Planning and Visibility Assessment of High Building Development in The Hague
Frank van der Hoeven
Steffen Nijhuis

ABSTRACT A true skyline in the Dutch city of The Hague emerged in the spring of 2011 when the construction of four high buildings drew simultaneously to a close: the Ministry of the Interior and Kingdom Relations (146 metres, 2012), the Ministry of Justice (146 metres, 2012), a residential project De Kroon (132 metres, 2011) and a new office tower New Babylon 1 (142 metres, 2011). Together with the Hoftoren (2003, 142 metres) and the Strijkijzer (132 metres, 2007) they constitute a new visual cluster that can be seen by the naked eye as far away as the edge of neighbouring Rotterdam, 16 kilometres away. The Hague’s skyline has been four decades in the making. The earliest discussions on buildings to a height of 140 metres date back to the 1960s. Public opinion, fearing the visual impact of such buildings on the city, impeded the planning of such high buildings, while a weak municipal policy was not able to break the stalemate. New instruments that analyse the development of the skyline through time by means of mapping, scatter plots and viewsheds carry the potential to make such public and political debates on high building development more objective, and perhaps less emotional. This chapter presents three such approaches that were developed by the authors: the use of a scatter plot to unravel the dynamics of high building development and height categories through time, the viewshed of the buildings that make up jointly a cluster by means of GISc, and the mapping the outline of the cluster as it appears in the (urban) landscape.

Introduction
The high-rise has been controversial in the Netherlands for years, if not decades. A substantial number of Dutch towns and cities have felt the need to regulate the planning and construction of this specific building type. Because all building activities are regulated in the Netherlands, policy makers and civil servants need a solid framework to guide decision-making in approving or rejecting a high-rise proposal. Various online databases containing data on high-rise buildings show that at least three Dutch cities have a sufficient number of tall buildings or high-rise proposals to justify regulation: Rotterdam, Amsterdam and The Hague. The policy document that emerged in the Netherlands is called hoogbouwbeleid or hoogbouwvisie. This article analyses the high building policy of the city of The Hague as it was put in place in 2001, ten years ago, and uncovers some inconsistencies in the premise of the policy and assesses the relative visibility of high-rise clusters.

The Hague and its high buildings
The Hague is not the official capital of the Netherlands. It is nevertheless home to the government, the parliament and all of the ministries. The construction of governmental offices is an important driving force behind The Hague’s urban development. The volume of office space in The Hague is about 5.5 million square metres. Most of the high-rises here can be found in the city centre. The office rent levels of the two main locations in The Hague’s centre (Central Station and Beatrixkwartier) varied in 2009 from €165 to €215 per square metre and from €170 to €200 per square metre, respectively. This is significantly lower than the rent levels in the most prominent locations in Amsterdam, which varied from €250 to €375 per square metre in 2009 area (DTZ Zadelhoff, 2009).

The Hague’s 2001 high building policy provided primarily a framework for inner-city development, not for the high...
buildings in the post-war estates. This may very well explain why The Hague considers a building “high” when its height is equal to or exceeds 50 metres. The tallest buildings in The Hague’s post-war estates are 52 metres high.

The Hague started to develop its skyline rather late, only beginning in the early 1990s. At present, it encompasses a remarkable portfolio of high buildings designed by internationally renowned architects.

The initial high building development was hampered by the outcome of an inner-city development that went sour in the 1960s. In the post-war era, two neighbourhoods (Wijnhavenkwartier and Spuikwartier), situated just south of the historical district, were appointed by the city to become the national governmental centre. The proposed development was part of the 1949 strategic urban plan for Greater ’s-Gravenhage or the “Plan Dudok” (Schmitt, 2009). It envisioned an underground Central Station to facilitate the scheme. The national government and the Dutch Railways opposed the vision. Slowly, the Wijnhavenkwartier and Spuikwartier started to deteriorate. In the early 1960s, a local tycoon (Zwolsman) proposed a large real estate development based on a master plan designed by Nervi. It included a prominent office tower with a height of 140 metres just at the border of the historical district. The plan was legally contested and rejected (Van der Sluijs, 1989). The proposed tower was subsequently divided in two to accommodate two office slabs of half the size, which currently house the Ministry of the Interior and the Ministry of Justice. A maximum height of 70 metres in the Wijnhavenkwartier and Spuikwartier was introduced to protect a culturally important view of the historic buildings of the Binnenhof, which housed the parliament (Freijser, 2000). In this way, the 70-metre threshold became an important reference point for future developments.

The city has been cautious with regards to high-rise development ever since. In stark contrast to its neighbouring city Rotterdam, there are no proud publications written about the development of The Hague’s skyline. City officials tend to be careful when they have to decide on high buildings. For this reason, the high-rise development focused initially on the Beatrixkwartier. This is a peripheral district, safely separated from the inner-city by a double spatial barrier: the Central Station’s rail yard and the sunken A12 highway. The construction of the Malietoren (1996, 75 metres) over the sunken A12 was a major milestone for the Beatrixkwartier’s development, and was featured in several commercials as an icon for the future Netherlands at the time.

In a later stage, the development shifted back to the Central Station area and the inner city. In 2001, the city presented its proposals for the new accommodation for the Ministry of the Interior and Kingdom Relations and the Ministry of Justice in the Wijnhavenkwartier. Almost ironically, the height of the two towers will be just over 140 metres each. The alderman for spatial planning and urban renewal, Arend Hilhorst, had to defend the proposal in 2002 after a photo-montaged impression, released by the municipality, bluntly falsified the visual impact of the planned high-rises near the Central Station and the Wijnhavenkwartier (Veldhuizen, 2002). The panorama showed a view in which the planned Hoftoren (2003, 142 metres) was clearly reduced in actual size. The towers that would house the new Ministry of the Interior and Kingdom Relations and the Ministry of Justice were barely visible, concealed by elements that seemed to be original elements of the historic parliament building. In fact, the artist’s rendering included building elements from a different angle of the parliament; these were pasted into this montage in order to hide the new developments from view.}

The affair caused quite a stir in local politics. The alderman survived the controversy and the Hoftoren, which is currently home to the Ministry of Education, Culture and Science, was recognised with multiple awards after it was built, including the 2004 International High-Rise Award (Flagge, 2004). The fact that the local government had to operate from such a defensive stance regarding the visual impact that high-rises would have on the historical district is part of a larger picture here. Because of its prominent historical district The Hague seems to struggle with the difficult relationship between high-rise and built heritage like many towns in the United Kingdom seem to do (Short, 2007), including London (Tavernor, 2007).
Analysis of The Hague’s high building policy

The Hague’s 2001 high building policy (Dienst Stedelijke Ontwikkeling, 2001) centres on three main components: the architectural heights of building in the city, the high building developments in the various city districts, and possible future developments. In this respect, the document discusses a distinct “Hague Height” (Haagse Hoogte): a typical architectural height between 50 and 70 metres that is said to characterise the city’s skyline. The policy provides a number of reasons why buildings did not exceed this height. One reason is that older policies prohibited buildings higher than 70 metres in the historic city centre. The preservation of a culturally important view of the old parliament buildings prohibited higher buildings. Another reason was the need to maintain an open corridor along the Utrechtse Baan for transmissions from the telecommunication tower that was built in the middle of the Beatrixkwartier. Both restrictions have since been lifted. This is reflected in the new official high buildings policy, which permits buildings over 100 metres in this area. The 2001 policy nevertheless still prohibits the construction of buildings between 70 and 100 metres in height to preserve the integrity of the established skyline. The city seems to cherish its “Hague Height”. The high building policy document includes a full-page sketch of the city centre skyline to emphasise this point.

Looking at the actual heights of high buildings in The Hague however, there seems to be no such thing as a typical “Hague Height”, at least not between 50 and 70 metres. There are several online databases that are available, which contain data on high buildings, notably the listings at Emporis.com. According to the various websites listed here, in 2001, the year in which The Hague published its high-rise policy, the city already contained eight prominent buildings between 70 and 100 metres high; one building was under construction and three more buildings in this range were proposed. In the same year, The Hague had only one high building over 100 metres. Three similar buildings over 100 metres were under construction and four others were proposed.

How is it possible that this policy document is so factually inaccurate in neglecting the existence of tall buildings over 50 to 70 metres? The city’s planning officers, external experts and the city council must have reviewed an official document like this. How could they have approved it when it contains such obvious inconsistencies?

The problem may have arisen due to the differing definitions of height. The high building policy document fails to define height (bouwhoogte), which may be measured in many different ways: architectural height, floor-to-ceiling height, floor-to-floor height, highest occupied floor height, main roof height, observation deck height, observation floor height, roof height and tip height (Emporis, 2009).

For instance, the architectural height is defined as “the vertical elevation from the sidewalk level outside of its lowest exposed floorplate, to its highest architectural or integral structural element. These include fixed sculptures, decorative and architectural spires, ornamental fences, parapets, balustrades, decorative beacons, masonry chimneys, and all other architecturally integral elements along with their pedestals” (Emporis, 2009).

Furthermore, the document fails to define a high-rise or a high building. The document also falls short of providing an up-to-date overview of existing and planned high buildings in The Hague. If such an overview was presented in a clear and concise way, then readers could draw their own conclusions whether a typical “Hague Height” truly existed or not.

Because the architectural height is internationally considered to be the official height for primary ranking purposes (Emporis, 2009) this paper takes only the architectural height into account. Data on high buildings can be presented as a simple list or as a scatter plot. This article provides a scatter plot because it can show the relationship between several sets of data. A scatter
plot is a simple but efficient way to display the relation between two types of quantitative data tagged to a number of specific objects.

Using data on the architectural height and the year of completion of the high buildings, a graph of height (y axis) versus time (x axis) can be plotted. By including buildings under construction and proposed buildings, a timeline for high-rise development in a given city emerges. The Hague’s scatter plot reveals that the development of high buildings in The Hague began in the late 1960s and remained relatively constant for two to three decades thereafter. Then, in the mid-1990s, architectural heights rose sharply, almost doubling in less than a decade. The diagram clearly shows that there is a context and a rationale for a strategic planning guidance on high buildings in The Hague at the given time.

To visualise the relationship between the actual development and the planning guidance, colours can be added to the scatter plot. Simple rectangles are drawn to represent the different height categories identified by the municipality. A rectangle is drawn to indicate the so-called Hague Height of 50–70 metres, starting in the data from 1969 and continuing until the present day. The next rectangle represents the new height range of 100–140 metres, starting in the data from 1998, the year the first high building over 100 metres was completed (Castalia, 104 metres). At first glance, this graph looks promising, but upon further consideration, many of the dots (each depicting a high building) are still excluded from one of the two rectangles. It is thus apparent that the height ranges used in The Hague’s high buildings policy only partly explain what is going on in the city. 

---

**fig. 3** Scatter plot of the architectural height and the year of completion of The Hague’s high buildings, including the “official” height categories

**fig. 4** Scatter plot of the architectural height and the year of completion of The Hague’s high buildings, including optimised height categories
In order to paint a more accurate picture, the Hague Height should be raised to 80 metres, which encompasses most of the buildings built before the mid-1990s. Next, the upper limit of the new category should be raised from 140 to at least 150 metres. The first building in that category, the Hoftoren (2003, 142 metres) and the new buildings that will house the Ministry of the Interior and Kingdom Relations and the Ministry of Justice (146 metres, 2012) are already too high for this category. Similarly, the lower boundary of the category should be raised to 120 metres. A clear frontrunner group of six high buildings now emerges, with a dividing line between 110 and 120 metres that separates them from the rest. This leaves some dots not categorised. These can be accounted for by introducing a third height category, ranging from 80 to 120 metres, which emerged only in the late 1990s.

Instead of two height categories (50–70 metres and 100–140 metres), the city may have to deal with three categories (50–80 metres, 80–120 metres and 120–150 metres). The scatter plot analysis makes this idea appear plausible. So far, the analysis only considered the architectural height and year of completion. The location of a high building within a city is another important dimension of high building policies. For this reason, a second analysis is introduced that looks at the relation between the height categories and zoning in the city. This second analysis takes a fresh look at the area that comprises the cluster of high building in The Hague.

GISc-based visibility analysis

The high level of visibility of high buildings is one of the major reasons to draw up specific policy documents to regulate the development of these special buildings. The joint visual impact of The Hague’s high buildings is visualised here in order to determine the area that most influences that visibility.

The visual impact of a high building cluster can be reviewed using a comprehensive GISc-based viewshed method (Rød and Van der Meer, 2009; Nijhuis, 2009; Germino et al., 2001; Nicolai, 1971). The accuracy of this analysis depends on the digital landscape model (DLM), the rule for judging visibility (Fisher, 1991 and 1993; Riggs and Dean, 2007). According to Riggs and Dean (2007), the average level of agreement which can be achieved is up to 85%. These findings suggest that it is better to express the analysis results in terms of probability (Fisher, 1995 and 1996).

However, to achieve the highest degree of reliability, an accurate barrier model or digital landscape model was constructed consisting of a digital elevation model (DEM) in combination with topographic data. The basis is a high-resolution elevation model, the Actueel Hoogtebestand Nederland (AHN-1, 1997–2003), which is precise to about 15 centimetres per square meter. The DEM’s density, distribution and planimetric accuracy is such that topographic objects with a size of two by two metres can be identified clearly and with a maximum deviation of 50 centimetres (AHN, 2010). The model has been supplemented with recent topographic data: the digital topographic map at a scale of 1:10,000 (TOP10NL, 2009). All legend items were selected that are higher than eye-level (including ascending elements, buildings...
and trees and/or shrubbery) based on the definitions of the Topographic Department of the Land Registry (Topografische Dienst Kadaster). The location, architectural height and year of completion of the high-rise buildings were derived from the Emporis database (Emporis, 2010) and added to the digital topographic map. The resulting digital landscape model was corrected using recent aerial photographs, field visits and Street View imagery (Google Earth, 2010).

A number of parameters influence the result of the GISc-based viewshed analysis. Especially when it comes to high buildings the vertical size (area of the façade) and weather conditions play a crucial role in prediction of probable visibility (Nicolai, 1971). To put it more precisely, the visual range of objects in the landscape depends on: the apparent contrast between the object and its background, the angular size of the object, its shape and vertical area, the contrast threshold at the level of luminance (type of day), the conditions and technique of observing and the eye level and related curvature of the earth (Duntley, 1948; Middleton, 1952). An important factor for determining the maximum visual range of distant objects is the meteorological optical range at different weather conditions. Observations from the Royal Netherlands Meteorological Institute (KNMI) show that the meteorological optical range by full daylight varies from nearly zero up to several tens of kilometres (KNMI, 2010). However, the average ranges of 12 kilometres (50% of the time), 20 kilometres (25%) and 28 kilometres (10%) are typical for Dutch circumstances (Nijhuis, 2013; Nicolai, 1971). For the analysis we calculated the maximum visual range of the high-rise buildings under different meteorological conditions by full daylight and involved vertical area (length-width proportion < 5), vertical shape (rectangular) and contrast value (object-background ≥ 2%). See fig. 6 (Nijhuis, 2013, Van der Hoeven and Nijhuis, 2011). The vertical area was calculated by using fifty percent of the perimeter of the footprint multiplied by the architectural height. The cumulative viewsheds that were from the analysis show the probable visibility at a meteorological optical range of 20 kilometres and takes into account the curvature of the earth. The analysis results were tested for reliability through field visits and photos. →fig. 6,7

The visibility analysis of The Hague’s high buildings shows that the collective visual impact of the high building cluster can only be seen at a few isolated spots in the city. Outside the city the combined visual coverage of The Hague’s high buildings reaches as far as 5 to 20 kilometres away. The North Sea especially seems the perfect place to observe the skyline. However, the human eye cannot assess the relative position between the individual buildings at a distance of 5 to 20 kilometres. Whether the high buildings are neatly lined-up or randomly positioned is impossible to tell, unless they are all the same size and shape (which they are obviously not). As a result a skyline appears mostly as a two-dimensional phenomenon. To develop a better understanding of the visual appearance of the city’s skyline it is helpful if the geographical coverage of the corresponding cluster is known. To determine this a simple outline can be drawn that links the outer buildings that are supposedly part of the cluster. If a new building is erected within the outline it will not change the width of the city’s skyline, regardless the angle from which it is viewed. Any building erected outside the outline does extend the skyline, as seen from a specific angle. Three distinctive height categories were identified in The Hague: under 80 metres, between 80 and 120 metres, and above 120 metres. This means that three of such outlines can be drawn. →fig. 8

![Visual range of high buildings as a function of the relationship between vertical area, shape and contrast value under different meteorological conditions by full daylight. (image source Nijhuis, 2013)](image-url)
Visibility buildings > 50 meters

Full daylight: meteorological optical range
20 km (25% of the time)
in relation to vertical size and area of the building

fig. 7 Map of the joint visual coverage of The Hague’s high buildings
The outline that includes the buildings over 120 metres is substantial. The outline for the buildings between 80 and 120 metres is remarkably small. These buildings are all clustered in close proximity to the Hague’s central transit hub. The outline of the buildings between 50 and 80 metres is somewhat larger than the over 120-metre outlines and defines a clear block surrounding the Hague Central Station area.

In the case of most buildings it is clear whether they belong to such a cluster or not due to their proximity to the others buildings. The question is whether the high buildings in the Laakhaven area belong to the area that makes up the visual skyline or not. From some angles these buildings are visually part of the cluster and from other angles they are not. A simple technique can be applied to visualise this. The areas from which a building appears to be part of the cluster (or not) is determined by drawing two lines that connect the building in question with the two buildings that mark the borders of the cluster. If the angle between the two lines is larger than 90 degrees, then the area in which the building appears as part of the cluster dominates over the area in which it is visually separated from the cluster. None of the buildings in the Laakhaven area seem to be part of The Hague high building cluster, but one: Laakpoort (50 metres, 1975).

What emerges is a solid block of roughly 1.2 by 1.2 kilometres that seems to define the skyline of The Hague with almost no difference between the lower and the higher height categories. That diagram is radically different from the one that was presented in the 2001 high building policy document.

Conclusions

The development of high buildings in The Hague has been analysed by considering the historical development in relation to the patterns that emerge from architectural height, year of completion, and location in the city of the buildings that measure 50 metres high or more. The height categories that derived from this analysis were used to determine the visual impact that high buildings have on the city and its surrounding territory, and to determine the scope of the high building cluster that seems to determine the development of the city’s skyline. The findings contradict the concepts of height categories and zoning used in The Hague’s first policy framework published in 2001. Systematic research delivers new and robust height categories (less than 80 metres, 80-120 metres and above 120 metres) and a square shaped cluster that spans the core of the city’s high building development. Both findings can be used as a scientific foundation for the city’s future policy on high building development.

REFERENCES

— Dienst Stedelijke Ontwikkeling (2001) Hoogbouwwise
—— Toronto; University of Toronto Press.

Frank van der Hoeven | Steffen Nijhuis

118 Planning and Visibility Assessment of High Building Development...