Planning with water and traffic networks

Carrying structures of the urban landscape

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Tjallingii, S. (2015). Planning with water and traffic networks. Carrying structures of the urban landscape. *Research In Urbanism Series*, 3(1), 57–80. doi:10.7480/rius.3.832

Abstract

The two networks strategy is a guiding model for planning and design that takes the networks of water and traffic as carrying structures. Its origin is in the early 1990s when it resulted from research by design projects aiming at the generation of tools for making urban development and the urban landscape more ecological. Reviewing practical experiences is one reason to look again at the strategy. A second reason is to explore the possible contribution to current debates such as those about complexity, landscape urbanism and landscape as infrastructure. The origin of the two networks strategy goes back to Ian McHarg's *Design with Nature* and Michael Hough's *City Form and Natural Process*. Inspired by them, the approach does not, in the first place, take nature and ecology to create limiting but carrying conditions. This asks for carrying structures. In the urban landscape there are at least three crucial fields of synergy between activities that ask for carrying structures: the territorial or spatial field or the area perspective, the activities related to flows that pass through these areas or the flow perspective, and the human activities involved in the plan and in the planning process or the actor perspective. The two networks create conditions for two multi-functional environments of synergy. The fast lane is the competitive profit-oriented zone where efficient production comes first. The traffic network is the carrier. The slow lane is the co-operation based non-profit oriented zone where water safety and quality, landscape and heritage, biodiversity, recreation and local food production are brought together. Here, the water network based on the drainage pattern is the carrier.

KEYWORDS

urban planning; urban design; landscape; infrastructure; landscape ecology; water networks; traffic networks; flows; strategic planning

1. INTRODUCTION

How is it possible to design spatial structures for urban and regional development that gear the diversity of needs and amenity to the carrying capacity of the planet and the ecological potential of the local landscape? In the early 1990s the idea emerged to answer this question by taking water and traffic networks as carrying structures in the making of strategic plans. Since then the *two networks strategy* has evolved as a conceptual guiding model for planning and design projects in the urban landscape.

Traditionally, biologists and environmentalists tend to take ecology to their own corner, the corner of conservation. Urbanisation is perceived as the enemy. In search of a more integrated approach and inspired by the emerging spirit of sustainable development that led to the Rio Conference in 1992, researchers and designers from different backgrounds embarked upon a programme of studies and pilot projects to make urban development itself more ecological. This implied a reframing of the issue: from ecology providing limiting conditions to ecology providing carrying conditions. The Dutch National Spatial Planning Agency initiated and stimulated this process in the years that followed (Tjallingii, 1981,1995,1996; Zonneveld & Dubbeling, 1996). The *two networks strategy* is one of the fruits of this programme. Over the last twenty years this strategy served as a conceptual tool, a guiding model that has guided planning and design projects at different levels. The purpose of this paper is to provide a critical review of these practical experiences. Learning from practice, the paper further elaborates on key elements of the strategy and explores the contribution that can be made to current debates about complexity, landscape urbanism and landscape as infrastructure. In this way the paper is part of a process of learning. In the TU Delft methodology review *Ways to Study and Research* this is called study by design (De Jong & Van der Voordt, 2002:19, 20; Frieling, 2002: 493).

1.1 Basic questions

This paper focuses on the role of the *two networks strategy* as a guiding model, as a conceptual tool. How is it used? Did it play the role of creating a frame for integrated urban development? The term 'integrated' is approached from three corners (see figure 1). From an area perspective, it is a question of durable diversity: the use of the identity and the ecological potential of the area for economic development and other activities such as maintaining biodiversity. Do the spatial elements fit together? From a flow perspective, it is a question of the safe and sustained use of resources. This includes balancing the upstream and downstream use of flows, and working with the 'reduce, reuse, recycling' principle. Do flows fit to the local situation and to each other?

From an actor perspective, the question is about a sustained commitment from the actors. This includes the capacity of the carrying structures

to act as a frame for a flexible infill that can meet the needs of yet unknown future activities. Does the structure create conditions for avoiding conflicts and promoting synergism?

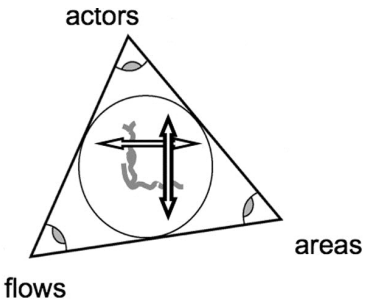

Figure 1 Three action-oriented integration perspectives (Tjallingii, 1996)

1.2 Outline

After a short description of the origin of the approach in an international perspective, the paper will discuss the area, flow and actor perspectives highlighting practical experiences and comparing with other concepts. In the conclusions, the paper focuses on the Schalkwijk case, an example of an integrated project that used the *two networks strategy* to structure the plan. The case illustrates answers to the basic questions posed. The final section compares this strategy with other integrated approaches.

2. ORIGIN AND HISTORY OF THE APPROACH

Rapid urban and industrial development in the period after the Second World War triggered a wave of environmental awareness in the 1960s and 1970s. Most ecologists with a biological background perceived urban development as a threat to ecology. The 3rd edition of the well-known textbook *Fundamentals of Ecology* by Eugene Odum, published in 1971, characterised urban-industrial environments as non-vital systems. (Odum, 1971: 269). Today, however, urban metabolism studies have become a major field of research (Holmes & Pincetl, 2012). And even biological research programmes such as the *Long-Term Studies of Urban Ecological Systems* (Grimm et al., 2000) are now based on two approaches: the ecology in the city, referring to wildlife in the city, and the ecology of the city, referring to the city itself as an ecosystem.

Unsurprisingly, planners and designers have less difficulty with integrated approaches. Frederick Law Olmsted was a great pioneer in this respect who with his 1887 plan for the Boston Emerald Necklace Park System showed how urban development can benefit from a design that incorporates natural valleys that act as drainage and water retention systems combined with an urban park (Spirn, 1984: 147; Ahern, 1999). This is a good case of good practice preceding the theory of it. Unfortunately, in the first half of the 20th century, practice was dominated by geometric form and function based concepts and it took nearly a century for Olmsted's ideas to be put into practice again. Planners like Patrick Geddes and Lewis Mumford continued and elaborated on these ideas, but it was Ian McHarg with *Design with Nature* (1969) who really brought ecology back as both a source of inspiration and a practical guide for urban design. To McHarg the use of what he calls natural process lands is central. In the urban landscape this implies a central role for the water cycle and its natural drainage pattern, valleys, floodplains, aquifers, steep slopes and forests. For reasons of safety, health and identity, urban man-made structures should fit to this existing natural order. Inspired by McHarg, other landscape architects, such as Michael Hough and Ann Spirn, further explored and elaborated this approach to urban design. For them too natural processes, not nature as an object, constitute the basis for urban design. In his *City Form and Natural Process* (1984) Michael Hough argued for an integrated management philosophy for the planning and design of open space. Beyond recreational and aesthetic values, open spaces should assume multi-functional roles, including water and waste management and biodiversity. Also in Europe, integrated ecological approaches to urban planning emerged (Tomasek, 1979; Tjallingii, 1981; Adam & Grohé, 1984; Neddens, 1986). In this tradition, the *two networks strategy* was introduced as one of the conceptual tools of the *Ecópolis strategy* (Tjallingii, 1995), later deepened and widened to the *Ecological Conditions Strategy* (Tjallingii, 1996).

Figure 1 summarises the key issues of this integrated ecological approach to planning. Traditionally, specialists such as spatial planners, engineers and policy makers tend to take urban development to their own corners represented by the area, flow and actor corners of the triangle. The scheme points at the need to turn around and keep an eye on the whole, represented by the circle. Just as the specialists in a hospital are expected to keep an eye on the whole person, the specialists in urban and regional planning are invited to use their own expertise but share their views with others and together focus on the integrated urban landscape. This paper approaches several basic action oriented questions from the different perspectives of each of the three corners. The focus here is on the two networks.

Reframing the role of ecology from creating limiting conditions to creating carrying conditions leads to a search for spatial and functional carrying structures. Here, the *two networks strategy* follows a line of thinking that took shape in the Netherlands around 1990 with the 'casco concept' (frame concept), a conceptual strategy that takes water networks as a carrying frame for rural development (Sijmons, 1990; Kerkstra & Vrijlandt, 1990). The casco concept sought to create a frame as a carrying structure based on the synergism of water management and nature – both in terms of conservation and new habitat construction – and created conditions for industrial land-bound agriculture in the spaces opened by the frame. The path-breaking plan *Ooievaar* ('Stork' in Dutch) illustrated this approach for the rivers of the Dutch delta (De Bruin et al., 1987). The plan proposed a framework of floodplains where nature was to replace agriculture. The *two networks strategy* expanded this idea to include urban development and took the traffic network as a second carrying structure for both agricultural and industrial activities. These activities require transport conditions that meet the demands of the dynamics of technology and economy. After its first publication (Tjallingii, 1992 English version 1995) the *two networks strategy* found its way to Dutch practitioners (Zonneveld & Dubbeling, 1996), to European platforms (Expert Group, 1996: 199) and to subsequent studies and projects that made use of the strategy (Aalbers & Jonkhof, 2003; Tjallingii, 2000, 2004, 2005). In 1997, the strategy inspired one of four prospective scenarios for The Netherlands in 2030, commissioned by the Dutch National Spatial Planning Agency (Tjallingii, Langeveld & Bus, 1999). At the local level the strategy was used in a number of projects. Some are discussed in Aalbers & Jonkhof (2003).

3. AREA PERSPECTIVES

How does the strategy work in plans and projects at different levels of scale if we look at it from a territorial quality point of view?

3.1 Design at the neighbourhood level

Figure 2 shows how the model can guide the design process at the scale of a small urban neighbourhood: the Poptahof project in Delft, the Netherlands. The neighbourhood of Poptahof, Delft was built in 1969 and renovated over the last ten years. (Van Dorst, 2005). The site consists of two groups of six apartment buildings, 11 and five storeys high. The schemes on the right represent them as two grey rectangles. Design option *b* for the roads and *c* for surface waters offer the most promising combination and create conditions for a quiet central zone of a park with a pond, a place to sit, walk and talk, where children can play safely. The pond can also store storm water run-off.

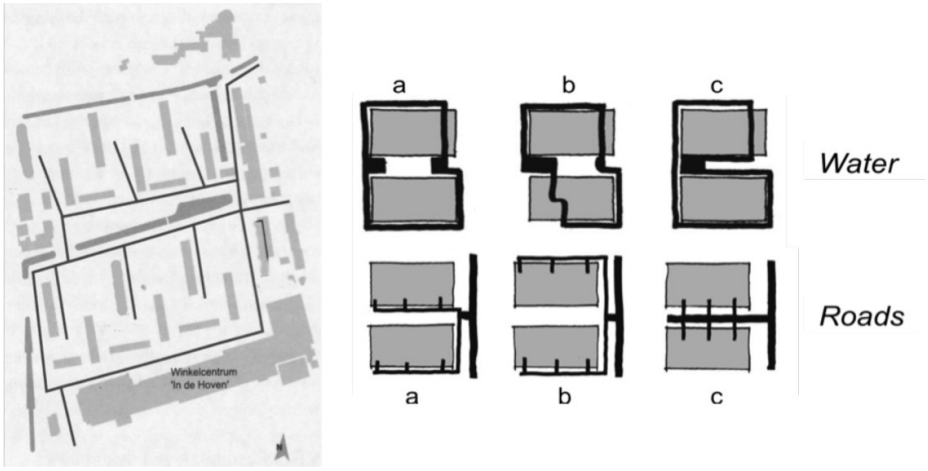

Figure 2 Delft, Poptahof. Design options for an urban neighbourhood.
Left: existing situation, light grey: buildings; dark grey: water; black: roads. Right: design options

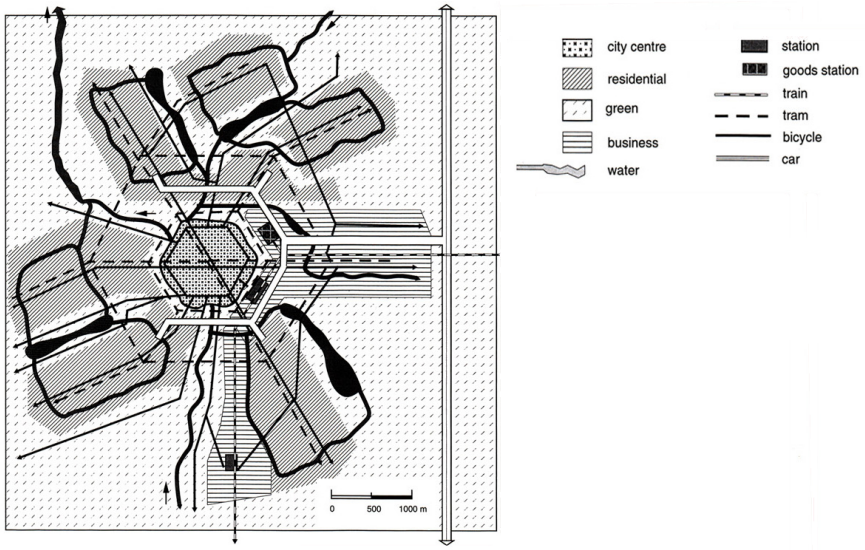

Figure 3 The city model (Tjallingii,1995)

3.2 A city model (figure 3)

The city model in figure 3 shows a guiding model based on the *two networks strategy* suitable for medium-sized cities of 100 000 inhabitants as presented in Ecópolis (Tjallingii, 1995: 94). In short, the model uses the well-known experiences of many lobe shaped cities with green wedges, such as Copenhagen.

From an area perspective, the model creates conditions for a long quiet edge with attractive residential environments, close to urban services and close to green areas. The green wedges offer opportunities for recreation, biodiversity and urban agriculture. They also are a basis for a green cycle network and for water storage. The motorway on the right side gives direct access to the business district and connects to the residential areas with minimal disturbance.

In design practice, the use of this guiding model is sometimes met with difficulties. Many cities, for example, are not star-like. The model, however, is an abstraction and the essential characteristic is not that of star form, but the edge qualities of a green structure that penetrates into the built environment. In a European project entitled *Green Structureand Urban Planning* (Werquin et al., 2005; Tjallingii, 2007) detailed studies situated in cities from 15 different countries demonstrated that it was not the limiting conditions of greenbelt strategies, but the carrying conditions of green structure strategies that offered a promising perspective for the qualities of green edges, supported by the *two networks strategy*.

In some cases the green structure is a new artificial design. More often however, urban green structures relate to river valleys, floodplains, coastal zones and other elements of the existing ground layer of the urban landscapes. Even in cities with high-density built-up areas and no green spaces, it is sometimes possible to redevelop old railway yards, industrial or harbour areas and re-introduce green structures. The city model may offer a strategy for the integration of green spaces into an existing city.

3.3 A regional model (figure 4)

The *two networks strategy* introduced in the first publications did not present full networks, only parts. Yet at the regional level this is inadequate. An opportunity to elaborate a full regional network scheme presented itself in the research and teaching programme of the IUAV University in Venice, Italy. The structuring capacity of water and asphalt, the infrastructure of these two networks, is a leading theme in this programme that focuses on the dispersed form of the European city as found in the Veneto plains north of Venice (Vigano, 2008). Here, the capillary networks of mobility and water have created *città diffusa* (diffuse city), an urban landscape characterised by many phenomena that are 'equal in all directions' or isotropic. This area is also characterised by a high degree of self-organisation based on a culture of small family based businesses. Yet more recently, these local networks have become part of global supply chains and market networks. As a result, hierarchy confronts isotropy. Big 'tubes' of new impermeable motorways cut into the existing permeable capillary 'sponge' of road networks (Secchi, 2011). An increasing number of trucks, private cars and farming machines use the same narrow roads. Expanded paved surfaces increase the risk of flooding. The *cit-*

tà diffusa is under pressure. The *Regional Model* (figure 4) develops a scheme that guides the construction of scenarios for the future of different parts of the plains (Tjallingii, 2010). The basic idea is to upgrade and downgrade both roads and watercourses. The thick black roads will be upgraded to accommodate car-based traffic, especially goods transport. In this way traffic can serve the needs of industry and world market oriented agriculture. Moreover, these roads reduce congestion and the risks of busy roads crossing residential areas.

Some watercourses will be upgraded to accommodate water storage and purification. In this way the plains will be better prepared for climate change. At the same time these blue-green structures provide attractive green spaces close to residential areas and supported by multifunctional agriculture.

The landscape will still be isotropic in that it carries a multifunctional diversity of comparable qualities in all directions. However it will be diffuse at a higher scale. There is no way back to the fine-grained patterns of fifty years ago but at the lowest level there are good conditions for the quality of the edges. This can also be an attractive perspective for many other regions with diffuse urbanisation processes.

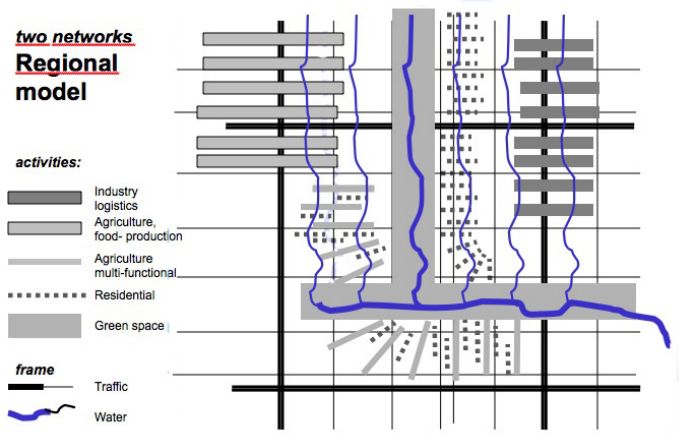

Figure 4 Regional model (Tjallingii, 2010)

3.4 Starting with the network layer

From both practical experiences and further elaboration of the *two networks strategy* it becomes clear that it can guide the design of a carrying structure for activities. However, the relationship to the potentialities of the underlying urban landscape is also an essential element. The so-called layer model, presented in figure 5, illustrates the position of the networks ap-

proach. The layer model is an analytical scheme; it does not guide planning actions. In practice, planning is often programme oriented: it starts with the occupation layer, then seeks to develop the supporting networks and then looks at the way the ground layer has to be adapted to the chosen land-use objectives.

In this way development tends to generate environmental problems as undesired externalities. The *two networks strategy* is different. It starts with the network layer. In designing the water structure it starts with the ground layer that includes the hydrology of the area resulting from the historical interaction between nature and culture. Designing the traffic structure, however, is starting with the occupation layer, the first idea about the activities' programme that triggers the planning process. In this way, the *two networks strategy* plays an intermediate role in seeking the best balance in the interaction between activities and the ecological basis.

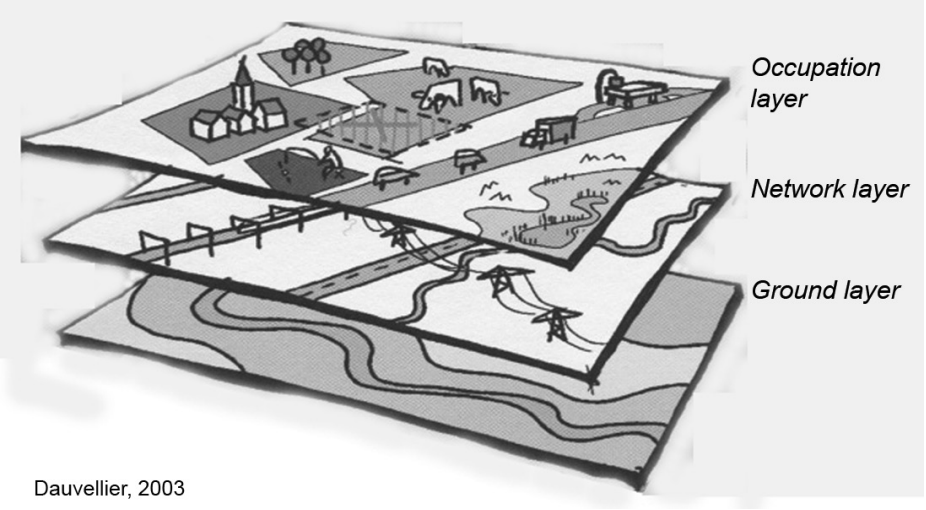

Figure 5 The *Layer approach* (Ministerie van VROM, 2004; Commission of the European Communities, 1999)

4. FLOW PERSPECTIVES

If we were to look at it from a flow point of view, how does the strategy work in plans and projects of different levels of scale?

4.1 Flows and networks

From a flow perspective, the *two networks strategy* addresses central issues of water and traffic flows. These are the flows with most spatial implications for the plan. Figure 6 presents the model of the strategy with an emphasis on the flows.

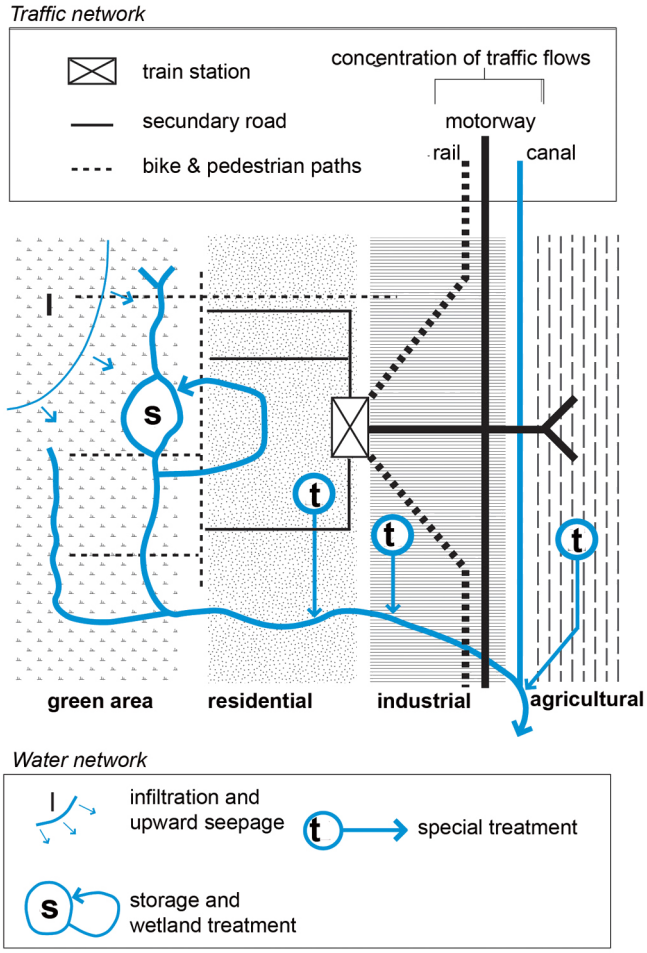

Figure 6 The *two networks strategy* guiding model (Tjallingii, 1995, 2005)

4.2 Water flows

The implication is that of all the water flows, the infiltration and drainage networks, can play a role as a spatially organising structure: the infiltration zones, small rivers and valleys, bigger rivers and floodplains, wetlands and lakes. Shipping canals may have a role in the supply or discharge of surface water, but their position and direction primarily depend on transport considerations.

In the top left corner of the general model in figure 6 there is a hill with infiltration, then, at the foot of the hill, there is a zone of springs with upward seepage that generates a network of smaller and bigger rivers. A key element is the presence of water bodies for storage. Increasing paved surfaces leads to peaks of storm water run-off that require rainwater peak storage to

prevent flooding. But too little water can also be a problem. For the green parts of the urban landscape it is important to have seasonal storage, surface water or ground water bodies that can store water temporarily in order to use the wet season's surpluses for dry season's needs. The strategy shown in figure 6 demonstrates creating space for peak and seasonal storage in the green zone. In the other zones more technical strategies can be applied. For example slowing down storm water run-off by using rainwater inside buildings or by installing green roofs. This is a discussion about quantity. From a water quality point of view the key question is how to address downstream pollution problems caused by upstream sources of pollution. If there is only moderate pollution, as in green and residential zones, wetland treatment can be effective and the space required can be found by combining the wetlands with the storage lake. More heavily polluted wastewater from offices, shops, factories or high production farms may require special technical treatment as indicated by (t) in figure 6. For water pollution it also applies that 'an ounce of prevention is worth a pound of cure'. Good design is prevention.

In quiet zones, the green zone and the adjacent quiet side of the residential zone, the models shown in figure 7 can guide the ecologically and spatially detailed design process. The bypass and gully model is a strategy to deal with the risks of river floods. As a guiding model for increasing the flood plain capacity it is derived from the Dutch *Room for the River* programme (Rijkswaterstaat, 2000) which has been adopted as official policy and is currently being realised.

The infiltration model is a solution for run-off problems in situations where groundwater and soils allow for infiltration. Rainwater can be stored in groundwater. The circulation model performs the same role in situations with impermeable clay soils and shallow groundwater tables. In that case fluctuating surface water levels can provide storage. The infiltration and circulation models create rainwater storage at the neighbourhood level, a condition for separating wastewater and rainwater. In the past twenty years these models have developed as common conceptual design tools (Tjallingii, 2012). Explicitly or implicitly the basic principles of these models have been used in a great number of projects in Europe, America and Australia.

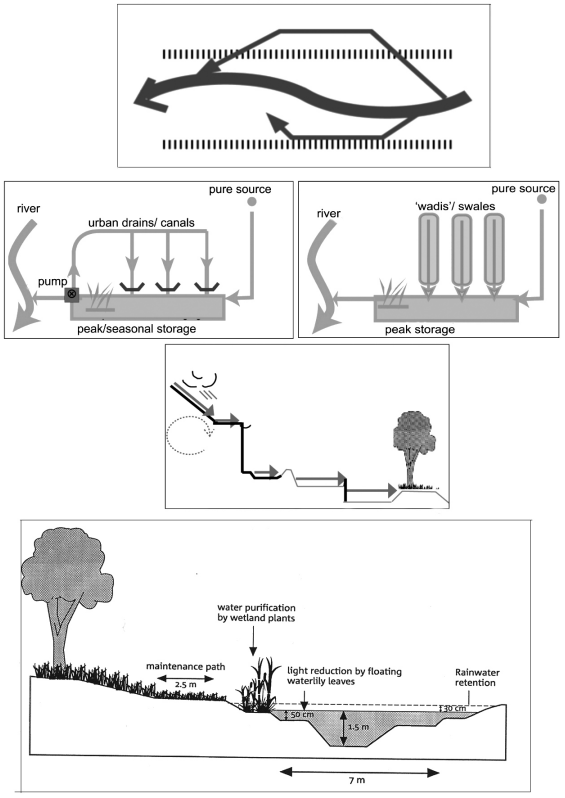

Figure 7 Water guiding models (Tjallingii, 2012)

4.3 Traffic flows

Traffic can be a flow of vehicles, carrying flows of materials, but it can also be approached as a flow in its own right. Figure 6 shows a traffic corridor on the right hand side to serve the industrial and agricultural businesses. On the other side there is no busy traffic to disturb the quiet residential and green zones. How do these simple proposals relate to theory and practice of traffic networks? In practice many cities developed on the waterside at a time that shipping was the most important way to transport goods. As a result, businesses set up along the water and big roads were built there to serve them. Shipping is still important for some goods and for cruises, but the seaport activities have moved seaward to deeper waters and river harbours have developed outside the city centres. But many roads are still there. Paris, for example, struggles with busy roads on both sides of the Seine that make the waterside almost inaccessible. Cologne has built a tunnel for traffic and on top of it a river promenade along the Rhine. Many cities, such as Barcelona have realised similar projects as part of their waterfront redevelopments. And

now also Paris has made a first step. In summer, part of the busy road is closed and replaced by a temporary promenade along the river: *Paris plage*. Clearly watersides are attractive for slow lane activities and these are not compatible with fast lane dynamics.

Current transport and traffic studies (Immers & Stada, 2004) distinguish between three main fields of choices in traffic planning related to urban development:

1. the *travel market*, where the need for transportation is the central question;
2. the *transport market*, where the choice of transport means is the issue;
3. the *traffic market*, where the opportunities of regulating the flows is the focus.

Figure 8 shows some traffic guiding models for different situations that require different detailed traffic network design solutions, all fitting within the general scheme of the *two networks strategy*.

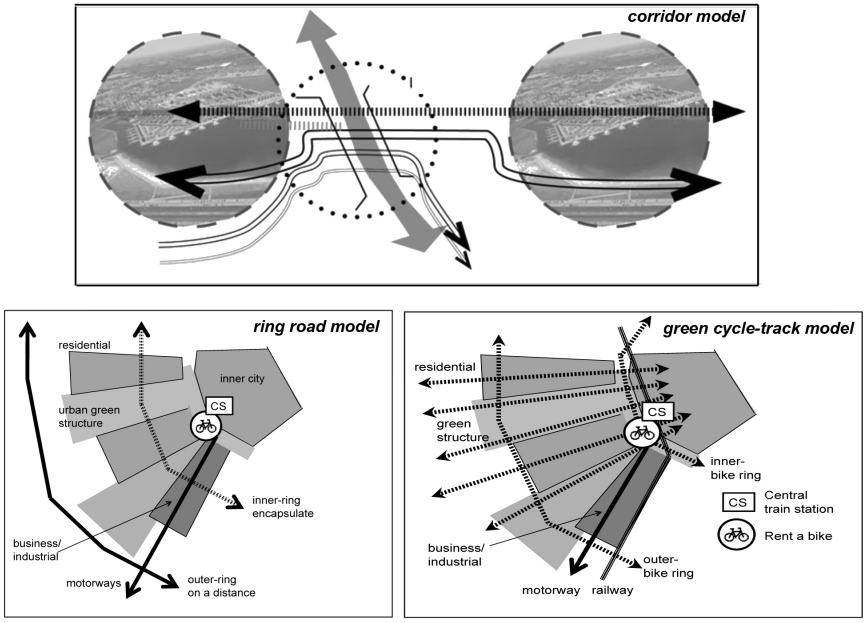

Figure 8 Traffic guiding models

The ring road model aims to offer attractive green environments with residential quality on the edges of the city so that people can buy or rent a house that is close to both green areas and urban services and jobs. This may reduce the transport need for commuters who want to live in the green and work in the city.

The green cycle-track model further elaborates the possibilities of an attractive network for the movement of bicycles based on the blue-green network of the city. Also electric bikes and low-speed electric vehicles may use this network. Blue-green and slow traffic networks are good allies.

The traffic corridor model seeks to reduce congestion by functionally separating long distance and short distance flows. From a spatial point of view concentration is desirable. The model indicates how spatial concentration can create effective investment in noise and pollution control and in bridges and tunnels to reduce the barriers. This facilitates the crossing of blue-green networks.

4.4 Industrial ecology and landscape ecology

The *two networks strategy* model shows a quiet zone or slow lane, carried by the water network and a dynamic zone, the fast lane, carried by the traffic network. In the slow lane, space is made available for water storage and consequently the hydrology, geology, soils and geomorphology of the local landscape play an important role. Here, landscape ecology is a key discipline for planning. In the fast lane, however, industrial and agricultural activities have changed the natural landscape more radically and there is a strong competition for space. Here environmental criteria for design are equally important but they tend to be more related to resources and waste issues of the wider environment or other parts of the world. The emphasis of design solutions is more on technology and the key discipline is industrial ecology.

5. ACTOR PERSPECTIVES

5.1 Social aspects of fast and slow lane dynamics

In urban planning, there are strong arguments for creating zoning for fast and slow lane worlds: not the traditional mono-functional zoning, but a multifunctional spatial organisation. The distinction is based on activities and their spatial behaviour (figure 9). In the two multifunctional activity zones the ecological approach is linked to social and economic processes.

The social aspect of slow lane and fast lane zoning is based on understanding *"how vital it is for a town to give people both intense activity and deep and satisfying quiet"* (Alexander et al., 1977). This is the contrast the city has to offer its citizens. Creating a long edge and quality of the edge is a basic condition for giving access of a great variety of urban citizens to a wide variety of urban environments.

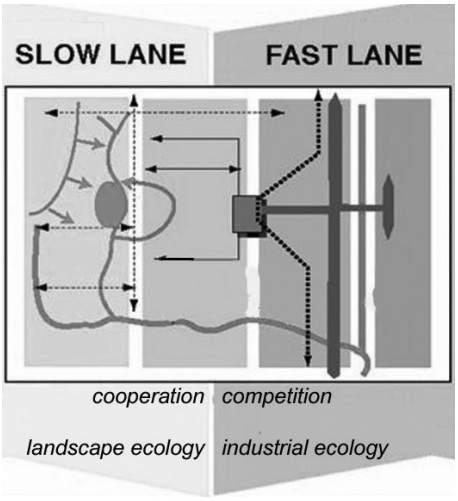

Figure 9 Activities model of the *two networks strategy*

5,2 Economic and financial aspects of fast and slow lane dynamics

The economic aspect of the slow-fast dichotomy is on the one hand the increasing importance of heavy infrastructure for the industrial and commercial activities that have to survive in a competitive global economy. The fast lane is the competitive profit-oriented zone where efficient production comes first. The role of the government here is to invest in the transport infrastructure and to stimulate innovation in production and in industrial ecology. Public investment will be recouped from profitable business activities.

On the other hand for companies it has become increasingly important to follow the preference of their employees for close proximity to a green and quiet residential and recreation landscape. This is illustrated for example by the collective efforts in the German Ruhrgebiet to revitalise the Emscher Region blue-green structure as part of the economic survival strategy for the old industrial area (Schmid, 1995). Thus, the fast lane world depends on the quality of nearby slow lane environments. The slow lane is the co-operation based non-profit oriented zone where water safety and quality, landscape and heritage, biodiversity, recreation and local food production are brought together to create long term conditions for safety, health and quality of life. These activities are not suitable for making short-term profits. The role of the government is primarily to create an institutional and financial setting for public and private organisations to operate cost effectively.

5.3 Two economic models for farming

Modern land-based farming is part of the world market and can only survive if the farms have optimal transport connections. It is part of the fast lane world. Economic pressure forces the farmers to adapt land and landscape, fill ditches, lower groundwater tables and cut trees. In this economic context, land-based farming cannot support fine-grained landscapes. A recent study by the *Institute for Agricultural Economy* in the Netherlands has made clear that a fruitful synergy between agriculture and the urban landscape of the Randstad depends on a new economic model for urban agriculture with short food chains, sustainable small-scale production and regional products (Vogelzang et al., 2011). Financial support for these farmers in exchange for what is called green-blue services is part of this economic model. Only in a slow lane environment can multi-functional urban agriculture play a role as an economic carrier of fine-grained landscapes.

6. TWO NETWORKS STRATEGY IN AN INTEGRATED CASE: SCHALKWIJK

The Schalkwijk case (figure 10) is chosen to illustrate how the strategy can act as a guiding model in a real process of planning and design. This case is a good example because the planners explicitly took the *two networks strategy* as a guiding model. Schalkwijk is a residential district in Haarlem, west of Amsterdam, with 30 000 inhabitants and built in the post-war period. It is a one-sided social housing area with predominantly rental apartments and a shopping centre. As in many of these developments of the same age, this area threatens to slip into a downward spiral of unemployment, poverty and poor living conditions due to social and economic change. The *two networks strategy* guided the structure plan (Van Eijk, 2003) that was adopted in 1999. The basic structure has been realised and now serves as a frame for further infill and detailed projects. Here, we take the basic questions raised in the introduction of this paper to demonstrate how the strategy guided the structure of the plan and the planning process.

From an area perspective the Schalkwijk planning process, guided by the strategy, led to the decision not to build a ring road in the urban fringe but to concentrate car-traffic and slow down its speed in the central zone to give access to the offices and the shopping mall that is in a process of modernisation and upgrading. As a result, the fringe zone with water as a carrying structure can become a quiet zone with a park, urban agriculture and interesting natural habitats for biodiversity. This is a multi-functional zone that uses the identity of the historic landscape structure.

From a water flow perspective, a storage lake and wetlands in the urban fringe provide peak storage, seasonal storage and quality control of surface waters. From the storage lake, the water re-circulates through the built-up areas and then returns to the fringe. The guiding model used in this case is the circulation model (figure 7). Only rainfall exceeding the storage capacity flows into the river Spaarne that runs to the sea.

From a traffic flow perspective the ring road is kept at a distance and the inner ring and access road has reduced speed and improved crossings. The central position creates conditions for collective transport and the blue-green structure also carries an attractive network for bikes. In this way the ring road and green cycle track models (figure 8) have guided the design. The structure plan creates conditions for more sustainable management of water and traffic flows.

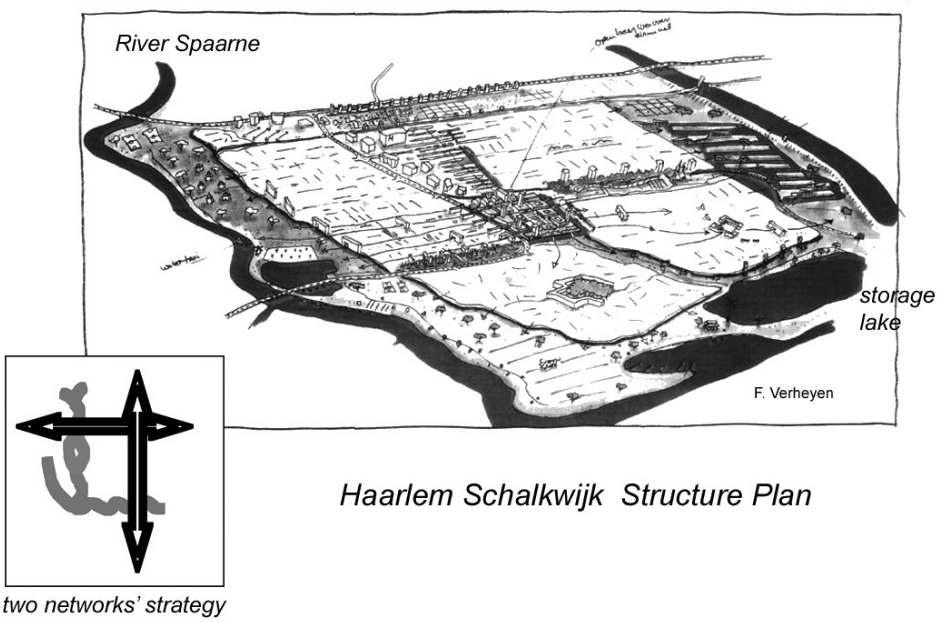

Figure 10 *The Two Networks Strategy* and the Schalkwijk restructuring plan. Water is shown in black

From an actor perspective, the network approach stimulated the actors to discuss their ideas in a long-term perspective regarding needs and potentialities. In an early stage a workshop with residents generated seventy proposals that were used by working groups of public officials and private organizations to solve social, environmental and spatial issues in the plan. The redesigned

fringe area greatly enhances the quality of the edge, creating attractive places for the construction of middle class houses that combine a nice view with the proximity of both green spaces and the shopping centre. Diversification of the housing stock is one of the social objectives. For those residents that improve their income, it creates possibilities to stay in the Schalkwijk area and move to the new houses on the edge. Given the demand, investment and development is relatively easy. Also lower income residents from the apartment buildings will benefit from the presence of the green and quiet fringe zone. The durable frame of the carrying structures creates two magnetic fields of fast lane and slow lane environments allowing for a flexible infill in the future. The spatial structure avoids conflicts and promotes synergism.

7. DISCUSSION

7.1 Theory and practice

Urban planning practitioners are often sceptical about conceptual models such as the *two networks strategy, "because our situation is different"*. In discussions it is assumed that they may be useful in new greenfield urban developments but not in existing situations. However, the Schalkwijk case demonstrates how the guiding model is used in restructuring an existing residential area. The regional model also refers to an existing landscape. Even in old industrial brownfield areas, with no green spaces available, the strategy can be a fruitful guide. In many old cities the river valleys provided hydropower and thus became the carrier of early industrial development. The study by Werquin et al. (2005) discussed many examples, such as Sheffield, where the industrial backbone is turned into a blue-green axis for recreation and nature. In more recent transformations, we often see that polluted lands left behind after the collapse of heavy industry may become part of a green structure, often in combination with phyto-remediation or other decontamination procedures. Thus the former fast lane becomes part of the slow lane.

7.2 Cradle to cradle and Blue Economy

The approach of the *two networks strategy* presented here combines flow management with territorial structure. From a flow perspective, it is compatible with the 'cradle to cradle' vision (Mc Donough & Braungart, 2002), however the 'cradle to cradle' recycling strategies aim primarily at *"remaking the way we make things"* which relates directly to industrial ecology. With traffic and water flows the issue is not only recycling but the use of the territorial structure in relation to cascading, storage, model split and the design of crossings. This implies that the approach starts with landscape ecology before it goes to industrial ecology. But of course the combination is what counts in

the end. In this respect the *two networks strategy* fits very well in what Gunther Pauli calls the *Blue Economy* (Pauli, 2012). Here the issue is the optimal use of local resources in a multi-functional approach.

7.3 The ecological footprint

In flow analysis and urban metabolism studies, input and output are key issues. The ecological footprint approach (Rees, 1995) focuses on input and output and offers a method to calculate the impact of an urban system on the neighbouring countryside or on other parts of the world. Aside from the discussions regarding quantitative values used in the calculations, a critical remark can be made about the implications for planning. The suggestion is that a small footprint is always better and this idea has stimulated many environmentalists and architects to design and develop self-sufficient buildings or neighbourhoods. A network approach does not discourage self-reliant systems, but creates a basis for strategies that seek the synergism between the parts, for example between town and country, fringe and centre. If synergism works, the footprint of the parts is less important. The fitness of the whole is more than the sum of the efficiency of its parts.

7.4 Coping with uncertainty

The *two networks strategy* is a guiding model for strategic plans. These plans aim to improve decision-making. They create the frame for operational decisions that effectively change the world (Faludi, 1987: 118). This is problem setting and not yet problem solving (Schön, 1983 [1991: 40]). Weighing and detailed calculations will play a role in later operational stages of planning. The strategic frame however, creates a basis for coping with uncertainty. For example, one cannot with certainty determine the capacity of a retention lake that can cope with future heavy rainstorms because we do not exactly know what can be expected as a result of climate change. In such a case it may be useful to create other good reasons to design a lake with a considerable size. Creating allies, synergistic systems, is a matter of strategic plans. The water guiding models address uncertainties related to climate change and the traffic strategies address basic complexity and uncertainties related to economic globalization. By combining them in a two networks approach we create a durable frame that allows for flexible infill.

7.5 The layer approach and landscape urbanism

This approach takes landscape as a basis for urban planning. As discussed in the comments that go with figure 5, landscape is both the ground layer of spatial potentials and the occupation layer of spatial intentions. The *two networks strategy* suggests starting with the water network and the slow lane environment and adjusting them to the ground layer. Then the traffic net-

work and the fast lane environment will be planned on the basis of future occupation. In this way the two networks offer an action oriented strategy that fits well in the approach of the studies and plans discussed in the *Landscape Urbanism Reader* (Waldheim, 2006). It seems, however, that in most of these cases more attention is given to industrial ecology than to landscape ecology. The rehabilitation of abandoned industrial areas, waste dumps, former mines and other drosscapes (Berger, 2006) seem to play a more important role than design with nature as design with the ground layer, in the tradition of Mc Harg and Hough. The two networks approach offers an opportunity to combine the industrial and landscape ecological strategies. In the context of landscape urbanism, the concept of infrastructure is not always clear. In his book *Landscape Infrastructure*, Bélanger (2013), discusses the urban landscape as a whole as infrastructure in a combined engineering and design perspective. It seems better to distinguish between landscape as a combination of the three layers and infrastructure as one of the layers: a network of carrying structures.

7.8 Alexander's Pattern Language

The water and traffic flow guiding models in section 5 illustrate the use of conceptual models to guide the design process. This comes close to the use of patterns in Christopher Alexander's pattern language (Alexander et al., 1977). Both patterns and guiding models can act as a documented language for learning in design and planning practice. However, if patterns look like forms they may create confusion among designers. The experiences with the city model point at the advantages of starting with guiding models that provide ecological-technical structures that can carry a variety of forms. In the words of McHarg, *"form follows nothing – it is integral with all processes"* (1969 [1971: 173]).

8. CONCLUSION

The discussion of experiences with the *two networks strategy* in this paper demonstrates the feasibility of taking water and traffic networks as carriers for urban development. Learning from practice has enriched the theory and deepened our understanding of area, flow and actor aspects. The emphasis on integration characterises the guiding model as a general tool for the making of strategic plans. To what extent is it an ecological approach?

In general terms the slow lane environment asks for landscape ecology that can work on the basis of the ecology of diversity. Activities support landscape diversity and even urban agriculture ultimately serves landscape diversity. The fast lane landscape, on the other hand, supports the efficient productivity of activities. This includes the industrial ecology of recycling,

waste treatment and waste prevention strategies. From a planning perspective the slow lane environment requires for strategies of co-operation and key involvement from non-profit organisations, both private and public. In the fast lane, strategies for competition are the driving force. There can be no fence between the two worlds of course. They need each other and should be planned as a polarity of magnetic fields that prevent conflicts and support a synergy of activities.

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