# Joint-accessibility Design (JAD)

Thomas Straatemeier

To cite this report: Thomas Straatemeier (2012) Joint-accessibility Design (JAD), in Angela Hull, Cecília Silva and Luca Bertolini (Eds.) Accessibility Instruments for Planning Practice. COST Office, pp. 125-131.

# Joint-Accessibility Design (JAD)

Author of report: Thomas Straatemeier

Organisation: Goudappel Coffeng & Universiteit van Amsterdam

Address: De Ruijterkade 143, 1011 AC Amsterdam

E-mail: tstraatemeier@goudappel.nl

## Background

In both the scientific and professional community the need to integrate transport- and land use policies in order to achieve more sustainable mobility patterns is widely recognized. However, in practice these integrated strategies are hard to come by. The concept of accessibility provides a basis for making trade-offs between land-use and transportation policies that has been sorely lacking, since it relates to features of the transport system (e.g. speed, and travel costs) as well as the land-use system (e.g. densities and mixes of opportunities). It is a well-known and studied concept within the scientific literature, but its use in practice however is still limited. The motivation for developing the accessibility instrument was to support integrated transport and land-use strategy making in planning practice. The scientific questions where threefold:

1. How to measure accessibility to support integrated transport and land-use strategy making?
2. How to use accessibility measures in integrated transport- and land-use strategy making processes?
3. Does the use of accessibility measures in planning practice lead to more integrated transport- and land-use strategies?

It is important to highlight that the measure that is chosen depends on the planning process for which it is used.

## Conceptual framework and theoretical underpinnings

We defined accessibility in zone x as the opportunities in all other zones that can be accessed within a certain travel time and cost. In other words this means that accessibility indicates the potential space for action that people and firms located in a particular place have to engage in spatially and temporally dispersed activities. Using this definition accessibility cannot only be directly related 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). It thus provides planners with the possibility to understand interdependencies between transport and land-use development, and thus support the exploration of the scope for joint action.

There has been little attention within the scientific community for the application of accessibility in planning practice. Handy and Niemeier (1997) are a welcome exception. As Handy and Niemeier (1997, p.1182) signal: “The trend in transportation planning literature has been towards more disaggregate and complex representations of accessibility.” However, more complex accessibility measures, such as utility-based measures, while more sophisticated from a theoretical point of view, also require more analytical skills from the participants making it harder to use such measures in practice. In order to be useful for practical planning purposes, an accessibility measure must meet two basic requirements: on the one hand it must be consistent with the real accessibility needs of the relevant social actors (people, firms); on the other hand it has to be understandable to policy makers (Bertolini *et al.*, 2005). In this respect two hypotheses are advanced. The first is that it is not possible to use complex measures in the phase of policy design. The second hypothesis is that relatively simple measures can already provide insights that can help develop more integrated transport and land use policies.

## Operational aspects

The exact accessibility measure is different in each application, since the measure is developed together with planning practitioners and to address a specific planning problem. The accessibility measures are related to societal goals, such as social cohesion, economic competitiveness and sustainability (see Table 2). Accessibility is a way of relating transport policies to societal issues. A potential accessibility measure is always the starting point. In the section for illustration the measures that have been developed in the case of Almere are described.

The accessibility analysis was carried out using a potential accessibility measure with a distance decay function. This means opportunities that are closer are given a stronger weight than more distant opportunities. Table 1 shows the different impedance functions depending on the spatial scale and the mode of transport. The travel times shown in Table 1 indicate the turning point in our impedance functions, or the travel time where there is a 50% trip likelihood. These travel times where estimated with the use of the 2007 national travel survey (Mobiliteitsonderzoek Nederland/MON). Travel times and accessibility scores were calculated using a combination of a multimodal local and regional transport model. Travel times by car were calculated for the inter-peak period. Travel times for public transport include waiting time and time needed to travel to and from the station. The local model has 600 zones for Almere and has detailed data on inhabitants, jobs and services. Depending on the planning goal access to different type of opportunities was measured. To improve social cohesion we measured access to basic services (shops, health care, education etc.), while for economic competitiveness access to jobs on a regional level was measured (see Table 2, Figure 1 and Figure 2).

Each zone of the model has between 50-2.000 inhabitants. The local model was used to calculate the accessibility measures on neighbourhood and city level. To calculate the metropolitan accessibility scores the local model was combined with the regional model. This model has much less detail outside Almere (1.000-20.000 inhabitants per zone).

The spatial and travel time data is not freely available but owned by the municipality. They make the data available to researchers or consultants if they think this is useful for a particular project. When you have obtained the travel times the accessibility analyses are relatively easy to carry out using GIS. Basic GIS skills are sufficient. Calculation time for the transport model is one-day, once the travel times are loaded into the GIS set-up. The actual production of the accessibility maps itself takes 15 minutes per map (in this phase the impedance function can be adjusted, or the type of activity).

## Relevance for planning practice

The joint-accessibility-design framework has been used in three cases in the Netherlands, they were applied to real planning problems and developed with planning practitioners. It is important to highlight that the set-up was more of an experiment outside the real planning process. However, results of the analysis have been used in the real planning process in all the cases.

The limited number of participants in each of the cases forces us to be humble about generalizing our conclusions, but we discovered some interesting benefits of using accessibility as a concept to design integrated transport and land-use strategies:

- Accessibility strengthens the knowledge about the geographical distribution of opportunities and how these are influenced by interventions in the transport and land-use system;
- It increases awareness about the development potential of locations and how well different activity patterns can be served in a particular location.
- It is important to have a multidimensional perspective in your accessibility analysis since accessibility can differ quite a lot depending of the mode of transport or type of opportunities you look at;
- Accessibility makes it possible to develop transport strategies that improve the accessibility of locations you want to develop and/or develop a land-use strategy that takes into account the development potential of locations given their accessibility;
- Accessibility can lead to different transport and land-use strategies compared to a planning process in which only mobility impact analyses are done;
- Accessibility makes it easier to relate transport policies to wider societal goals;
- Accessibility is just one of the factors that influence development at a particular location, but it seems to be an important precondition. If the accessibility needs are not met it is very difficult to get development going;
- To come up with the most suitable transport and land-use strategy it is important to combine accessibility analyses and mobility impact analyses.

## Strengths and limitations

During the cases it became clear that using simple accessibility measures, such as the cumulative opportunity measure, already requires quite some explanation especially for land use planners. It was thus decided to stick to a cumulative opportunity measure and increase complexity only by placing different cumulative opportunity maps on top of each other, or use a distance decay function if practitioners where able to understand it. Sometimes complexity that was lacking in the accessibility indicators was added during the discussions. Despite the problem of interpretation there were several indications that accessibility does have the potential to be an integrative concept. A transportation planner stressed the fact that “These accessibility maps were very helpful to me in discussing the opportunities and threats of different spatial policy options with land use planners". On the other hand a land use planner noticed that with the help of the maps a transportation planner took a much more active role in signalling opportunities for economic development, rather than just pointing, as more usual, at mobility management issues.

Questions were also raised about the kind of data that had been used. The traditional four step transport model is designed to calculate the level-of-service on the regional road system, while for calculating actual travel times a much more detailed road network would be a better input. Data on travel time by public transport or slow modes is also of low quality in traditional models. Next to this, the spatial data on the distribution of activities was not always available on the same level of aggregation as the zones of the transport model. As a result, when the accessibility maps were examined in detail participants sometimes noticed things, which conflicted with their perception of the actual situation. This made it hard for them to accept the information unconditionally.

During the process, participants became more and more familiar with advantages and drawbacks of the use of the accessibility maps. Most clearly was this the case with the land use planners who were closely involved in all the workshops part of the strategy making processes. They seemed to undergo a learning process, which was different, and much more thorough, than that of those who just attended some of the workshops. This suggests that involving participants in the production, not just the use of the information could be an important success factor. In all instances it appeared crucial to collectively decide what type of information to use in the accessibility analysis and make clear what the drawbacks were of the use of a particular model. In other words, accessibility measures have to be developed with the participation of those who will use and learn from them, similarly to what has been found for other indicators.

Improvements of the instrument depend to a large extent on the context in which it is being used, since the type of indicator depend on the planning problem being discussed and the practitioners at the table. However improving the geographical representation of the accessibility indicators is something that makes the maps easier to understand for planners. The sometimes weird shapes of the transport model zones, especially the large zones in rural areas, dominate the picture and hamper the interpretability. The speed of the transport model to calculate different scenario is also something we look to improve. Ideally, we would like to show the effects of a different transport and land-use scenario during the course of one workshop. Figure 3, Figure 4 and Figure 5 show the results of analyzing different transport scenarios on the accessibility of Almere.

## References

Bertolini, L., F. le Clercq, Kapoen, L. (2005), Sustainable Accessibility: A Conceptual Framework to Integrate Transport and Land Use Plan-Making. Two Test-Applications in the Netherlands and a Reflection on the Way Forward, *Transport Policy*, Vol. 12 (3): 207–220.

Handy, S., and Niemeier, D.A. (1997), Measuring Accessibility: An Exploration of Issues and Alternatives, *Environment and Planning A*, Vol. 29 (7): 1175–1194.

## Tables and Figures

Table 1 Travel times with a 50% trip likelihood

| Spatial scale | Bike | Public Transport | Car |
|---|---|---|---|
| Neighbourhood | 10 min. | 10 min. | - |
| City | 20 min. | 20 min. | 15 min. |
| Metropolitan | - | 45 min. | 30 min. |

Table 2 Accessibility needs and planning goals

| Goal | Spatial scale | Accessibility needs | Preferred modes of transport |
|---|---|---|---|
| Social Cohesion | Neighbourhood<br>City | Access to basic services (child care, health care, daily shopping, social services and sporting facilities) | Bike and public transport |
| Economic competitiveness | Metropolitan | Access to labor force<br>Access to international Airport | Car and public transport |
| Variety in living environments | City<br>Metropolitan | Access to restaurants, bars, cultural facilities and non-daily shopping<br>Access for people | Different combinations of car, Bike and public transport |
| Sustainable growth | City<br>Metropolitan | Access for people | Ratio Car / Public transport |

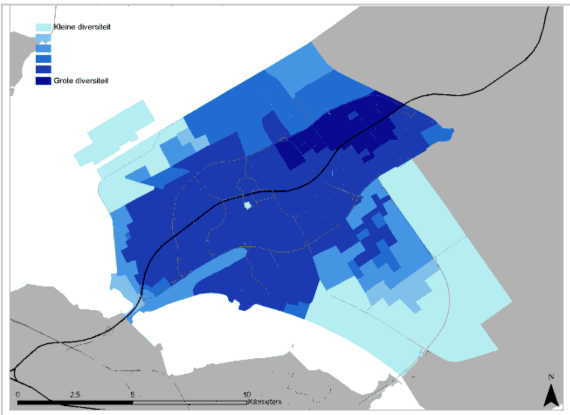


Figure 1 Access to basic services Bike (10 min.)

(Note: Darker colours indicate higher accessibility)

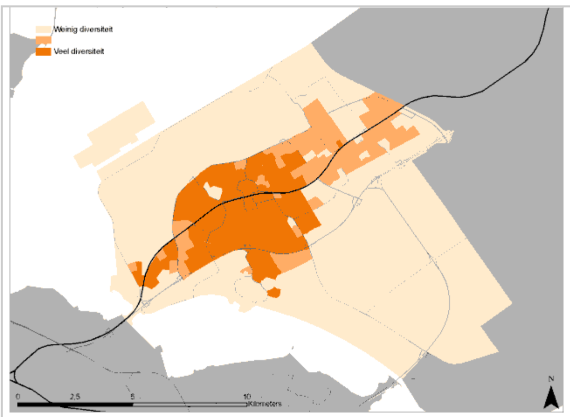


Figure 2 Access to bars, restaurants, non-daily shopping and cultural facilities, Transit (20 min.)


Figure Error! No text of specified style in document. Access to inhabitants Car (30 min. inter-peak)

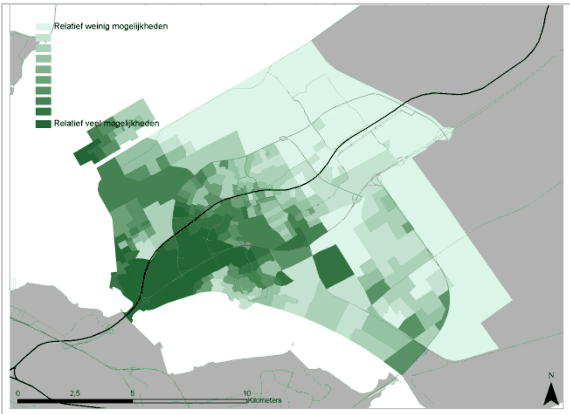


Figure 4 Access for inhabitants Car (30 min. inter-peak) - Scenario Hub and Spoke


Figure 5 Access for inhabitants Car (30 min. inter-peak) - Scenario Metropolitan Connectivity