

**International accessibility and rental levels:  
a case study for the office-market in the Netherlands.**

Hugo Gordijn

Spatial Planning Agency of The Netherlands

[gordijn@rpb.nl](mailto:gordijn@rpb.nl)

Michiel de Bok

ABF Research

Delft, the Netherlands

[michiel@abfresearch.nl](mailto:michiel@abfresearch.nl)

**Abstract**

Rental levels of office floor space are determined by aspects of the buildings and aspects of the location. In this contribution we focus on the characteristics of locations using a large database of market-transactions. Accessibility proves to have an important impact on price levels. In particular the most expensive locations must have an excellent international accessibility by Air. Empirical results are presented.

## 1. Introduction

This paper deals with the importance of accessibility as a location factor. In this case we show that land price or better rental levels are the result of the attractiveness of a location. Of course, accessibility related factors are not the only attractiveness factors that influence land prices. Transport related factors are weighed to the influence of other location related factors: neighbourhood-characteristics, status, parking stress, volume of employment.

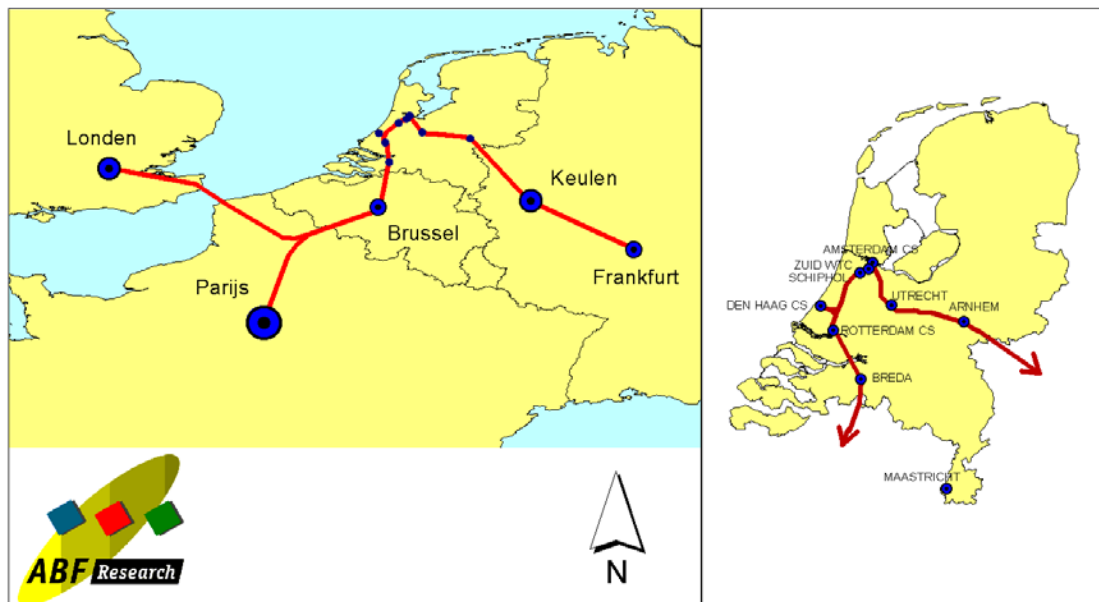
Transport infrastructure has a guiding role on urban development (Hamerslag and Immers (1989) and Bruinsma (1994)). Accessibility is related to the quality of the transport infrastructure and influences transport costs. Therefore accessibility influences location decisions of firms: decisions where to locate or expand production. (Bruinsma and Rietveld, 1992). The relation between accessibility and the location of economic activity is two sided: if firms decide to locate near a city, this will lead to an increase of economic activity in this city and hereby improve the accessibility of the city. Accessibility can be further defined by transport system and scale. Although the frequent subject of research into the relationship between accessibility and office prices (see Geurs and Ritsema van Eck (1992) for an overview), international accessibility is hardly taken into account as a location factor.

This paper focuses on accessibility for different transport modes, both national and international, and their influence on rental levels of office floor space. Part of the research is to quantify international accessibility at a local level to study local variances in international accessibility. International accessibility is quantified for high-speed train and air transport for office locations in the Netherlands. The accessibility of each location is measured taking into account the position of this location in the network of local infrastructure and international train-stations and airports. Traveltimes are used as data and a gravity type model is used to measure accessibility.

## 2. International accessibility

### *High-speed train: method and results*

The international accessibility is firstly expressed as an outbound accessibility for traveling by high-speed train. The accessibility is quantified for business travel using a high-speed train for international destinations, taking into account the possibility of a return trip the same day. Therefore the accessibility is calculated from the travel time to the population of major international cities within a reasonable travel time (four hours). Brussels, Paris, London, Cologne and Frankfurt are the major international cities within the research area (see figure 1 for an overview of the research area).



**Figure 1: Research area**

In the Netherlands two high-speed tracks are under development: the HSL-South from Amsterdam, Rotterdam, Brussel to Paris and the HSL-East from Amsterdam, Utrecht, Köln to Frankfurt. In the Netherlands eight stations are designated as possible stations for the high-speed train. The international train-infrastructure is defined through the eight national stations along these tracks. All international trips by train take place via these international railwaystations. To avoid an unnecessary detour for trips departing from the south of Holland, Maastricht is also taken into account as an international railway station (See figure 1 for an overview of the Dutch international railway

stations). Therefore the travel route from a random 4-digit postal area to an international metropolis consists of the access to the high-speed-train station and the travel time from this station to the international metropolis. The travel time for both car and public transport as access modalities are taken into account.

In this research the international accessibility by train is defined with a gravity type model. The international (outbound) accessibility of a 4-digit postal area ( $S_i$ ) is measured as the weighted sum of the population in foreign cities ( $M_j$ ), where the weights are based on the travel time to these cities ( $t_{ij}$ ). The results of the accessibility are visualized in figure 2.

$$S_i = \sum_j \frac{M_j}{t_{ij}}$$

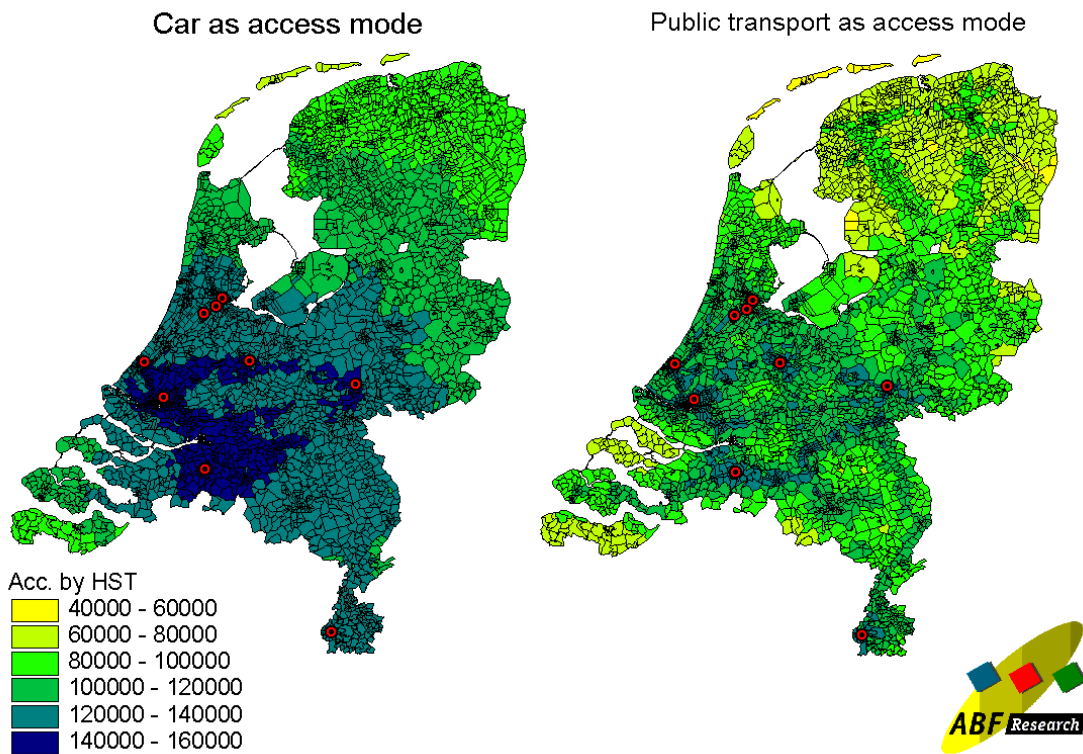


Figure 2: International accessibility by high-speed train

*Air transport: method and results*

The second means of international travel is air transport. The international accessibility is expressed in terms of the access to national and regional airports and the possible destinations and flight-frequencies of these airports. In this case study the actual flight-schedules were not available for each airport. Instead, the number of passengers yearly is used to measure the possible destinations and flight-frequencies.



**Figure 3: International airports in/nearby the Netherlands**

Airport	European (x 1000)	Inter-continental (x 1000)	% inter-continental
Frankfurt	31799	17570	36
Amsterdam	26361	12910	33
Brussels	17450	4145	19
Dusseldorf	12000	4000	25
Hamburg	9534	336	3

**Table 1: Yearly passengers for airports in North-West-Europe**

First step in the analysis was the importance of regional airports in the Netherlands. The number of passengers was marginal: the largest regional airport Rotterdam has less than 800.000 passengers yearly compared to 40 million passengers for Schiphol Airport. Therefore the influence of these regional airports is left out of the rest of the analysis.

An air traveler has besides Schiphol Airport, other larger airports nearby. (figure 3). From an analysis of the number of yearly passengers a selection is made of possible airports for air travel to and from Holland. The size of the airports that are used to measure the international accessibility is shown in table 1. A distinction is made between continental and intercontinental passengers. As stated, the

international accessibility is measured using a gravity type model. In this gravity type model the number of passengers is weighted with the access travel time to the airport and a time constant, representing the time-loss between checking in and boarding. These

time constants are assumed at 30 ( $C_{\text{european}}$ ) minutes and 100 minutes ( $C_{\text{intercont}}$ ) for European en intercontinental flights respectively.

$$S_i = \sum_j \frac{M_{j;\text{intercont}}}{t_{ij} + C_{\text{intercont}}} + \sum_j \frac{M_{j;\text{european}}}{t_{ij} + C_{\text{european}}}$$

The results of the accessibility are visualized in figure 4. The Deltametropolis region, consisting of the four major cities in the Netherlands: Amsterdam, Rotterdam, the Hague and Utrecht, has the best international accessibility by air. Explanation is the central position of Schiphol Airport in this highly urbanized area. As can be seen from the share of schiphol in the total international accessibility, the effect of foreign airports need to be taken into account in quantifying international accessibility. In some areas, the share of foreign airports in the accessibility by air, reaches 70 %.

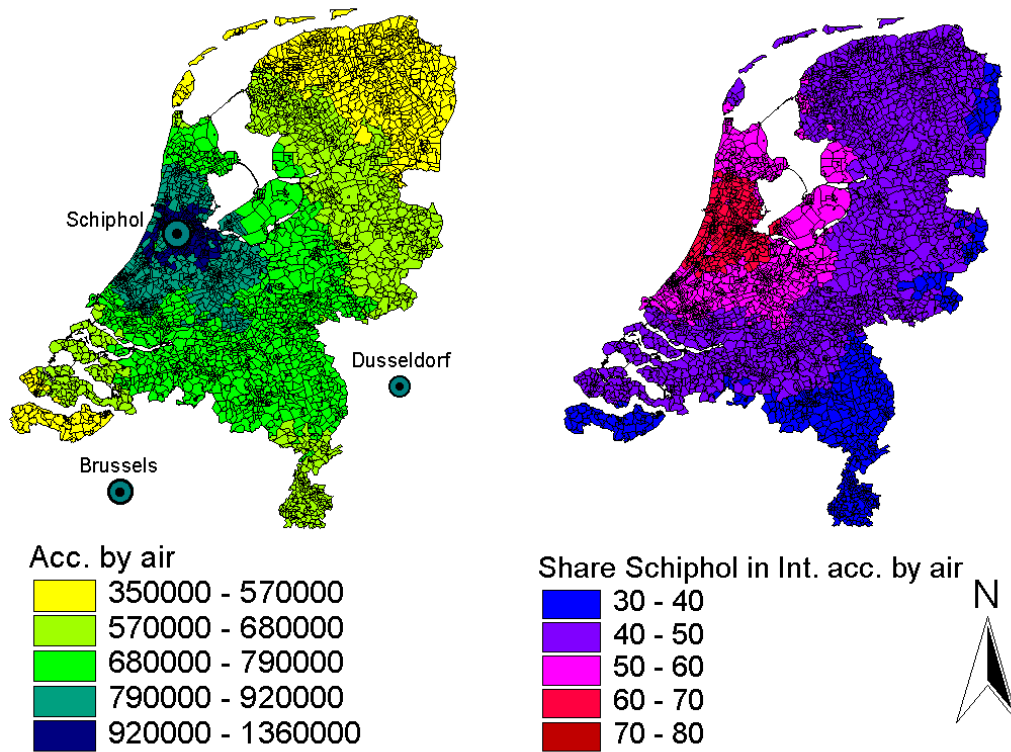


Figure 4: International accessibility by air

### 3. Effect of accessibility on rental levels of office space.

#### 3.1 Data used.

The rental value of office-space is determined by characteristics of the building and characteristics of the location. Characteristics of the building are for instance the technical facilities, the quality of the building and parking facilities. Characteristics of the location of an office are for instance the accessibility towards the road network and public transport, the availability of services and labour force and the quality of the environment.

The data used in our analysis are derived from a large database with individual market transactions of commercial real estate. The database has some 600.000 records for both rent and sale of office space and other commercial real estate like shops. The database does not contain information about other characteristics of the building than its address, surface and its price. Therefore we had to restrain our analysis to characteristics of the location, using a large database of zone characteristics of ABF-research.

The data for rental value of office space were selected and pooled over the time period (1984-2000) taking inflation into account. The mean value per 4-digit Postal Code regions (PC4) was computed. In the Netherlands there are about 4000 PC4-zones of which about 1500 have one or more office-space transactions in the database. The average yearly rental-value of office space per square metre is shown in figure 5.

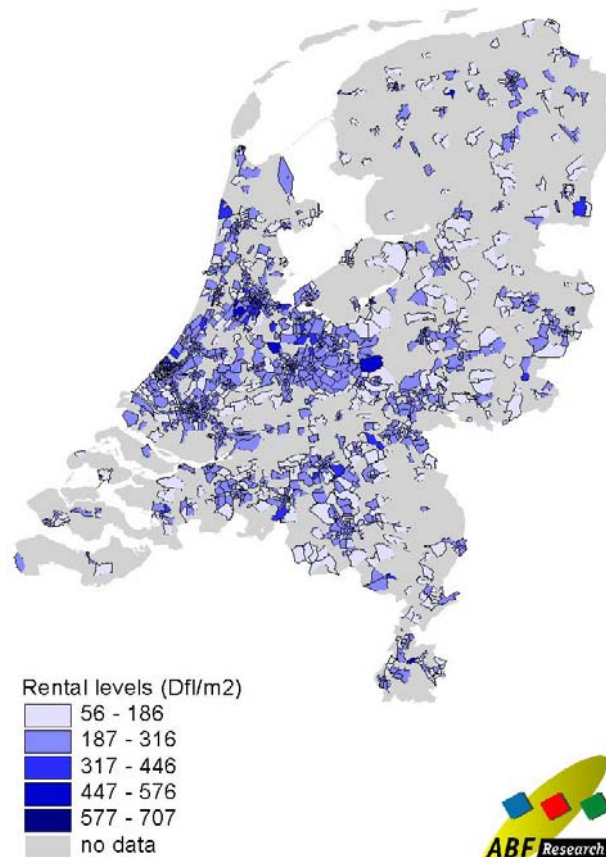


Figure 5: Rentallevels of office space in the Netherlands

The location of an office has some relevant characteristics :

- International accessibility,
- National accessibility,
- Parking-pressure
- Neighbourhood-characteristics (Age-categories and type of zone : city centre/ outskirts/ Newtowns/ village/ countryside/ other),
- Volume of employment in the zone
- Availability public transport
- Historical sites

Different operationalisations were tested for these characteristics.

The national accessibility is formulated as :

- Accessibility for the labour force by road transport,
- Accessibility of the labour force by public transport,
- Accessibility of potential customers by road transport,
- Accessibility of suppliers by road transport.

The international accessibility is formulated as :

- Accessibility of international metropolis by High Speed Trains and complementary transport by road
- Accessibility of international metropolis by High Speed Trains and complementary transport by railway transport
- Accessibility of continental travel by air and complementary transport by road
- Accessibility of intercontinental travel by air and complementary transport by road

For reasons of multicollinearity two aggregate variables were constructed and standardised

The Parking pressure is deducted from the price of parking space in parking garages.

### 3.2 Methods and results.

The differences in rental levels are estimated by means of weighted multiple regression. The volume of rented floor space is used as weight factor. Table 2 shows the results of the estimation.

Variable	t-value
International accessibility	15,2
Parkingstress	7,1
Milieu	range -5.3 to 7.6
Buildingperiod	range -5.7 to 6,8
Volume of employment	4,1
National accessibility by car	3,4
Public transport	3,0
historic amenity	2,6

Table 2: estimation results for differences in rental levels.

The estimated model explains 46% of the variance in rental levels and has an overall F-statistic of 78.

Detailed statistics can be found in Borsboom (2002). In zones with a good international accessibility prices are on average 75 Euro / square metre/year more expensive than in zones with a bad accessibility.

### 3.3 Discussion

International accessibility turns out to be the most powerful factor explaining differences in rental levels. This is an important finding and indicates that at least a part of the renters of office space is willing to pay a substantial price for international accessibility. Further analysis shows that this is the top of the business services sector.

The positive sign of the t-value of Parking stress indicates that a high parking stress goes with high rental levels. The question can be asked what the direction is of the

causal relationship. Is parking stress causing high rental levels or are high attraction zones very crowded, causing both parking pressure and rental levels?

The milieu-factor (a classification factor) is a proxy for amenity characteristics like density and access to green-areas.

The building period also is a proxy for amenity characteristics like modern infrastructure and modernity of the buildings. Moreover, each building period has its own atmosphere.

The volume of employment can indicate that the nearness of other employment creates more supply of business services like copy-shops, small restaurants and the like or that there is a common factor causing both a high volume of employment and high rental levels.

The low value for Public Transport can be explained by the fact that almost all large zones with a lot of offices are connected to the public transport network.

The conclusion may be that if location characteristics in terms of accessibility are good office development can be successful both in terms of Volume as in Price-levels.

Despite all doubts about some causal factors in the model we think the conclusion is correct that for the most attractive zones the I.A. is an important factor and moreover a key element.

#### **4. Discussion and conclusions**

International accessibility is proved to be an important factor in the locational preferences of firms and business real estate developments. Further improvements of the concept are necessary.

We feel that a lot of improvements can be made. We could not study all the relevant literature. So we welcome criticism. We feel that the specification of the accessibility model can be refined. For example: more exact travel times by using the true origin of air travelers. More research into the experience of the access and egress in international traveling might learn more about the weight of access and egress in relation to the total trip.

Especially the causal structure of the attractiveness of a location should be unravelled. More data on individual cases are necessary to determine what the causal structure is.

The strong results make it plausible that also in other fields of research the concept of international accessibility is important. For example the attraction and growth of business services.

In other modalities (like shipping, air-freight and possibly inland shipping, pipelines and tgv-fret) it is worth trying to employ this type of analysis on small zone data. Another interesting application might be a comparison with another European region.

## References

Borsboom, S. (2002), *Kantoorontwikkeling op het Rondje Randstad*, Thesis for the department of infrastructure at the Delft University of Technology, ABF research, the Netherlands [in Dutch].

Bruisma, F.R. (1994), *De invloed van transportinfrastructuur op ruimtelijke patronen van economische activiteiten*, Vrije Universiteit, Amsterdam, the Netherlands [in Dutch].

Bruinsma, F.R. and P. Rietveld (1992), *De structurende werking van infrastructuur: een state of the art review*, Vrije Universiteit, Amsterdam, the Netherlands [in Dutch].

Geurs, K.T. and K.T. Ritsema van Eck (2001), *Accessibility measures: review and applications*, RIVM (National Institute of Public Health and the Environment), Bilthoven, the Netherlands.

Hamerslag, R., B.H. Immers, (1989), *The Interaction between Transport Planning and Spatial Development*, Paper prepared for the 5th World Conference on Transport Research, Yokohama, Japan.