Accessibility Based Planning in The Netherlands: Better, Faster, Together

Accessibility Based Planning: More Opportunities with Less Mobility

Ron Bos, Goudappel Coffeng, The Netherlands
Sandra Meng Ying Lee, Tsinghua University, School of Architecture,
People's Republic of China

1. Prelude: A New Planning Approach

Mobility is a major factor within urban dynamics and is often neglected by architects and planners. Mobility-based planning has created urban sprawl, as can be seen in North American cities and, to a certain extend, European cities. As a result people spend a lot of time and money on basic travel needs such as commuting or shopping. This approach cannot be applied in 21th century urban planning, in which sustainability becomes a major issue and resources are becoming scarce. New integrated planning approaches are needed which can deal with urban growth without neglecting environment and people.

In this article we elaborate a different approach addressed as accessibility-based planning. This approach defines accessibility as the amount of services and jobs people can access within a certain amount of travel time, considering multimodal modes of transport such as walking, biking, driving and the use of public transport. This approach implies a shift in paradigm: urban and traffic planners focus on people and their needs instead of the infrastructure system itself. These needs can imply sustainable goals, such as social inclusion, economic urban potential or ecological preservation.

2. Evolution in Mobility Planning

As urban planning is as old as the first settlements, transport planning as an independent working field is relatively new. Especially since the invention of mass-transportation this has gained more and more importance in both policy and influence on the urban form. There has been much research on the interdependence of spatial and mobility planning, but in general mobility is both leading (creating or 'discreating' urban opportunities) and following (solving traffic problem resulting from urban developments). Considering mobility planning, an evolution can be seen as shown in the figure.

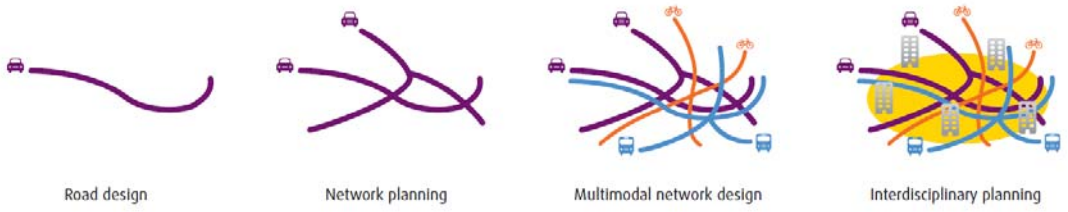


Figure 1: Evolution in mobility planning

Considering this evolution, mobility planning has evolved from designing roads between places or cities into network planning, as clearly can be seen in the motor highway network and railway network. Gradually these independent networks have collided into a multimodal network planning, considering car, public transport, biking and walking networks. The latest development is interdisciplinary planning, in which transport, urban and economic planning are intertwined. This increases the complexity even more, as is elaborated now.

3. Three Trends Making Planning More Complex

The traditional debate between traffic engineering and urban planning seems obsolete. There are three reasons for this.

- Firstly, planning for large-scale infrastructure has become more relevant on a 'large scale playing field'. No longer mobility plans are about solving traffic problems on a very local level by eliminating congestion bottlenecks, but the focus now lies on conceptual planning on a higher regional scale, which focuses on creating opportunities for urban and economics developments. This especially counts for fast growing cities. Planning questions (and therefore solutions) have become more complex due to scale enlargement, as can be seen also in environmental issues such as reducing pollution or climate change problems.

- Secondly, as a result of this scale enlargement, the design and planning process has become more complex as more different stakeholders are being involved during the process. Within large scale developments different discipline are included, such as mobility experts, urban planners, economists and environmental experts. Next to this, due to increasing democratic legalization of planning processes private stakeholders such as inhabitants, business and NGO's are gaining influence in the planning process. As a result there is no longer a clear linear and sectoral planning process, but a complex set of interrelated processes in which the infrastructure and urban form takes shape.

- The third trend consists of the continual improvement of technical instruments and data collection. This has been growing exponentially as computers are getting more powerful and more data is being gathered and, not in the least place, connected and transformed into information. This results in having more information available to more people, both public and private, which also influences the planning process. With the risk of information mis-use or misinterpretation by non-experts or subjective parties.

These three trends, named *content* (scale enlargement), *process* (more diversity in stakeholders) and *technical* (more information available) make urban and mobility planning more complex. The emerging urban transportation planning is therefore much more multi-, inter- and trans disciplinary than its past counterpart. The new challenges demand multi-disciplinarily, or collaboration with other professions and policy sectors. They also demand interdisciplinary, or integration with other professions and policy sectors, as most notably with land use planning.

4. Creating a Common Language: Spatial Accessibility

In order to let different specialist communicate in a better way, a different framework is needed. Traffic and transport policy is often responding to plans made by spatial planners. The question therefore usually is: *'Can the network facilitate certain spatial developments?'* We look at this in a broader way by asking the opposite question: *'What spatial development opportunities does the infrastructure network have and how can interventions in the system contribute to this?'* By reversing the question a different relationship between the traffic and transport system and the spatial system is created: the traffic and transport system becomes leading by providing opportunities for individuals, businesses, and land use activities.

This implies a paradigm shift in land use and transport planning. Instead of focussing on either solving traffic problem or making urban plans, we need to look at the interdependence between urban development and infrastructure development. In order to do so, we define accessibility as *the amount of services and jobs people can access within a certain travel*

time, considering multimodal modes of transport such as walking, biking, driving and public transport. Using this definition accessibility does not relate to the qualities of the transport system (e.g. travel speed or costs), but also to the qualities of the land use system (e.g. densities and mixes of opportunities). Accessibility then becomes both a feature of the spatial system (What can I achieve?) As the traffic and transport system (How can I achieve?).

Figure 2: Mobility based planning and accessibility based planning

Within this definition, mobility becomes a means to accessibility as a goal. Mobility is about *movement of goods and people* and transport policy about *system efficiency*: how can we get as many vehicles and persons move and travel as fast as possible. Accessibility centralises *goals of people and businesses* and accessibility policy about *enhancing people's (and businesses) opportunities*, focusing on specific goals.

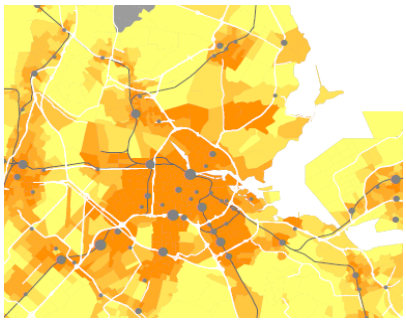
5. The Role of Instruments in Planning Processes

In the past years we have been practicing both mobility-based planning and accessibility-based planning for a variety of local and regional governments in the Netherlands, using instruments to facilitate the planning process.

Traditionally traffic models are being used to calculate the effects of new infrastructure developments and demographic changes. Traditionally, urban transportation planning has mainly focused on the efficiency of the transport system itself. The results are used to evaluate whether measurements are needed, both on the infrastructural level as environmental protection measurements. Such an approach neglects the influence of interventions in the transport system on broader and often conflicting economic, social and environmental goals. Traffic models are able to accurately predict the future flows of traffic, including congestion and environmental effects. Within the new definition of accessibility traffic models lack understanding of the spatial effects of new infrastructure developments. In other words: the models do not show whether improvements benefit specific target groups. In fact the models only focus on the infrastructure systems' performance in general.

In order to deal with this we use accessibility maps as instrument for evaluating the effects of new infrastructure developments on the current urban structure. This is the first level, as

accessibility maps also show the economic and social potential of the infrastructure system for further urban developments. In other words: *the maps show what are the best accessible places within a city or region, considering one or more specific modes of transport, timeslot and target group.* Next to this, the maps can be used to show the effects of new developments on infrastructure performance. Both instruments are complementary: transport models are mainly used in evaluation studies, such as cost-benefit studies. Accessibility maps are more useful within the earlier phase of strategy making, when both urban and infrastructure developments are not fully detailed.



Evaluation: Transport model	**Strategy: Accessibility mapping**
Re-active	Pro-active
Transport oriented	Transport and Land-use oriented
Calculate effects of land-use plans	Discuss locations for new development

Figure 3: Planning instruments and policy phases

In short the following is concluded:

- Traffic models can be used in order to design solutions for infrastructure related problems;
- Traffic models relate to traffic planners' view of problems and do not relate to individuals goals or problems;
- Accessibility maps can be used in a broader spectrum of policy issues, such as demographic and economic issues;
- Accessibility maps also relate to broader societal goals which are consistent with the perception and behavior of households and firms.

6. The Role of Knowledge within Planning Processes, a Scientific Approach

Mobility-based planning focuses on the efficiency of the infrastructure system itself. Accessibility-based planning can be related to broader economic, social and environmental goals that are at the heart of present day urban politics. The need to provide people with access to jobs, or to provide firms with access to skilled workers are just some examples of these issues. Accessibility-based planning therefore provides planners the possibility to understand interdependencies between transport and land use development. More specifically this implies developing urban regions that offer people and firms the means to reach *more opportunities with less mobility*.

It thus opens the floor to a more normative approach to transportation planning involving different actors. For politicians, citizens and firms it might be easier to discuss the quality of access to education, services and markets than it is to discuss the inefficiencies of the transport system. But in order for non-experts (both public and private sector) to be able to participate in policy processes in addition to traffic engineers and spatial planners, models should be especially easy to understand, fast and transparent. This implies a different approach on the knowledge and data needed within the planning process; knowledge which connects to the stakeholders' perception.

In the field of knowledge management, a distinction between explicit and tacit knowledge ws introduced. Explicit types of knowledge come in formal ways, such as data, formulas and general/universal theories; they are therefore easily codified, and supposedly have a wide validity. Scientific knowledge often falls in this explicit category. Tacit knowledge on the other hand is more difficult to codify, because it is context-specific, informal of nature and acquired by experience; "tacit knowledge is deeply rooted in an individual's actions and experience as well as in the ideas, values, or emotions he or she embraces". Explicit knowledge usually resides within certain (planning) disciplines and there are certain institutionalized rules about how new knowledge in these disciplines can be created. Tacit knowledge and information are not necessarily related to particular disciplines, but rather to people's individual experiences.

Several researchers have pointed out that tacit knowledge plays an increasingly important role in formal decision-making, and should therefore be recognized as such in planning processes. If planners want to address complex socio-economic planning problems (and thus cope with the many uncertainties surrounding it), explicit knowledge and information should play an important role, but it is pivotal to realize that information should be combined and confronted with tacit forms of information. In other words: *If actors do not understand the information provided, if it is not transparent and if it does not connect with their daily practice they will not use it during the planning process.*

In science it is argued that thorough integration of the two can lead to the generation of new knowledge. Based on research in innovative Japanese companies, this was elaborated in a conceptual mechanism showing how interactions between tacit and explicit knowledge take place in a cyclical process creating new individual and shared knowledge. Knowledge is converted from tacit to explicit and exchanged between groups and individuals, leading to new knowledge. Four conversion processes are recognized, which are essentially processes of learning: *socialization, externalization, combination, and internalization*.

Socialization of knowledge is the sharing of tacit information between individuals or in a small group, particularly by means of shared experiences: observation and imitation. Such knowledge can be made explicit through *externalization*. Here, tacit knowledge is articulated and codified from the individual to the group, by using words, concepts, images, narratives, and metaphors. This externalized – now explicit – knowledge can be reconfigured, recategorised, coordinated and linked with other bodies of knowledge by combination. By the process of *internalization*, individuals convert the collectively generated explicit knowledge back to a tacit form. Through practice, experimentation, or training programmes: 'learning by doing'. This internalized knowledge can then be socialized again.

7. Accessibility-based Planning as a Multidisciplinary Process

Why focus on knowledge? Using instruments within a planning process might be very useful to a certain extend. But as the planning issues have gained complexity (as mentioned before), technical improvement is not the only solution. While on the one hand engineers are still trying to improve success of the instruments, on another front a whole new development

is being put in motion: *giving participants more opportunities using information and tools they themselves can use.* This is not so much increasing the precision (and thus complexity of the models), but rather increases the speed at which a first impression of effects is available.

Therefore we created a model which promotes accessibility-based planning as a (cyclic) process, instead of a lineair 'input-output'-model. We therefore are working in a series of workshops with a multidisciplinary team of stakeholders in which we use the processing steps as shown in the figure:

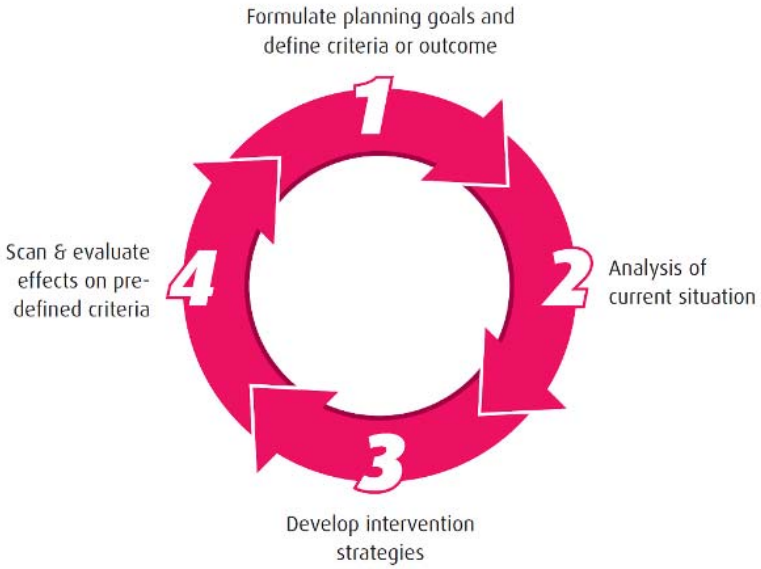


Figure 4: Cyclic planning process

Firstly, societal goals addressed by policy makers are translated into accessibility criteria. This means we ask stakeholders to give a clear view on what kind of accessibility measures is important for their discipline. These include mode of transport, travel times, type of services or target groups which should be reached and times of the day. These criteria form parameters for GIS-models, which will produce accessibility maps as output. Usually this takes some time, although new technical developments speed up this process (we will further elaborate this in the conclusions paragraph).

The second step is the analysis of the maps, also in a workshop setting. We ask the participants what new insights the maps show them. Next to this we ask participants whether the current situation (often we also use future situations which are based on trend projections) is matching with their specific policy goals. For example; in case the policy is to provide basic services such as schools, banks and supermarkets to all citizens of a city within 5 minutes travel time by bike, we measure whether this is the case and in which areas this might not be.

After analysis possible hiatus in the current or future situation, the next step is to develop strategies to improve the situation in order to meet the goals. The strategies both include spatial interventions (creating new dwellings or services) and infrastructural interventions (creating new routes or improve traffic conditions).

These interventions then are translated into traffic models and accessibility maps, producing output in the same manner as the first maps (with the same criteria). In a last workshop we evaluate the effects and, if needed, further improve the strategies. If needed, the last two steps are repeated.

In order to further elaborate the theoretical part, we provide this article with a case study in the Netherlands.

8. Case Study: Almere 2030: Working Together on Accessibility

Almere is a city which was created as a satellite city of Amsterdam on reclaimed sealand of the former Zuiderzee (Southern sea), which was redesigned as a lake, the IJsselmeer. It now inhabits around 200.000 people and makes the fastest growing city of the Netherlands. For the coming decades, Almere needs to expand until it reaches twice it's size in the year 2030.

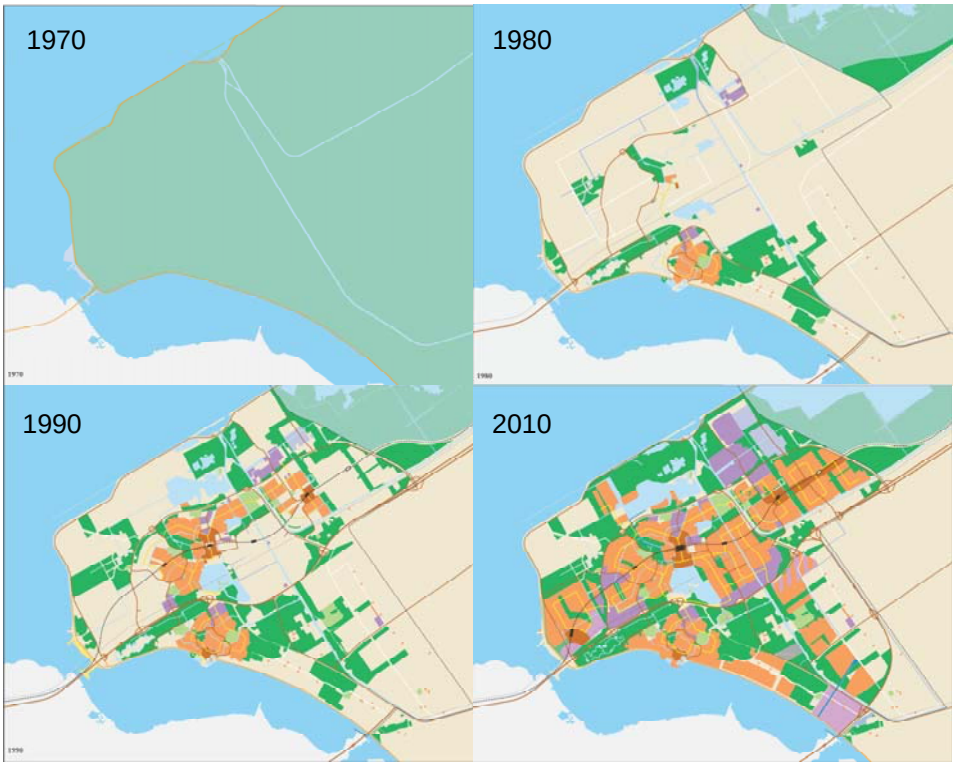


Figure 5: Development of the city of Almere

The municipality of Almere used the different perspective on accessibility as a starting point for a design project that aimed to gain insight into a number of strategic choices at the intersection of urban- and infrastructure design. The study focused on the expansion of the city, creating input for the urban master plan for 2030. The project was carried out with support from the University of Amsterdam and consultant agency Goudappel Coffeng. We used accessibility mapping as a common design language, following the 4-step process described above. The project included three workshops with policy makers of various departments within the municipality; including traffic & transport, urban development, urban planning, social development and economy.

Workshop 1: Translating social goals into accessibility criteria

In the first step we tried to select major goals and objectives and translate those into key accessibility features. The following three objectives have been chosen:
1. Develop regional locations for businesses and facilities;
2. Increase differentiation in living and working environments in Almere;
3. Social development opportunities for residents of Almere.

We defined accessibility from two perspectives:
- Fromout the perspective of residents is examined to what extent employment is available. Accessibility is defined as the number of jobs be reached within a certain time with a certain mode of transport.
- Fromout the perspective of companies examined the extent to which employees can be attracted. Accessibility is defined as the number of residents which can go to a zone within a certain time with a certain mode of transport.

Workshop 2: Assess the current quality of accessibility

To ensure the quality of accessibility in the current situation relating to the selected targets we looked at the following accessibility features:
- People reached by car, bike & public transport at different travel times (Objective 1 and 2);
- Facilities reached by public transport & bike (Objective 2 and 3).

After evaluating the current situation of Almere we compared those with other cities in the region, such as Amsterdam.

Workshop 3: Designing strategies and identifying strategic choices

Based on the current situation, infrastructure scenarios for future development were designed, which are translated into models and accessibility maps to help understand the effects of different interventions. The effects of infrastructure scenarios on accessibility make it possible to make statements about infrastructure investments that contribute to the desired spatial development of Almere and vice versa. To determine the bandwidths are two conceptual models used:

- Scenario 1: Almere as a independent regional hub within the northern Randstad
  Almere positions itself as an independent city within the Randstad region, like Amsterdam. The city is connected to the region with fast highways and intercity trains. These infrastructures form a backbone for the city within the region, with few ramps and train station. Fast and few are keywords in the network connection.
- Scenario 2: Almere as part of the metropolitan region of the northern Randstad
  Almere is part of an ongoing and continuous regional car- and public transport network and is intertwined with Amsterdam. Infrastructural Almere forms a ladder structure for road and public transport stretched between Almere and Amsterdam. This scenario provides an IJmeerconnection for car and public transport between Amsterdam and Almere. The infrastructurenetwork focuses on the traffic distribution by spreading traffic on multible comparable routes. Slow and many are keywords in the network connection.

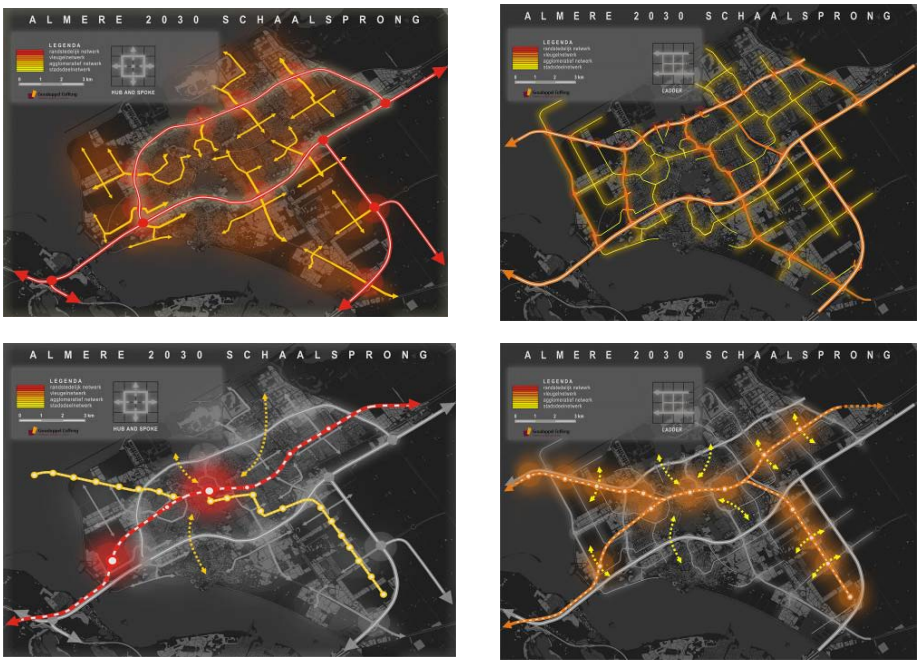


Figure 6: Development scenario's for the city of Almere

Both scenarios also include the urban development plans of Almere for 2030, including expansion of 60.000 inhabitants and jobs. These scenario's were translated to traffic models and accessibility maps, showing the effects of both infrastructure scenario's on the development potential of inhabitants and businesses, considering the accessibility criteria set in workshop 2.

The results led to new insights for both urban planners and traffic managers. The most important insight is that, when looking at this definition of accessibility, the best accessible part of Almere was not the intersections of highways, but the southern part, which is closest to Amsterdam. This is important when regional services or companies depending on qualified employees from the Amsterdam region.

The scenario analysis showed that the type of infrastructure system has a major effect on development potential for city areas. In scenario 1, in which Almere is projected as an independent regional hub, we limited the number of ramps and therefore focused on a faster flow on the highways which lead to a better accessibility for the complete city. The differences between districts in terms of regional accessibility are smaller in this scenario as traffic flows faster and even more remote areas relatively quickly become accessible from Amsterdam. In scenario 2, with a more dispersed and slower infrastructure system, results in a further differentiation of the districts, leading to different development potential for these areas.

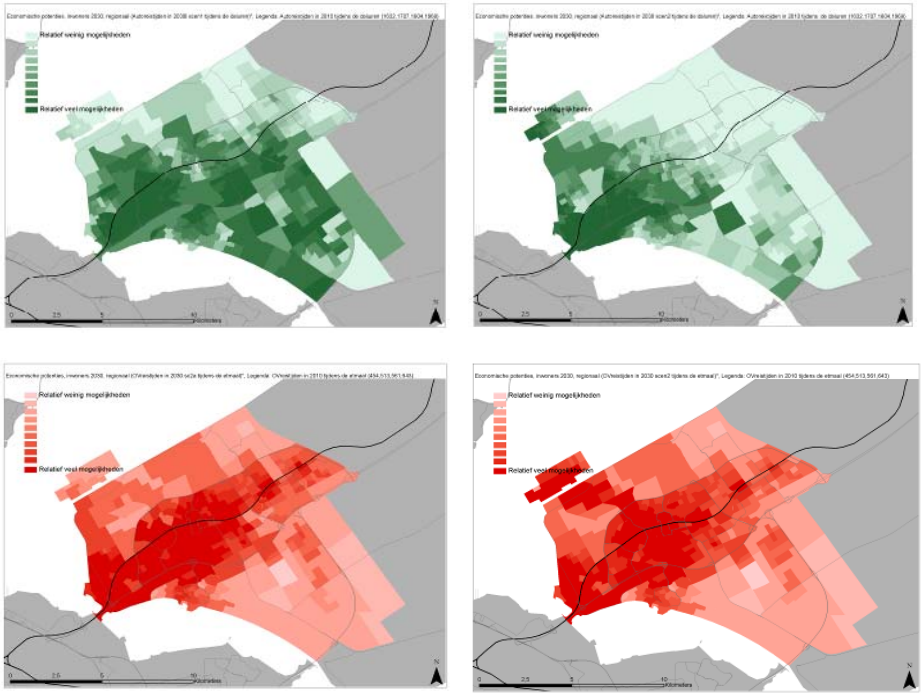


Figure 7: Accessibility maps for development scenario's for the city of Almere

The study showed that integrated thinking about the separation of flows of regional and local traffic and the choice of auctions is not only important for an efficient flow of traffic, but also strongly affects the spatial-economic development potential of areas in Almere, eventually resulting in different value of stock property. This then becomes a political choice: one the one hand equally distribute higher and lower income developments or rather focus on more differentiation between urban districts by focusing on selective accessibility.

As this conclusion shows, traffic management becomes a pro-active player in the field of urban and economic development, rather than having more reactive characteristics by solving congestion. Showing this type of information early in the development process leads to a better understanding of the interactivity between urban and economic development and traffic management and therefore better decisions on urban planning in general.

9. Conclusions & Further Developments: Interactive Planning Tool

The emerging urban transportation planning is much more multi-, inter- and trans disciplinary than its past counterpart. The new challenges demand collaboration and integration with other professions and policy sectors, as most notably with land use planning.

In order to do so, we define accessibility in a different way, such as the amount of services and jobs people can access within a certain travel time, considering multimodal modes of transport such as walking, biking, driving and public transport. Using this definition, accessibility does not relate to the qualities of the transport system, but also to the qualities of the land use system. Within this definition, mobility becomes a means to accessibility as a goal. Mobility planning is about system efficiency: how can we get as many vehicles and persons move and travel as fast as possible. Accessibility planning centralizes goals of people and businesses and enhancing opportunities, focusing on specific goals.

Planning instruments are useful tools to provide information within planning processes. Traditionally traffic models are being used to calculate the effects of new infrastructure developments and demographic changes. Such an approach neglects the influence of interventions in the transport system on broader and often conflicting economic, social and environmental goals. Within the new definition of accessibility traffic models lack understanding of the spatial effects of new infrastructure developments. Accessibility maps on the other hand create a common language between urban planners and traffic planners, often leading to interesting new insights and mutual understanding. The maps relate to societal goals, which are consistent with the perception of stakeholders.

As the planning issues have gained complexity, technical improvement is not the only solution. While on the one hand engineers are still trying to improve success of the instruments, on another front a whole new development is being put in motion: giving participants more opportunities using information and tools they themselves can use. Letting stakeholders chose their own criteria makes instruments more valuable as information connects better to their own perception. Sometimes a fast exploration of different strategies is needed though, as show in the case study of Almere. Especially in the early phase of urban development process, a global and less detailed evaluation is suitable: which strategies work and which strategies might not work?

Workshops take time though, which is not always available. In order to speed up the design process and explore more different strategies, we have currently developed a web-based tool which enables stakeholders to quickly explore solutions to their planning questions, such as new land developments or infrastructure enhancement. Professionals who deal with these themes can now independently quickly explore the effects of interventions in land development, transportation management and infrastructure. The Mobility scan, as the tool is named, is an add-on to existing traffic models, using a origin-destination matrix, socio-economic data and a (multimodal) network. The user decides which strategies will be explored, including adding homes or businesses, moving or adding traffic intensive functions, parking interventions or interventions in the infrastructure such as new roads, closing roads and changing speed.

Reason for developing this tool is speeding up the workshop process. Still, stakeholders do need understanding of the input and outcomes of the tool. It is recommended the cyclic process is at least explored once with stakeholders. The workshop therefore can function as capacity building, both providing technical know-how and knowledge on how to read the maps. We are currently developing and testing this methodology in pilots within an international scientific research programme.

10. International Reflection: Lessons for Fast Growing Cities

Mobility-based planning has created urban sprawl, as can be seen in North American cities and to a certain extend European cities. As a result people spend a lot of time and money on basic travel needs such as commuting or shopping. This approach cannot be applied in 21th century urban planning, in which sustainability becomes a major issue and resources are becoming scarce. New integrated planning approaches are needed which can deal with urban growth without neglecting environment and people.

As the biggest growth in Western European cities has mainly already taken place, this process is different in other fast growing cities such as in China. The scale of the city and pace of urbanization is bigger and faster then as shown in the case study city of Almere. Due to continuously urban expansion, growing population, land exploration and booming motorization, traffic issues have raised attentions in China and become major issues in its capital city, Beijing. Urban planning is a key factor in seeking sustainability. Therefore urban

planners are still looking for balancing traffic and urban planning in a sustainable way. The idea of accessibility based planning and it's core concepts multi-, inter- and transdisciplinary could give new opportunities for Beijing and other cities in China.

Endnotes

First Author: Ron Bos M.Sc.
Studied Land Use Planning in Wageningen University, Netherlands and now works as consultant urban and regional planning in the main mobility consultant office of the Netherlands, Goudappel Coffeng (www.goudappel.nl). He is specialized on urban and regional accessibility planning and sustainable urban mobility.
Email: rbos@goudappel.nl /mobile:+ 31614133480

Corresponding Author: Sandra Meng Ying Lee Ph.D.
Studied Urban planning in Tsinghua University, Beijing, China and now as a post doctoral fellowship in School of Architecture, Tsinghua university, Beijing. Specialized on sustainable regional and urban planning.
Email: leemy@mail.tsinghua.edu.cn / mobile:+86-13911483580

Key words: accessibility based planning; GIS; urban mobility; urban planning, Netherlands

Acknowledgements

The authors would like to thank Thomas Straatemeier (University of Amsterdam) and Marco te Brömmelstroet (University of Amsterdam) for their contribution and inspiration on this topic. We also are thankful to Goudappel Coffeng (www.goudappel.nl).

References

[1] Bos, R, Straatemeier, T, Elias-Cornelissen, J. Samen Ontwerpen aan Bereikbaarheid, casestudy Almere, Goudappel Coffeng, Universiteit van Amsterdam, Gemeente Almere, 2008.4
[2] Brömmelstroet, M. te., Hoetjes, P., Straatemeier, T. Linking knowledge to strategic urban planning processes, paper in progress. 2012
[3] Gao M.H, Zhang Z.H., Resolution to metropolitan traffic congestion. Urban Problems[J].2009(10)
[4] Heikkila Eric J. Microeconomics and Planning: Using Simple Diagrams to Illustrate the Economics of Traffic Congestion.1994
[5] Lightleign, B. Shi, H. Traffic Congestion and Rational Channeling in World Megalopolis Development. Journal of Shanghai Polytechnic College of Urban Management[J].2007(6)
[6] Liu, X. Literature review on the study of urban traffic congestion problems. Economic Research Guide[J].2010(4)
[7] Zou D., ON THE TRAFFIC ISSUE IN BIG CITIES:A CASE STUDY OF BEIJING. City Planning Review[J].2010(2)