bolderdijk recently co-authored a key report published by the Council for the Environment and Infrastructure, which also drew media attention. However, there are other types of research carried out under the SAR programme which have not been as high profile but which are just as essential to the sustainable accessibility of urban areas. I would include the research involving the Super Network Model in this category, for example, along with efforts to improve the sustainability of freight transport. You will find more information about these projects on the [SAR website](#).

Finally, I am pleased to report that the research conducted in conjunction with SAR researchers as part of the Connecting Sustainable Cities programme will continue once the SAR programme has been concluded. With a new – and more comprehensive – programme currently in the works devoted to the development of urban areas in the Netherlands and in an international context, you will likely hear from us again in the future.

Siebe Riedstra
Secretary-General, Netherlands Ministry of
Infrastructure and the Environment
Chairman of the Connecting Sustainable Cities
Supervisory Board
(research theme: Connecting Sustainable
Cities)



Siebe Riedstra

P.S.: All SAR-related news, research results and previous annual reports are available on the [SAR website](#).

1. 2013 Highlights

The year 2013 was the sixth year of Sustainable Accessibility of the Randstad Conurbation (SAR). It was the year in which the first projects were completed. A large number of PhD students/research assistants earned their doctorates; several other projects entered their final stages. Various SAR researchers participated in demand-driven research notes as part of the first stage of the synthesis study. Preparations were made for the second stage – which will also involve the publication of a special issue of the trade publication Rooilijn. The SAR community is preparing for the Connecting Sustainable Cities conference scheduled for 2014, which will include discussion of a large number of results of the SAR programme.

Unfortunately, we also lost one of the driving forces behind the SAR programme last year: VU University Amsterdam Professor Piet Rietveld passed away after a brief illness in early November. Together with Hugo Priemus, Professor Rietveld was one of the founding fathers of the SAR programme. This has been a painful loss for everyone who knew him and had the pleasure and privilege of working with him. Professor Rietveld routinely supervised young researchers, including at SAR, and played a significant role in the dialogue between the scientific and political communities.

Numerous meetings and conferences

Various SAR meetings were held in 2013, during which researchers and users had the opportunity to interact with each other. The Netherlands Ministry of Infrastructure and the Environment organized the first of three “landing meetings”; as part of the Synthesis Study, several meetings were held throughout the country and the communities devoted to Transit-Oriented Development and bicycle use gathered on several occasions. The members of the SAR Programme Committee met the programme managers on 2 October, during which they exchanged the main research results produced up to that date, evaluated to what

extent the original SAR objectives had been achieved, and brainstormed on further methods of knowledge dissemination. They also agreed to publish a special issue of the Rooilijn trade publication, which will be launched to coincide with the Connecting Sustainable Cities conference to be held on 16 and 17 June 2014.



SAR lecturers Linda Steg, Erik Verhoef and Bert van Wee visiting the Ministry of Infrastructure and the Environment

International contacts

An internationalization program was launched in 2011 to promote cooperation with foreign experts. This presents world-class foreign researchers with the opportunity to participate in the SAR research programme for a maximum period of one year. In 2013, four new top researchers were accepted into the programme from Italy, South Korea, Hong Kong and the UK, enabling them to participate in the research for a short period of time.

2. Four first-round programmes

Synchronization of “time” and “space”; recreational transport; sustainable freight transport; and the use of travel information and IT

Launched in 2008, the first four extended-term SAR research programmes were all but completed in 2013. These programmes relate to the synchronization of activities in time and space, recreational transport, sustainable freight transport and the use of IT resources (i.e. travel information and telework).

Supernetworks of activities, space and time

The researchers involved in the Synchronizing Networks programme are developing a supernetwork in which transport systems, town planning and activity patterns are interrelated in terms of time, space and virtual space. This will help designers and town, mobility and infrastructure planners to learn more about traveller’s behavioural patterns. There is an active user group whose members represent Travel Information Group 9292, the Dutch Cyclists Association (Fietzersbond), NS Dutch Railways, KIM, the City of Rotterdam and the Ministry of Infrastructure and Environment. The programme director is Delft University of Technology’s Eric Molin.

Different ‘synchronization’ methods

Synchronization – that is, more effectively adapting space and time to human activity patterns – can potentially have significant accessibility benefits for individuals, according to Eric Molin. Targeted transport and town planning policies are of strategic importance when it comes to optimizing synchronization between transport and the town planning system. Molin explains that there are different types of synchronization that can potentially improve the accessibility of locations. Molin: “One option is to synchronize transport networks in terms of space, similar to the technology used for Park & Ride facilities. Another form of synchronization is time synchronization: you can synchronize the timetables for different types of public transport or within a single mode of public transport. The technology also allows you to mix different uses: for example, you can concentrate homes, shops, health centres and schools all in the same area. This urban planning mix, then, also allows for temporal synchronization, which might include extending the opening hours of health centres until after regular office hours. Another example is the spatial synchronization between transport networks and activity sites, for example the construction of high-density offices and residential neighbourhoods in the vicinity of railway stations – a phenomenon also known as Transit-Oriented Development.”

Synchronization Policy

You can even take it one step further and continue to time-synchronize the transport and activity sites. Molin: "This might involve adapting a bus timetable to correspond with the start times and end times of, say, music concerts. The seventh form of synchronization is completely disconnecting activities from locations, for example by providing services through telecommunications, such as teleworking and teleshopping. One last example is that of disconnecting activities from time, including the use of email, flexible office hours and 24/7 teleshopping." Molin continues: "Policy measures aimed at synchronization can be organized as follows. You can impose rules, set prices, plan your city or town, engage in infrastructure planning, create specific public transport policies, get involved in marketing and publicity and implement time-related measures – for example, by changing your opening hours."

First-Class Honours for Supernetwork Model

PhD student and research assistant Feixiong Liao of Eindhoven University of Technology – who developed the "Supernetwork Model" – earned first-class honours for his project, obtaining his PhD on 4 November. In order to more effectively manage mobility and make it more sustainable, you need to monitor where and how people perform specific activities, so that their transport patterns become more predictable.

In his doctoral research, Feixiong Liao contributed significantly to these activity-based models, using supernetworks and then further expanding this model approach. Liao linked transport networks to a network of service locations, which allows him to make accurate predictions for the day-to-day transport patterns of individuals. This reveals where, when, with whom, with what mode of transport and via what route people go about their daily routines. The model factors in the myriad interdependencies between the various journeys completed by an individual on a typical day, making it sensitive to the mobility effects of a wide spectrum of policy measures.

Liao explains that policymakers can use his research to predict how changes in the transport network and/or town planning affect people's travel patterns. For example, the model can be used to assess changes to the urban system – particularly how transport and town planning measures combine to affect accessibility and sustainability.

People make suboptimal choices

PhD student and research assistant Chao Chen of Delft University of Technology is working on a project involving the use of the supernetwork model. He collected data through a specially developed lab experiment, and his results demonstrate that if time constraints and the complexity of the decision environment (i.e. the transport network) increase, travellers tend to make increasingly random decisions. Chen: "It's important to incorporate these effects into the ex-ante evaluation and the design of synchronized multimodal networks. These types of networks are by definition relatively complex in nature, and the research shows that people who participate in those networks therefore tend to make random – and thus suboptimal – choices. This means that, in practice, you

do not actually get to enjoy all the benefits you would from traditional models, such as reduced travel time. In other words, the research suggests that the accessibility benefits of network synchronization calculated using traditional models should be regarded as an upper limit rather than a best estimate.”

Governance models nearly completed

PhD student and research assistant Sara Levy of Radboud University Nijmegen is working on the Governance Project and the three models used in this project. The first of these models simulates the impact of the coordination (or lack thereof) between local authorities – such as municipal governments – in relation to land use and transport. The second model identifies the effects of the three different forms of governance on land use. The third model, which is nearly completed, simulates urban development under three different types of planning: unregulated planning, plan-based planning and participative planning.

Transport policies and town planning policies reinforce each other

Wendy Bohte, a postdoctoral researcher at Delft University of Technology, was succeeded by Jan-Willem van der Pas of the same university in 2012; he is in charge of the Synchronizing Networks design project. In 2013 he completed a case study in the Rotterdam-The Hague corridor, which turned out to be extremely enlightening. See Jan-Willem van der Pas' profile below.

Researcher's perspective

Jan-Willem van der Pas (TUD) is involved in developing a second case for the application of the Supernetwork Model.

“The case developed by Wendy Bothe led to some interesting insights, which we also incorporated into our [Synthesis Study notes](#). However, that study was limited to the Greater Rotterdam Area, and the objective of the follow-up case is to study the impact at the regional level. In the past year, Eric Molin and I focused mainly on finding a suitable case and then further developing it. We

consulted with employees of the City of Rotterdam, and eventually decided to take the Rotterdam-The Hague metropolitan area as our research area. In conjunction with policy officers in the metropolitan area, we then developed a number of policy scenarios, of which we can compare results. The purpose of this exercise is to find answers to the following questions:

What are the differences in impact of policy programmes aimed at geographic distribution and policy programmes aimed at concentration?

What are effective measures when it comes to strengthening the public transport backbone in the metropolitan area? That backbone is, mainly, the Dordrecht-Rotterdam-The Hague railway network. The primary question is what measures



Jan-Willem van der Pas

– or combination of measures – are most effective in terms of strengthening the existing backbone.

The various policy scenarios have now been fully developed, and the supernetwork model is used to predict their impact. I'm not personally involved in the simulations with the supernetwork model – that's the work of Feixiong Liao of Eindhoven University of Technology. We are expecting the initial results of the new case study to arrive in the immediate future, so there are exciting times ahead for the Synchronizing Networks researchers!"

Recreational transport behaviour

The researchers working on the The Value of Recreation programme (headed by Delft University of Technology's Bert van Wee) are seeking to gain greater insight into the needs and decisions of travellers in terms of recreation and mobility, both now and in the future. In their research, they factor in radically changing conditions, including the rising demand for recreation and the impact of climate change and climate change policy. The user panel for the programme includes representatives from the Ministry of Infrastructure and the Environment, the Research Institute for Mobility Policy, the Netherlands Ministry of Economic Affairs, and InnovationNetwork/STIRR.

Diversity: a key factor in determining the value of recreational areas

Tom Gosens of VU University Amsterdam focuses on the economic value of recreation, a process in which he uses the latest econometric methods. In his work, he considers both consumers' preferences for specific activities and the values assigned to recreational sites and transport choices. All these aspects are then related to consumers' residential locations, making the effect of accessibility the key focus. Gosens: "My research shows that consumers, during recreational daytrips, value both the size and the diversity of the rural area. The appeal of a rural area with a dominant type of scenery can therefore be increased relatively easily by adding another, less dominant type of scenery. The value of the Green Heart area (relatively sparsely populated area located within the Randstad conurbation), for example, could potentially be increased by adding another type of scenery. When selecting a location for urban recreation – say, shopping or dining out – the diversity of supply plays a role in addition to size. As with the value of rural areas, the value of urban destinations can therefore be increased by improving diversity. An additional factor that prompts consumers to travel to a specific destination is the aesthetic appeal of the town or city centre in terms of the presence of cultural heritage of landmark buildings. This has led to the conclusion that cultural heritage attracts leisure visitors and enables a destination to successfully compete with other destinations."

First SAR PhD: Research on factors determining holiday and leisure behaviour

Eindhoven University of Technology's Anna Grigolon was the first member of the SAR community to earn her PhD, on 16 May 2013. Her thesis subject was holiday and leisure behaviour, and, specifically, the fact that the differences between these behaviours – based on individual lifecycle stages – can generally be explained by the flexibility or restrictions typical of the different groups of leisure visitors. The main factors are time and budget, as well as factors relating to age and household composition. Grigolon also found that recreational sports and leisure facilities served as substitutes for outdoor recreation. This led her to conclude that these types of facilities can be used in urban areas as compensation for a lack (or potential lack) of green space. Since urban recreation (including recreational shopping and cultural activities) is complementary to outdoor recreation, such facilities cannot compensate for a lack of green space.

Another SAR PhD: the impact of increased travel expenses on holiday behaviour

On 29 November, Sander van Cranenburgh of Delft University of Technology received his doctorate for his research on the effects of substantial increases in travel expenses on holiday behaviour. For further information, see Sander van Cranenburgh's profile below.

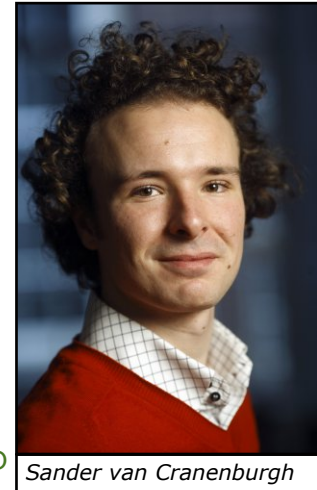
The hedonistic treadmill: more holidays do not lead to increased happiness

Delft University of Technology post-doctoral researcher Maarten Kroesen teamed up with Susan Handy of the University of California once again in 2013 to focus on the question of to what extent recreational bicycle use is related to bicycle use for commuting purposes.

In addition, the pair also studied the relationship between people's holiday behaviour and their overall well-being. Although prior research has shown that people tend to feel better after returning from holidays and score higher on indicators relating to physical and mental health, the question is whether these effects have an impact in the longer term. Kroesen: "In order to answer that question, we related people's holiday behaviour over a four-year period to their well-being during the same period. The results showed that people who go on holidays more often assign higher scores to their quality of life – we refer to that as the "cognitive component" of well-being. That is to say, people generally do not actually feel better in reality – it's simply the affective component of well-being. These results suggest that the positive effects of holidays are likely to be subject to what we call the "hedonistic treadmill": more frequent holidays lead to a higher standard of living, which then reduces the positive effects on well-being."

Researcher's perspective

Sander van Cranenburgh (TUD) obtained a PhD in 2013 for his research into holiday travel behaviour and the expenses involved.



Sander van Cranenburgh

"I have a Master's degree in Aeronautical and Aerospace Engineering, which is a pretty hardcore science degree to have. When I entered my first year as a PhD student and research assistant, I was exposed to the brand-new world of social science. I was fascinated by all the theories and methods involved – I found it very interesting and exciting. For me, the most challenging part of being a PhD student and research assistant was the uncertainty about the direction my research would eventually take, although there was never any doubt in my mind that it would lead somewhere – a PhD, obviously. As I got to the final stages of my research, I finally saw how everything tied together, which is kind of a thrilling feeling. I'm currently employed as a post-doctoral researcher in the same department at Delft University of Technology where I earned my PhD: Transport and Logistics.

My current research focuses on developing a national transport model based on regret minimization – the first of its kind in the world. The current transport models are based on use maximization, but my doctoral research focused on holiday transport. People all over the world are travelling for pleasure more frequently, and the demand for tourism-related mobility has increased sharply over the past decades. The depletion of fossil fuels, international climate policies and many other potential non-traditional changes could reverse the trend in the growing demand for tourism-related mobility solutions. A number of these non-traditional changes is likely to result in significantly higher travel expenses. I conducted a number of experiments to develop new holiday selection models – these models can be used to predict the effects of high travel expenses on holiday behaviour. For example, these models tell us to what extent people are favouring holidays close to home over more exotic travel destinations, and the effect on the average duration of domestic holidays. This is relevant, because the factors of destination, length of stay, mode of transport and type of accommodation are all interrelated in the selection of a particular holiday. For example, the choice to go camping is related to the mode of transport selected by campers. We also found that the relative sensitivity of holidaymakers to travel expenses decreases as these expenses increase. This means that holidaymakers are relatively sensitive when it comes to spending a couple tens of euros more when booking inexpensive holidays and relatively insensitive if the same price difference arises when booking more expensive holidays. In addition, my research also shows that there are many ways in which holidaymakers think they will react to higher travel expenses. The most frequently cited responses were: looking for budget accommodation, travelling to destinations closer to home, booking cheaper accommodation, and spending less money at the travel destination. One surprising bit of information, however, was that the differences in frequency

between the responses are relatively small: no response was cited significantly more frequently than the other ones. The holidaymakers' responses were correlated, however. For example, the responses 'booking cheaper accommodation', 'spending less money at the holiday destination' and 'taking fewer holidays' were frequently cited together."

Travel behaviour of well-informed travellers

The TRISTRAM programme (Traveller Response and Information Service Technology: Analysis and Modelling) researches how travellers use travel information such as travel time estimates when dealing with traffic congestion. The researchers are making full use of advances in information technology to avoid undesirable side effects of travel information, such as merely shifting congestion elsewhere. The user group includes representatives from GPS manufacturer TomTom, the Research Institute for Mobility Policy, and ARS Traffic & Transport Technology. The programme's director is Harry Timmermans of Eindhoven University of Technology.

New types of information and communication technology affect the "activity travel behaviour" of individuals

Information makes travellers more aware of their possible options, allowing them to make more effective decisions. Information can cause people to change their routine activity patterns and transport patterns. Professor Harry Timmermans tells us that the TRISTRAM programme is nearly completed. "The literature did not provide a lot of information to date on the correlation between information and changes in transport behaviour. The objective of the TRISTRAM project was to learn how to track and monitor these processes and, in particular, to develop suitable models for doing so. And that's exactly what we delivered: models for the impact of travel information on travellers' choice of routes and models for the impact of travel information on activity patterns. We also developed a new technology for data collection, based on the use of GPS systems, and we created a model to measure the effects of travel information on accessibility. Finally, we now also have a greater understanding of the potential benefits of the use of IT for travellers and society at large."

Implementation of road pricing sees city expand

The use of IT resources is increasingly being recognized as a measure or potential measure to improve accessibility. Timmermans: "We identified two types of technologies in the TRISTAM system: the first is the technology for actual travel, including traffic updates for travellers. The second type is related more to "virtual travel", for example online technologies that allow employees to work from home instead of in the office. "As part of a study into the economic effects of traffic information, the VU University Amsterdam team analyzed a market situation in which a road network manager, a traffic information provider

and individual motorists attempt to maximize their individual advantage,” Timmermans explains. “We noted that if traffic information is provided by a private monopolist, it results in a minor to negligible loss of prosperity. It would therefore appear that the nature of the organization providing the traffic information – which either wants to maximize profit or maximize prosperity – is of no relevance. We also investigated a wider question, namely how morning congestion and commuting costs relate to where people live in a city. We demonstrated that the implementation of time-based road pricing incites a city to increase in size.

Dynamic route selection model, driving details and the effects of travel information

PhD student and research assistant Giselle de Moraes Ramos of Delft University of Technology is currently completing her project Analysis and Modelling of Network Effects. As part of her research, she collected a very extensive dataset relating to travel patterns, using GPS technology, travel reports, interviews and registrations of the traffic situation. She is currently able to investigate travel behaviour in real-life situations. The proposed model to be described in her thesis consists of a dynamic route selection model.

Delft University of Technology PhD student and research assistant Ruihua Zack Lu is completing his project Analysis and Modelling of Accessibility Effects. The work he has completed together with post-doctoral researcher Anna Kononova resulted in two basic information systems for the collection of driving data. This has led to the insight that, because the availability of travel information tends to be limited and does not provide many options, many travellers are strongly driven by habit. PhD student and research assistant Zahra Parvaneh of Eindhoven University of Technology is also in the final stages of her project Analysis and Modelling of Spatial Externalities. In terms of research methods, her research resulted in mathematical and econometric models for the measurement, analysis and prediction of the effects of travel information. For further information, see Zahra Parvaneh’s profile below.

Researcher’s perspective

Zahra Parvaneh (TUE) studies the spatial aspects of the use of ICT resources for accessibility.

“One of the milestones for 2013 was creating a data collection system, after two years of hard work and research. The system allows users to provide personalized travel information to people and assess changes in their activities and travel patterns. The way the system is set up offers the type of interactivity that someone might experience during a face-to-face interview, and the system also enables you to assess complex situations such as multimodal travel and activity chains. In this system, the real world and potential changes are visualized in a hyper-realistic way,



Zahra Parvaneh

which increases the response rate. In the second half of 2013, respondents provided detailed information about their activities and travel schedule for a given day that they selected. I then provided them with travel information using my system, and based on this information they were able to implement changes to their original timetable. We received around 650 responses during the data collection process. The response rate was higher than 65%, which can be considered successful given the complexity involved in collecting the data. The initial results confirmed our suspicions: travel information can indeed be effective in terms of behavioural change, provided that the alternative offered in the travel information is significantly more advantageous to the traveller. When people are confronted with travel information, they tend to change the time they start their activities or the duration of those activities in order to prevent time loss; they are generally not willing to change their route. We found that it's also quite rare for people to change the location of their activity, which means it's important for the information provided to factor in the usual behaviour of the people in question. Also, each alternative must show how the individual can gain maximum benefit from the alternative.

As far as the progress of my research project is concerned, I think that in order to be successful, you also need to be willing to fail. I did experience periods of disappointment and failure during my research; my search turned out to be more complex than expected. Still, I learned to persevere and how to eliminate unexpected barriers. I'd say that I learned more than I expected to from the experience. All those years of working on my PhD made me grow as a scientist, and I also grew on a personal and professional level. The opportunity to participate in a major project has taught me to think big and focus on innovation, as well as how to transform my ideas into a reality.

My final goals as part of my research are to use the results of the data collection in the actor-oriented simulation system I developed, and to finish my thesis. That doesn't mean my research will be fully completed after that, though – you never really have enough time to do research; it's a perpetual process.”

Sustainable freight transport

The researchers involved in Towards a Sustainable Multimodal Freight Transport System for the Randstad – the programme led by Lori Tavasszy of Delft University of Technology and TNO – focus on the significant increase in freight transport in and around the three main transport hubs in the Randstad conurbation (the ports of Amsterdam and Rotterdam and Schiphol Airport). The team is researching production, consumption, trade and supply chains and considering such topics as the concept of transshipment terminals and the issue of urban distribution. Various experts are involved in Tavasszy's freight transport programme, including people from the Research Institute for Mobility Policy (KIM), Statistics Netherlands (CBS), the Rotterdam Port Authority and TNO.

Reducing freight-traffic mileage

The year 2013 saw the first ever PhD graduate in the Freight Transport programme, Mo Zhang of Delft University of Technology, who successfully defended her thesis in August 2013. Zhang used a calculation model to demonstrate that there are a sufficient number of multimodal terminals in the Netherlands and that the integration of several terminals can result in a reduction in freight-traffic mileage. Her work is currently being developed further by TNO and used for the subject of synchromodal networks, which is a strategic priority for leading logistics companies in the Netherlands.

Logistics sprawl

PhD graduate Igor Davydenko of TNO and Delft University of Technology used a simple spatial-economic selection model to investigate the distribution function of specific regions in the Netherlands. His work included an investigation of the “logistics sprawl” phenomenon (similar to urban sprawl) in the Randstad conurbation and surrounding areas. He tested the model using Dutch, German and European data, and negotiations are currently underway for applications in Japan and by the Port of Rotterdam.

Unique data with Statistics Netherlands

Post-doctoral researcher Maureen Lankhuizen of VU University Amsterdam completed her project – which involved working closely with Statistics Netherlands – in 2013. Lori Tavasszy, commenting on the project: “There was always a lack of models and data to separate continuous streams in Dutch regions, as a result of transshipment or storage, that could be separated from streams arising from production or consumption. Since the Randstad conurbation is a place where continuous streams and origin/destination streams conjoin, this difference is relevant to policymakers. We developed several different models for this purpose, one of which has been adopted by Statistics Netherlands and the other of which is included on the roadmap of the Directorate-General for Public Works and Water Management.”

Tavasszy could not be more pleased with the partnership with Statistics Netherlands: “We already had connections there before starting the project, and those have now been reinforced. Our research has resulted in new CBS products, and we also collaborated on a number of articles for scientific publications. Statistics Netherlands has made never-before-used data available for research, which means it has produced new information about freight supply chains in the Netherlands. The project also involved the conception of new forms of data collection, which has already given Statistics Netherlands a leading position in Europe and which will see a new partnership with the universities and TNO over the next several years.”

Carbon reduction game

PhD student and research assistant Niles Anand of Delft University of Technology investigated how to create an actor-oriented model in an urban logistics context which factors in the “language” and “stories” of actors to develop an image of their perspectives on problems and solutions. He tested the

model in game form together with students, and is currently preparing an application for the subject of carbon credit points (CCPs), which can be used to curb a city's total carbon emissions. He is currently studying experiences in Dublin, one of the few cities to have carried out these types of experiments.

Researcher's perspective

Professor Lori Tavasszy (TUD), who leads the programme "Towards a Sustainable Multimodal Freight Transport System for the Randstad", reflects on the programme now that it is in its final stages.



Lori Tavasszy

"Our research has shown that sustainability in logistics networks cannot be left to actors at the micro-level – to businesses and municipal governments, say – as this would result in too much fragmentation and a lack of economies of scale. What we need is government policy at a higher level, along with a dialogue between businesses in order to seize opportunities to increase economies of scale. The increase in transport costs should also help promote cooperation, which means pricing also affects the efficiency of freight transport through economies of scale. This data is now being quantified for the first time.

Our programme also focuses on logistics. Logistics serves as the link between transport and trade and is one of the factors that determine the sensitivity of freight transport to policy measures. We identified the impact of logistics on the sensitivity of the total flow of goods by estimating new price elasticities for transport for logistics chains with multiple modalities and with distribution centres as an additional link. Roughly speaking, more complex freight supply chains are less sensitive to policy, as they have more alternatives for logistics reorganization. Identifying that complexity gives us a greater understanding of the actual policy sensitivity of the system.

When you look at urban logistics, you'll see a combination of many different revenue models, which may conflict with each other. People often don't realize that conceiving and implementing intelligent solutions has to be a process in which all shareholders participate and where analyses should cover multiple experiences. We developed a method of model construction which allows us to incorporate the experiences of stakeholders in a traceable, transparent way. The method serves as a building block for creating widely accepted, decision-supporting systems.

Our team has the satisfaction of having participated in a unique research programme. We are grateful for the opportunity we received to develop solutions to the proposed issues relating to sustainable freight transport. The research has resulted in interesting tools and insights, which, in turn, have led to a large international response and new partnerships. My presentation of the programme even won an award in the United States for the best integration of the private perspective in freight transport models. We are proud to be considered pioneers in this project. The project has also raised many new questions, and this

programme will serve as the basis for new applications to NWO and the European Commission. For me personally, the best part of the project was watching the researchers grow and develop over the past few years. Their growth will have a greater impact than all new data and models combined.”

3. Three second-round programmes

Pricing policies; strategies for sustainable accessibility; and the relationship between climate, space and transport

The three long-term research programmes i-PriSM (involving innovative pricing policies) and CESAR (relating to weather, climate and urban transport) are currently in the final stages of completion, and the researchers detailed their progress for us in 2013.

Innovative pricing policy

This research programme, led by VU University Amsterdam’s Erik Verhoef, focuses on innovative pricing systems that can contribute to sustainable mobility. The researchers are investigating both road and rail transport, as well as analyzing the various parties involved (including passengers and key stakeholders). They study the interaction between infrastructure and urban networks, making a point of including the implementation and transition stages in their considerations. A user group set up for the project includes representatives from the Ministry of Infrastructure and the Environment, the City of Amsterdam, the Haaglanden metropolitan area, the Arnhem-Nijmegen urban region, the Research Institute for Mobility Policy and NS Dutch Railways.

Basic implications of price disruptions; differences in types of disruption

VU University Amsterdam’s Ioannis Tikoudis and his team drafted an initial paper addressing the interaction between urban planning, urban labour markets, and mobility streams. In a follow-up study, he is analyzing how disruptions in another key urban market – the housing market – are affecting pricing policies for road transport. Preliminary results show that this differs fundamentally depending on the type of disruption involved: the policy implications of price disruptions (e.g. mortgage interest relief) are radically different from those of direct regulations (e.g. maximum building height). Ioannis also developed a model for an area containing multiple cities, calibrated for the Randstad conurbation, with which the competition between cities with taxes and other policy instruments can be studied, along with the interaction between pricing for road and rail transport.

Improved traffic modelling provides more realistic picture

The research carried out in 2013 by Erik-Sander Smits of Delft University of Technology centred on improving traffic modelling. Smits: "When you analyze pricing strategies, for example, you can establish an efficient and realistic picture of travel times and the creation of congestion." During his stay at the University of Sydney's Institute of Transport and Logistics Studies, Smits focused on three limitations of the current traffic models: the routes selected by motorists, the modelling of traffic flow at hubs, and calculation times. "I developed a new, flexible model for route selection that can be used for large networks containing short and long routes. The model deals effectively with overlapping routes. The new hub model realistically describes the effects of congestion on traffic flow at the hub in question. The models have been integrated into an allocation model with improved modelling of the increase and reduction in congestion in a network, which can calculate significantly faster than the traditional dynamic allocation models. I finally conducted a case study of the Randstad conurbation which illustrates the operation of the models developed. The results of that study will be released in 2014." See Erik-Sander Smits' portrait below.

Information must align with values and type of pricing measure

Post-doctoral researcher Jan Willem Bolderdijk of Utrecht University (succeeded by Ellen van der Werff in 2013) and his team of fellow I-PrISM researchers developed a survey dealing with pricing measures and other issues. Their research showed that the attitude of motorists towards pricing regulations can be influenced by their underlying motivation to believe the information or not. Van der Werff's follow-up study also demonstrated that the effect of communicating the pros and cons of pricing policies depends on the specific pricing measure being presented. Van der Werff: "Initial analyses show that people do indeed find pricing policies more effective when it comes to reducing problems relating to car use in the event of increased expected environmental benefits of pricing policies. However, this applies only to pricing policies involving carbon differentiation and not to pricing policies without that differentiation. Whenever carbon differentiation was not part of the pricing measure, presenting the expected environmental impact even had a negative effect on expected effectiveness. This led us to conclude that the pros and cons of pricing policies should suit not only the values people feel are important, but also the type of pricing measure involved.

Technological advances influence the opinions of political parties and interest groups

PhD student and research assistant Özgül Ardiç of Delft University of Technology conducted research in 2013 in which she related road pricing policies to theories aiming to explain stability and policy changes. She used the advocacy coalition framework (AXF) as part of her studies. Ardiç: "We studied the implementation process involved in road pricing policies in the Netherlands during the period 1994-2010. I systematically observed any shifts in opinion for the two dominant

types of price proposals: road pricing and congestion charges. The data source contains 430 news articles from this period, which were analyzed using a content analysis. My findings show that technological advances – and this was, in fact, assumed in the ACF as well – influence the opinions on road pricing policies of both political parties and interest groups. It turned out that interest groups responded more to technological advances; the positions of political parties varied more depending on elections and on the position of their political partner(s) when they ended up in a coalition government. This would suggest that the opinions of political parties on road transport policies show a greater correlation with their political principles than with technological advances, which increased the options for pricing policies.”

Researcher's perspective

Erik-Sander Smits (TUD) studies modelling of people's travel behaviour based on different pricing measures.

“During my stay at the Institute of Transport and Logistics Studies at Sydney University, I laid the foundation for several new models, all of which help predict the traffic situation after a specific pricing measure has been implemented. Living in Sydney for a couple of months was an incredible experience, and amazingly, I actually found it easy to focus on my research during my stay there and was able to lay the foundation for several papers. The combination of working in an environment where you can fully focus on what you're doing and my collaboration with Michiel Bliemer and Mark Raadsen was absolutely my highlight of 2013.



Erik-Sander Smits

A central part of our research was creating realistic models of travel behaviour and the large-scale applicability of these models, by which I mean to say that the model can be applied to the Randstad road network. The new route selection method makes it easy to incorporate both short and long journeys, an option that isn't provided by the current models. Another advantage is the short calculation time and the fact that the model is well-equipped to manage overlapping routes. I presented the results of my research in Washington, DC in early 2014.

The new framework for describing driving behaviour at junctions and narrow parts of the road is based on the number of delays per vehicle; this makes it possible to determine behavioural assumptions within the model. Previous models did not provide this option of creating a link with behaviour. These junction models are important, because they determine where the congestion will be concentrated and at what pace the traffic is moving. The results were presented in Stockholm in September 2013.

I'm currently in the final stage of the project, and I can say at this stage that a PhD process is always unpredictable. I learned a lot in the past four years and am very happy with the opportunities for development I've been given – I've

certainly taken advantage of them! I wasn't able to achieve the goal I set for myself four years ago, but then that was a very ambitious goal: creating a comprehensive model with many innovative features. But I'm absolutely happy with the results I've achieved, even though there were periods when I got stuck with my research, and I'm still behind on my publications as well.

Mainly because I'm interested in so many different subjects and also used so many of them in the project, it's kind of tricky to use the different results of the research and develop them into a PhD thesis. But in the last month of 2013 I managed to work out the structure of my PhD thesis, and it's turned out really well. I was able to integrate a number of completely different methodological issues in the thesis. The only thing I still need to do is wait for the results of my current case study. Since most of my results are methodological in nature, it's not easy to explain the social relevance of the research. The models developed can be integrated into software applications, which will make it easier for consultants to make accurate predictions as part of their projects. Using these improved predictions, they'll better be able to support their recommendations, which are valuable to policymakers."

Cohesive Strategies for Achieving Sustainable Accessibility in the Randstad Conurbation

The SRMT researchers are developing cohesive strategies for the Randstad conurbation based on an integrated approach to land use (uses), location selection, multimodal transport networks, travel behaviour and transport policy. The programme's director is Professor Emeritus Ingo Hansen of Delft University of Technology. The anticipated research results will be relevant to sustainable mobility policies in relation to investments in the strategic transport network and Infrastructure, Space and Transport Multi-year Programme (MIRT) projects. A user group set up for the project includes representatives from the Amsterdam metropolitan area, the Ministry of Infrastructure and the Environment, Prorail, the Haaglanden metropolitan area, NS Dutch Railways, Bouwfonds and the RET Rotterdam Transport Company. The various group members each make their own contribution, by supplying data for example. The five executive researchers work closely together on these projects.

Mixing residential and business – pros and cons

PhD student and research assistant Yuval Kantor of VU University Amsterdam revised his article for the leading Journal of Urban Economics in 2013. "In the article, I describe the introduction of traffic congestion in the urban economic model developed by Lucas and Rossi-Harsberg in 2002, which helps create much more realistic city land use maps than in the past. In cities dominated by industrial agglomerations, reduced sensitivity to congestion – due to an increased use of public transport, for example – can lead to the creation of zones with different uses. The result, then, is more agglomeration effects. Such effects are less substantial in cities where the industrial sector is less affected by

external spillovers; in those cities, you can expect more mixed-use properties in specific areas. My model makes it easier to understand the complex relationships that affect land use in urban regions, including the Greater Amsterdam Area (Amsterdam Metropolitan Area). The model shows, for example, that even minor changes in commuting costs have a significant impact on the concentration of employment and dispersion of the population, which is difficult to estimate in advance. It would also appear that, in conditions where congestion is a significant part of the total travel expenses, town planning policies designed to ensure a mix of residential and business uses work to increase prosperity.”

“Work shopping” for Transit-Oriented Development

PhD student and research assistant Andrew Switzer of the University of Amsterdam conducted an international comparative study into the dynamics of urban transitions. In his research, he used a pre-developed heuristic framework centred on the coherence between urban planning, traffic and transport. Besides the planning process and policies which focus extensively on planology, Switzer also considers the role of different social trends on the economy, culture, and the political climate. In addition, his research also incorporates the role of interest groups and demand from households and businesses. Switzer: “I found that in Zurich and Munich, the main drivers of change are protest movements, interest groups and changes in living patterns and travel behaviour. Although government policies are obviously important in terms of keeping everything together, they are only one of several factors relevant here. You also see clear differences in how rapidly change and transition occur depending on institutional structures, such as the political system and the organization of civil participation. Our heuristic framework was developed with the intention of also using it together with stakeholders in order to explore opportunities for future transitions and develop transition strategies. Back in the autumn, we started a series of workshops in which we do just that. During these meetings, we and the other partners in our SAR programme explored options for a transition to Transit-Oriented Development in the Greater Amsterdam Area. Our main job was to facilitate small-scale initiatives while at the same time creating connections between those initiatives at a regional level. One particular idea involved creating an office that supports initiatives and connects them with each other across hubs by organizing partnerships between town planning players and traffic and transport authorities. Although the interdisciplinary collaboration with the modellers in the project was certainly challenging, it did allow us to calculate the contribution of town planning and transport concepts to sustainability, which really improved the dialogue. The workshop we’re holding in the near future is going to be very interesting: we will be presenting the findings from the international comparative study, as well as inviting players involved in innovations relating to space and mobility – the “niche players”, if you will, from the transition studies. This will help make the strategies from the previous workshop more specific. We will be exploring barriers and figuring out what approach to take.”

Challenge to effectively present model results

PhD student and research assistant Ties Brands of the University of Twente continues to work on his multimodal network design, through which he hopes to achieve several different objectives. His study covers the entire Northern Wing of the Randstad conurbation (including Haarlem, Zaanstad, Schiphol, Amsterdam and Almere). He discovered a more efficient optimization algorithm in 2013, which has enabled him to achieve better results using the same calculation time. This algorithm is currently used to determine the impact of the shifting transport demand on optimization results. This involves assessing the optimization results based on the 2020 demand for a situation using the 2030 demand as a basis. Brands: "We're also studying the impact of policy changes on Transit-Oriented Development, in which scheduled developments are concentrated around railway stations rather than being spread throughout the country. An initial analysis shows that, while the measures to be implemented do not differ much, the scores for the solutions are generally just below optimal for other traffic-related questions. It's always a challenge to present the myriad results generated by an optimization with several different objectives in a well-organized way. Several methods from the literature will be applied to the results of our case study, and we are consulting with policymakers in order to find a form that can be applied in practice as far as the policy is concerned. Any suggestions are always welcome! This should lead to new insights into the features of optimal multimodal traffic networks, concentrated on the North Wing of the Randstad conurbation."

Multimodal strategic transport model nearing completion

PhD student and research assistant Gijsbert van Eck of Delft University of Technology: "Strategic transport models are a key tool in designing transport policy in the medium and long term. Models currently used in practical situations often don't have all the properties required to carefully evaluate multimodal networks or specific parts of these networks. Passengers having the option to combine different transport tickets as part of the same journey sets additional requirements for the modelling method. Key aspects in which existing models fall short are mainly determining and describing relevant travel alternatives, modelling the choice between these alternatives, and realistically factoring in the effect of capacity limitations on this choice. I am therefore developing a new model based on four basic principles: the construction of an integrated network; advance generation of relevant travel alternatives; a simultaneous approach to the choice of route and transport mode, and the integrated modelling of capacity limitations. I further developed the latter two elements of the model over the past year, and it is now ready to be used across the entire North Wing of the Randstad conurbation. The purpose is to demonstrate the added value of the model. First of all, the detailed modelling of multimodal transport journeys generates more accurate future forecasts in general, and second, it also facilitates new applications, such as the evaluation of specific multimodal policy measures. We expect to complete the development and evaluation of the model sometime in 2014."

Accurate timetables

PhD student and research assistant Daniël Sparing's research interest is public transport timetables: he developed a model that can generate different timetables for different railway frequencies and hopes to earn his doctorate based on this research in 2014. See Daniël Sparing's profile below.

Researcher's perspective

Daniël Sparing (TUD) develops tools with which to evaluate the performance of multimodal public transport timetables.

"A year ago, I was developing a model that can optimize timetables for different railway lines. The plan was to use the model to filter out versions of timetables with the highest level of stability at a specific service level, where you could assess their stability through a quality of the timetable we call "minimum cycle time." This gave us the idea to integrate the focus on stability in the entire optimization process for our programme. It resulted in a model which can be used to optimize the train timetable in order to improve stability. The model saves a lot of time, as you don't need to analyze all kinds of other timetables. The new method has already been implemented in a case study for the The Hague-Utrecht corridor and the railway network between Schiphol, Amsterdam and Lelystad, and we're currently developing an application on an even larger scale.

In 2013, it finally became possible to analyze realistic data relating to the Dutch public transport system – the actual arrival and departure times of buses and trams, and their deviations from the timetable. This presents new research opportunities that the public transport providers were not even able to come up with themselves, including the interaction between services provided by various transport companies. In this pilot study, we demonstrated that the transition from buses to trains tends to be a lot more time-consuming in the long term than scheduled, which reduces passenger comfort and levels of satisfaction. As for my research project, I enjoy the fact that the problems we face are so international in nature; for example, we've been in talks with Belgian colleagues to resolve similar issues they have been experiencing on their network. During a study trip to Stuttgart, we saw how the high passenger volumes at some central railway stations in their tram network presented the same bottleneck as the kind we have around Schiphol Airport. But generally speaking, I enjoy the fact that the maths, methods and programming knowledge I picked up during my research apply to a much wider area involving logistics, industrial engineering, and other fields.

I am very pleased with the way my project turned out. I'm always very pleasantly surprised whenever people in academia and in the 'real' world show a lot of interest in my work, when I myself am not even sure about the results yet. Having said that, I think it's probably best to wait until after my thesis defence to look back and draw conclusions."



Daniël Sparing

Climate change, space and transport behaviour

The main challenge of the CESAR programme – led by Martin Dijst of Utrecht University – is to decipher the complex relationships between built-up urban areas and infrastructure, meteorological processes and behavioural patterns with regard to mobility, residential choices and car ownership. CESAR will then go on to integrate this knowledge in the Urban Strategy scheduling support system in order to balance climate-related challenges with other interests in the Randstad conurbation. The CESAR user group includes representatives from the City of Amsterdam, the Cyclists' Union, the Greater Rotterdam Area and the Research Institute for Mobility Policy (KIM).

Emotional perception of weather en route

PhD student and research assistant Lars Böcker of Utrecht University has performed extensive fieldwork in the Greater Rotterdam Area and is currently investigating how people perceive the weather and emotions while travelling on different modes of transport. Böcker: "There has been very little research into subjective perception of weather and travel to date. Our research shows that low temperatures, clouds, rain and wind create a less enjoyable experience for passengers. We also found that cyclists tend to be more affected by the cold than other transport users, presumably because they are most exposed to the elements."

Modelling the Randstad microclimate

PhD student and research assistant Natalie Theeuwes of Wageningen University uses measurements and a meteorological model to analyze the urban climate in the Randstad conurbation, which involves examining the correlation between urban morphology and the microclimate. Specifically, she is concerned with how greenery, water and street geometry affect the temperature in the city. Theeuwes: "One of our findings is that water does not always cool down temperatures in the city, but actually raises them as well. We are now using these results to develop a model for urban temperatures."

Effective process management is underestimated

Postdoctoral researcher Marco te Brömmelstroet of the University of Amsterdam conducted a series of experiments to determine how the usability of tools such as Urban Strategy can be improved. Although there is a great need for effective and efficient support in strategic planning and scheduling processes and there are many tools available that offer just that, they are not really used on a large scale by actual planners and schedulers. Te Brömmelstroet: "Using a systematic analytical framework allows us to measure the presumed added value of scheduling support systems (PPS) more effectively than in the past. The findings from six controlled experiments, which involved simulating scheduling dilemmas with students, show that Urban Strategy has systematic positive effects on individual enthusiasm, the credibility of the results, consensus and insights into the causes of urban problems. In addition, we also found that the usability of the

tool and the perceived quality of the planning and scheduling process are highly correlative. For one, the credibility of the tool is strongly linked to personal feedback and the extent to which the role is adjusted to the experiment. Transparency, clarity and communicative value are all important conditions for a wide range of process features. Particularly significant to the quality of the scheduling outcomes is whether the tool supported the creation of ideas.”

By making observations and incorporating the results from Peter Pelzer’s project, it has become clear that we may be able to significantly improve the structure of the workshop in which a PSS is used. “Many of our experiments and field observations have turned out to underestimate the value of effective process management, which ensures that the tool is correctly integrated into the creative-analytical cycle.”



Table with digital map

User questions lead to interesting results

Like Marco te Brömmelstroet at the University of Amsterdam, PhD student Peter Pelzer of Utrecht University and Radboud University Nijmegen conducts research into scheduling support systems, focusing mainly on practical experiences.

Pelzer: Pelzer: ‘In the literature on scheduling support systems, tools are often used to support argumentation. It’s assumed that policymakers will use them in any case. I took a different approach in my research by looking at the demand side instead. What sort of tools do policymakers need? I learned during a Group Decision Room workshop I organized back in October last year – somewhat to my surprise, I might add – that process aspects, in particular, are crucial. This includes facilitating cooperation and generating communications. Improving the results was not given the same degree of priority by the parties concerned. I am currently analyzing a workshop using TNO’s Urban Strategy tool and have been using the results of surveys after several digital support sessions in order to gain an even more accurate understanding of this process.” See Peter Pelzer’s profile below.

Researcher’s perspective

Peter Pelzer (UU and RUN) conducts research into scheduling support systems.

“The year 2013 was busy and very eventful. I did a lot of empirical research, wrote articles, and attended conferences. Since I study various tools and contexts in my research, this also meant that I had to travel a lot to conduct interviews. That involves getting up early and hoping you’ll find your way to wherever you’re going. If it hadn’t been for my smartphone and Google Maps, I wouldn’t have made nearly as much progress with my research. The interviews with practitioners were really



Peter Pelzer

inspiring: besides leading to a lot of valuable data, it also allows you to get immediate feedback on many of your findings. This is what applying research to the real world is really all about.

One of the main questions I asked in my research concerns the added value of scheduling support systems. I'd expected that users would regard better results – that is, more detailed plans and better-informed decisions – as an important value, but the interviews mainly highlighted the importance of improved processes. As one of the users of the digital map tables told me: "The use of these tables sparks some very interesting discussions between the participants – very active and focusing on content."

The absolute highlight of 2013 was the organization of a Group Decision Room session with users of digital map tables from all over the Netherlands. It was a huge challenge in terms of logistics to get everyone together at the same time, but fortunately, it all worked out in the end, and resulted in some very valuable data. At the end of the session, I organized a symposium together with Radboud University, Mapsup and the Royal Dutch Geographical Society (KNAG) for professionals under the name "Geo-information on the Table." The event sold out and turned out to be a great success.

Looking back on my research now, I would say the interviews with professionals were, without a doubt, the most educational; they were invaluable in terms of refining and adjusting otherwise rather abstract scientific insights. Since I enjoyed the process so much and it gives me so much energy, I had a pretty easy time of it. One negative aspect, though, was the long process involved in academic and scientific publishing; it can take more than six months to get a paper back from reviewers. That also means it takes a while to get back into the swing of things. Surely there must be a way to speed up that process!"

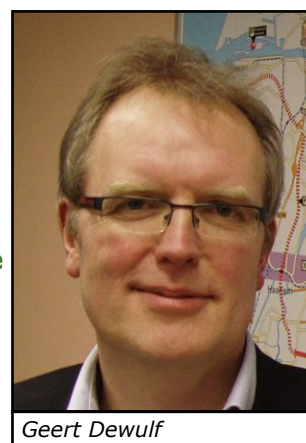
4. Three post-doctoral projects

Climate-resistant management and research into infrastructure, mobility management and electric transport

In 2011, six new post-doctoral researchers started work in three different programmes. Herbert Termaat of Wageningen University and the University of Twente's Irina Stipanovic are studying the relationship between climate change and the management and maintenance of national trunk roads and railways, supervised by University of Twente Professor Geert Dewulf. Sjoerd Bakker of Delft University of Technology and Marija Bockarjova of VU University Amsterdam are analyzing the transition to electric transport, under the supervision of Professor Bert van Wee and Associate Professor Kees Maat, both of Delft University of Technology. Linda Nijland of Utrecht University and Eva Gutiérrez-i-Puigarnau of VU University Amsterdam are researching different mobility management instruments under the supervision of VU University Amsterdam's Professor Jos van Ommeren.

Climate-resistant management and maintenance

What impact will climate change have on infrastructure management and maintenance? Researchers Herbert Termaat of Wageningen University and Irina Stipanovic of the University of Twente are looking to improve the decision-making process by organizations based in the Randstad conurbation which are responsible for infrastructure management and maintenance. As part of their project, the scientists link together three fields of research: climate change, infrastructure performance and policy development. They have been working on this project since March 2011, and the part of the research relating to train tracks was completed in 2012.



Geert Dewulf

Road infrastructure

The researchers then shifted their focus to road infrastructure and researched the impact of the winter climate on roads together with the Directorate-General for Public Works and Water Management (Rijkswaterstaat). Some of their main conclusions include:

- The probability of damage is greatest during the transition from frost to thaw and increases if there are more than 20 frost-thaw shifts during a particular winter;
- However, the probability of damage caused by frost-thaw shifts decreases as a result of the expected climate change.
- Winter damage reduces the actual life span of the covering layers of dual-layer porous asphalt by more than average life expectancy, which results in more maintenance work;
- Until 2030/2050, the cost difference between adaptation/non-adaptation of

- dual-layer porous asphalt in relation to temperature and precipitation change is not substantial;
- Until 2090, the cost difference between adaptation/non-adaptation of dual-layer porous asphalt in relation to temperature and precipitation change is set to increase.

Electric transport

Kees Maat, an Associate Professor at Delft University of Technology, heads a multidisciplinary research group studying electric mobility – partly under the banner of the SAR programme and partly under the banner of NWO's Energy Transitions programme. Dr Maat, commenting on the progress made by his team in 2013.

Broad spectrum of stakeholders

"Sjoerd Bakker from our group investigated how electric cars can eventually become important modes of transport, along with the attitudes of different stakeholders towards this trend. The transition theory holds that transitions must be driven by new, fresh players, but in the transition to electric mobility, there turns out to be a much broader spectrum of stakeholders involved. Both well-established and newer automotive companies have shown initiative, and this also applies to a large number of companies entering the market indirectly from the electricity sector."

Traditional automotive industry is gradually changing

Maat continues: "There was another NWO project that tied in perfectly with ours, from the Energy Transitions programme. That's actually Will Sierchula's PhD thesis subject. It presented us with the opportunity to investigate the initial stage of the commercialization of the automotive industry using empirical methods. It turns out that the traditional automotive companies pursue an incremental strategy: commercialization doesn't involve major breakthroughs to radical technologies; what happens instead is that small start-ups like Tesla are very gradually acquiring new knowledge while at the same time maintaining their experience. That gradual quality is also reflected in the increase in hybrid models – not just involving electricity, but running on CNG and flex fuel as well. Government authorities need to realize that we should expect automobile manufacturers to develop gradually and that incentive measures will be required to ensure a faster breakthrough."

Spin-off

The NWO studies turned out to be not only tools for studying electric mobility, but were also instrumental in securing EU research grants," Maat says. "As part of the E-mobility North Sea Region project, we are participating in research into urban distribution using electric vehicles and the standardization of charging stations. We did something unique, which involved conducting a study in six languages in seven North Sea countries in order to analyze the market potential

of electric cars. In our study, we are investigating the effects on accessibility in the event that electric cars replace household car mobility patterns (at least in part). Then, finally, we are carrying out a project relating to the transition to emission-free bus transport.”

Reaping the benefits

There are currently three special publications on electric mobility in the works: one in a Dutch magazine, one in an international publication, and one in book form. Maat: “When we were drafting the initial proposals for NWO, electric mobility was restricted mainly to the industrial sector and the desks of researchers and policymakers. Now, we’re seeing charging stations pop up all over the country, and there are currently more than 30,000 electric vehicles in the Netherlands. And yet... electric cars aren’t as easy to sell as electric bikes, which mainly offer benefits. Policymakers will need to make a much larger effort to make sure this will be more than just a fad and that those charging stations aren’t left to rust a couple of years from now, a bit like payphones now.”



Kees Maat

Mobility management

How employers and employees manage mobility issues is vitally important to the accessibility of the Randstad conurbation. Over the past three years, researchers have focused on analyzing tax policies relating to lease cars and teleworking. We caught up with Jos van Ommeren, who explained all.

Telework: No impact on distance to work

Eva Guttiérrez-i-Puigarnau of VU University Amsterdam has completed her study. Van Ommeren: “Our most recent study on telework shows that, in industries where large numbers of employees work from home, the average distance from home to work has increased as much as in industries where telework is not common at all.”

Mobility-related employee benefits matter

Linda Nijland of Utrecht University researches the effects of mobility management on mobility behaviour and activity patterns of employees and their households.

“I spent much of 2013 trying to identify the personal, business and geographical characteristics that affect what types of transport-related employee benefits companies provide, and to what extent employees are making use of those benefits.” Nijland’s work focused on telework, flexible working hours, and four types of compensation for commuting: lease cars, reimbursement of public transport costs, bicycle plans and general compensation (money, depending on

the mode of transport). Nijland: "The results show that there are interrelationships between the various transport-related employee benefits provided by employees. For example, it is very likely that, if an employment contract provides the option to work from home, the employer will also offer flexible working hours. In addition, she also noted that lease car drivers have options to start work earlier or later and work from home more often than the average employee does. This trend ensures that the negative effect of lease cars on traffic congestion is at least somewhat mitigated. Employees whose public



Jos van Ommeren

transport expenses are reimbursed by their employers also have flexible working hours, which is convenient, as it allows them to adapt their working hours to public transport timetables as well as making any delays less of an issue. Finally, the use of lease cars also results in a larger number of cars per household, while reimbursement of public transport expenses and bicycle allowances offered by employers actually reduce the number of cars on the road." Nijland will continue to investigate the impact of mobility measures on commuting during and outside peak hours and on transport behaviour during leisure time.

5. Four final projects

Use of bicycles and the integration of space and mobility in transit-oriented development

The four final projects included in the SAR programme were allocated in 2012, and currently two post-doctoral projects are underway that are devoted to Transit-Oriented Development (TOD). The other two projects focus on bicycle use. In this section, the project leaders explain what exactly their projects involve. A community of research and practice was set up for both topics in which researchers and field experts can exchange information, knowledge and experience.

Barriers to overcome in Transit-Oriented Development

The “Implementing TOD” project is headed by Luca Bertolini of the University of Amsterdam, while the research is being conducted by Sander Lenferink of Radboud University Nijmegen, supervised by Professor Erwin van der Krabben), Dorina Pojani and Verena Balz of Delft University of Technology (supervised by Dr Dominic Stead), and Ren Thomas of the University of Amsterdam. The project has produced data on potentially useful financial and legal tools, critical success factors for Transit-Oriented Development, and opportunities and limitations of practices of knowledge exchange and application.

Financing and governance tools now available

Post-doctoral researcher Sander Lenferink of Radboud University Nijmegen: “We investigated the application of various innovative finance and governance tools in 2013. We did this both on a qualitative and quantitative basis, for example through case studies and game simulations with field experts. The actors involved in the research found the tools we analyzed (Tax Increment Financing, business investment zones, urban reallocation and marketable development rights) to be relevant, applicable and interesting. These tools are generally applicable from a legal perspective and, in the current tough economy, they could give the decisive impetus or be used to facilitate area and hub development processes. However, the need to explore a wider application of the tools in the field, as well as in pilot projects and test programmes, is widely acknowledged.

We found that both the availability of information and the option for personal interaction play a role in negotiations regarding hub development and area development. Something that applies to all these different tools is that the more information is available about the positions of the individual stakeholders, the more solid the contract they eventually sign. As for personal interaction, we found that the more opportunities there are for such interaction, the easier it becomes to communicate the intentions behind the negotiation behaviour. Such communication increases the likelihood of success in the negotiations and that

they will result in a contract, and that the contracts signed are better able to serve the public interest.

We noted that the negotiations are not just about making as much information available as possible, since more information does not necessarily result in more successful negotiations. For example, the negotiations could become tougher once the parties learn more about each other's positions and financial situation. This means that, although the contracts signed generally do serve the public interest, the likelihood of a contract actually being signed is reduced."

Need for greater participation in TOD processes

Ren Thomas, post-doctoral researcher at the University of Amsterdam: "Our main findings are the sixteen critical success factors in the implementation of TOD, which arise from the eleven case studies we conducted. These factors were instrumental in implementing TOD – or actually turned out to be a barrier in this process. We also managed to isolate the factors that had the greatest impact, and we found combinations of factors which were used to achieve specific TOD objectives, including significant roles for public transport, cycling and hiking."



Ren Thomas

"For the first time, we made a systematic comparison of case studies in which we used rough-set data analysis to determine what factors combined were significant and which ones were the most important. That means we now know what factors carry the most weight in TOD implementation. Common factors turned out to be the necessity of political stability at a national level; the quality of the relationships between regional players; the presence of a regional town planning and mobility organization; the presence of multidisciplinary implementation teams; and public involvement. Conversely, we found that several factors were not as important as sometimes assumed, including the presence of political leadership and the use of area-focused tools during implementation. Our findings also turned out to be easier to generalize than the previous studies, on account of our systematic approach, which included international comparisons."

Foreign perspective

How does Canadian-born researcher Ren Thomas feel about Dutch TOD practices? "There were a couple of things that struck me during the workshops we organized. For one, Dutch urban planners interested in TOD tend to agree that TOD would be desirable both on the North Wing and the South Wing of the Randstad conurbation. The thing is, though, that they haven't quite figured out yet how TOD works. What is the managing organization, how does the planning process work, and what are the statutory rules or policies that facilitate TOD? One major barrier seems to be the lack of any formal relationships between the various players, including municipal governments, transport companies and the central government, as well as a lack of understanding of what their respective roles involve. For example, what can a municipal government do to support TOD, and what might the central government be able to do? How can they collaborate in order to ensure that the objective of more sustainable regions is

met, with TOD being one of the tools to achieve that objective? There has been some progress, however, in terms of improving informal relationships between the players, particularly on the South Wing. In this regard, I would say that understanding of TOD is still too much restricted to areas in the vicinity of railway stations and the railway infrastructure. Dutch city planners don't seem to consider the integration of the main types of infrastructure for cycling, hiking and public transport at the neighbourhood level – I'm referring to pavements, bike paths, trams and buses. The situation is somewhat different in the United States and Canada, where the focus has shifted more to the smaller scale of local communities, and that's where you see the impact of the most important decisions being made. Dutch city planners also don't understand the need of people to live in a neighbourhood with good public transport connections, since bicycle use is so common here. Their attitude seems to be one of: "Why would I want to live near a train station when it takes just ten minutes to cycle there?" Finally, what I would regard as the main barrier to implementing TOD in the Netherlands is the lack of influence in planning processes. In the US and Canada, ensuring participation is part of the training of urban planners. Dutch planners realize themselves that they haven't been trained to organize participation beyond some basic consultation about plans that are virtually finalized already. In some of the more successful international case studies involving TOD, city planners organized comprehensive consultation processes focused on the future of the entire region, where the issues involved included sustainability, transport, accommodation and structural design. This type of consultation, aimed at establishing a dialogue about the future of the region between participants in all projects, eventually helped to greatly improve understanding of urban planning issues. The processes resulted in greater acceptance among the public of higher densities and public-transport infrastructure. Town planning policies in the Netherlands still tend to be very much top-down, which is very different from the US, Canada and – to some extent – Australia. However, given the history of the Netherlands and its culture, which promotes dialogue and consensus, there seems to be great potential for integrating more civic participation in urban planning processes."

Practices cannot simply be translated from one country to the next

Delft University of Technology's Dorina Pojani and her research partner Verena Balz are involved in analyzing processes relating to the use, representation and application of knowledge and information regarding TOD planning concepts. "We examined policy documents, background reports and scientific literature, as well as conducting interviews with national, regional and local civil servants and the key stakeholders. We're analyzing the transition and representation of TOD policy concepts and tools from both an internal and external perspective. We're investigating the nature and type of policy tools civil servants and key stakeholders require in developing TOD policies in the Amsterdam Metropolitan Area. We've discovered that the transfer of knowledge tends to depend strongly on the actions of individuals and that the process of knowledge exchange tends to be uncoordinated and fragmented. Ideas on urban planning from outsiders can be inspiring to policymakers, but they generally don't lead to any major

changes in policies or practices.

I'm also investigating to what extent civil servants and stakeholders from outside the Netherlands look at Dutch experiences for inspiration, and I'm studying the lessons they've learned from these experiences. We found that foreign visitors to the Netherlands tend to be impressed and inspired by the achievements of Dutch urban planners, but that attempts they've made to adopt "Dutch" policies have rarely resulted in any real action or tangible results. Contextual differences in culture, social structure, language, physical patterns, legislation relating to town planning and financial resources, as well as the question of whether or not to involve political elites in the transfer processes turn out to be barriers to integrating Dutch town-planning and city-planning policies elsewhere."

Stimulating TOD in the southern Randstad conurbation

Karst Geurs of the University of Twente leads the project 'TOD in the Randstad South Wing', involving strategies for integrating urban development and transport hubs in the South Wing. The post-doctoral researchers involved in the project are Hans Koster and Martijn Dröes of VU University Amsterdam, Christa Hubers of Delft University of Technology and Lissy La Paix Puello of the University of Twente. The researchers are investigating (a) the impact of the quality of pre- and post-transport on mobility and accessibility, (b) the correlation between office vacancies and railway stations, (c) the correlation between the location of railway stations, the creation of congestion, and urbanization and (d) demand for housing construction in the vicinity of railway stations and the impact this has on railway use.

Bicycles: key factor in railway use

The University of Twente's Lissy la Paix de Puello is investigating the effects of accessibility of locations through railway stations. "Bicycles are a popular form of transport in the Netherlands for getting to railway stations: around 40% of train passengers uses the bike to get to the station. Railway stations attract many passengers due to the large number of cyclists; cyclists are willing to bike up to 3 kilometres to get to the train station," she explains. The quality (in terms of cost and travel time involved) of bicycle rides is a factor in determining whether people will choose the train as the main means of transport. "My research also shows that people tend to use the train less when bicycle parking costs are high in proportion to the travel time from their home to the train station. It also turns out that people who ride their bike to the railway station are more sensitive to improved travel times than people who go by foot. This means that improving bicycle routes to train stations will increase train use, which is an issue that certainly merits attention in local transport policies. This has also been borne out by choice experiments carried out among residents of the Southern Randstad conurbation. See Lissy's profile below.

Office vacancies: No different at stations than elsewhere

Hans Koster of VU University Amsterdam is researching the economic aspects of TOPD, including the status of the local property. "Around 15% of Dutch offices were vacant in early 2013, and at 18%, Amsterdam has one of the highest vacancy rates of all European cities," Koster says. "There are significant differences in vacancy rates between cities, ranging from 5% to up to 35%. To a large extent, this is related to the characteristics of the actual buildings, including the amount of rent paid and their age. We found that vacancy rates are not higher or lower in the vicinity of railway stations, and that includes intercity train stations. The re-prioritization of new developments, elimination of some of the oversupply, and the conversion of office sites will be essential factors in the coming years in determining the success of public-transport hub policies.

Stations key to regional economic boost

Vu University Amsterdam's Martijn Dröes is also involved in researching town planning and economic issues relating to TOD. "The numbers of train stations and their locations have an impact on congestion and town planning and economic trends and developments. Building a large number of railway stations is a good strategy for reducing congestion, but if you want to boost specific economic areas, a small number of strategically located stations is actually more effective. Adding more railway stations not only affects travel times, but it also has an impact on consumer behaviour, employment, and the number of commuters – including in the surrounding areas. It's important to consider this wider economic impact and the town-planning implications it will have in decision-making processes regarding the locations of railway stations."

People like to work near railway stations

One of the research subjects studied by VU Amsterdam's Christa Hubers is market perspectives for TOD. Hubers: "Train passengers in the Netherlands tend to represent the more educated segment of the population, which can potentially result in a highly diverse market demand for housing located near public transport facilities. This requires a large diversity in the supply of different housing types situated near train stations. We found that the vast majority of people who travel by train live and work in the vicinity of a railway station. A survey among residents of the Southern Randstad conurbation shows that the choice of the train as a mode of transport is determined more strongly by the distance of the work location to the station than the distance between a person's home and the railway station. Finding a workplace that's easily accessible by public transport is viewed as a more successful option in terms of increasing the appeal of train travel than is finding a home closer to public transport facilities. It is also expected that the combination of telework and the freedom of employees to determine when they start and finish work will make train travel more appealing. This would indicate that promoting train travel calls for a more comprehensive set of policy measures; that is, beyond merely building new homes near public transport stops."

Researcher's perspective

Lissy La Paix Puello studies the local and regional effects of accessibility by train station.



Lissy La Paix Puello

"I'm focusing on the correlation between station accessibility and regional accessibility in the Southern Randstad area. People travel to and from the station, which we refer to as 'pre-transport' and 'post-transport.' For these journeys, I investigated the impact of changes in the quality of routes to the stations, and station facilities. I made a spatial analysis of the scope of influence of railway stations and conducted surveys among the residents of the Southern Wing. These surveys include a number of choice experiments to be able to determine the individual impact of various characteristics of pre-transport and post-transport. I also had the opportunity to participate in two international conferences where new research insights were being presented. By the end of 2013, I had already submitted three papers, despite having completed only eighteen months of research.

For me, the highlight of the year was modelling the data I collected. The models I developed predict market shares and variations for the various modes of transport and for pre and post-transport, based on several different scenarios. We also used the results of the analyses to create a new version of an existing national transport model, which we're using to make transport analysis for the entire South Wing.

What I found particularly satisfying was the amount of data that became available. I used both old and new data and was able to compare them and correlate them, which has inspired me to continue my research. I found the project very well organized, and I was able to do everything as planned. I also love my work environment and I'm in awe of the opportunity I'm getting to work with brilliant researchers.

When I look at the results we've achieved to date, I see that train travel is influenced mainly by the costs and the time involved in pre and post-transport. For pedestrians, the quality of the route is more important than for cyclists. We also found that most people are not willing to pay for better bicycle facilities. I ended up getting more results from my research than I'd expected and am very satisfied with the level of development and with my personal learning process as part of the project. I'm acquiring new knowledge in an area that I find extremely interesting."

Learning more about bicycles

The University of Amsterdam's Luca Bertolini and Marco te Brömmelstroet head up the two SAR projects relating to bicycle use. Lucas Harms, also of the University of Amsterdam, is in charge of the project involving the social and spatial dynamics of bicycle use, and the policy implications of these dynamics in the Randstad conurbation. Another University of Amsterdam lecturer, Dr Roland Kager, began his research into the role of the bicycle in pre and post-transport at the end of 2013, taking over from Eva Heinen (then of Utrecht University). Researchers Lucas Harms and Roland Kager detailed their progress.

Major trend variations

Lucas completed the part of the project involving trends in bicycle use; the part in which he assesses the effectiveness of policies to promote bicycle use is still ongoing. Harms: "Although it may seem as if national trends in bicycle use in the Netherlands are pretty stable – that is, showing little or no change – there actually is a huge variation in trends. While bicycle use is increasing substantially in some areas, in other areas it has stabilized or even declined. And when you look at that growth and decline, you'll find that there's a differentiation within those trends depending on socioeconomic categories. The growing spatial and social differentiation is significant, since it shows, first of all, that bicycle use is sensitive to spatial and social conditions, and secondly, policymakers have the tools to actively control the conditions for bicycle use."



Lucas Harms

Priorities: More space for urban cyclists

Harms' research shows that the increase in bicycle use is mainly an urban phenomenon: the increased level of activity found in cities is often a direct result of a spike in the urban population – a phenomenon known as 're-urbanization.' More people moving to urban and metropolitan areas means that collective bicycle use increases accordingly, and in cities this growing use also tends to be concentrated in specific areas, routes and times. Bicycle use in Amsterdam, for example, grew by a substantial 40%, but this growth was concentrated mainly in the city centre and surrounding districts. The strongest growth occurred for specific routes, particularly to and from areas located near railway stations, as evidenced by significant capacity problems at bicycle parking facilities. Harms: "The policy implication is that the growing use of bicycles in urban areas puts pressure on infrastructure capacity, and increasing and expanding this capacity seems essential in order to facilitate further growth."

Improving bicycle accessibility in the countryside

In contrast, rural areas are showing a decline in bicycle use, due mainly to slower population growth. In some peripheral areas, the economies of scale of facilities and the resulting impoverishment of these facilities would also appear

to be a factor. Residents of rural areas who have to travel increasingly larger distances simply to meet their day-to-day needs often have no choice but to use the car. Harms: "What might be helpful would be to improve bicycle accessibility in rural areas by promoting use of electric bikes and facilitating better bicycle-public transport combinations.

Accommodating demographic differences

Another issue is that, from a demographic perspective, there are two significant life transitions which present a risk in terms of declining bicycle use, or, conversely, are likely to cause an increase in this use: starting a family and the loss of physical abilities in senior citizens. Harms: "As far as people starting families is concerned, the solution might be to keep families in the cities, and for the second situation, electric bicycles would be the answer.

Non-Western immigrants in cities don't use bikes as much as native-born Dutch urbanites, so culture and – more specifically – image are likely significant factors. Harms: Policymakers could consider making more of an effort to entice and facilitate people so as to get them to start using a bike."

Need for more information on policy effects

Harms has also noted during his research that there is relatively little information available about the effects of bicycle policies. Harms: "That's true not only in the Netherlands, but elsewhere as well. We would very much like to see policymakers do more to incorporate evaluations or impact studies when implementing measures and policy packages. They are also strongly advised to become more alert to non-infrastructure additional measures – including communications and marketing – and to the combination of different types of measures in a cohesive package."

A greater focus on problems and opportunities relating to e-bikes

In the internationalization component of the research project headed by Lucas Harms, Tim Jones of Oxford Brookes University studied trends relating to the possession and use of electric bicycles ('e-bikes') in the Netherlands and Britain. In a series of detailed interviews, users of e-bikes were asked for reasons and backgrounds for using an e-bike ('engagement'); how they gathered information prior to their purchase ('education'); how they rate the use of the e-bike ('experience'); and what expectations they have in terms of future use of the vehicle ('envisioning'). Many survey respondents stated that user experience of e-bikes varied significantly from user experience of regular bikes. More so than is the case with traditional bikes, they feel they need to anticipate other road users – and, vice versa, that other road users must also be more alert in anticipating irregular behaviour on the part of e-cyclists. If road users – both e-cyclists and others – are negligent in this regard, this can potentially lead to dangerous situations. Harms: 'It means there must be a greater focus on the road safety of e-cyclists and the challenges this poses to infrastructure, vehicles and behaviour. There would also seem to be some unused potential, particularly in terms of non-recreational travel. When making changes to the infrastructure

and the environment – including for the construction of new homes and offices – urban planners should pay more attention to the needs of e-cyclists.’ Two other conclusions I would like to share: e-bikes are not just for senior citizens, and it’s time for an image change! Second: people need to become more aware of e-bikes as tools of sustainable behavioural change.

Greater understanding of bicycle use near different types of stations

Based on his research, Roland Kager will attempt to develop an initial model relating to bicycle use in pre- and post transport. Kager: “Bicycle use in pre- and post-transport is traditionally interpreted and analyzed mainly as a means of increasing a station’s catchment area. However, a spatial analysis of population spread and the location of public transport stations in the Netherlands completed as part of our project indicates that there is another factor involved: bicycles present public transport users with a choice what station to use, and how



Roland Kager

frequently. This options provides public transport users who are also bicycle owners with the option to use the public transport system as it suits them – that is, adapt it completely to their day-to-day routines and/or changing circumstances. For example, an analysis of train journeys completed between 2010 and 2012 shows that, for 41% of these journeys, bicycle use can (potentially or otherwise) reduce total travel time significantly. In my research, will continue to analyze cyclists’ place of origin and destination and the choice behaviour of cyclists in terms of different types of stations offering the same train services and bicycle facilities. This will give us a greater understanding of future increases in bicycle use broken down by specific station and hub, which will, in turn, allow us to influence this choice behaviour where required.”