

# The impact of window openings on the openness and closeness of a building towards the public space

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**Abstract.** Window openings allow communication between the interior and the exterior, but they are also elements that allow the user to control several aspects such as the light, sound, air, and privacy. Although people spend a great time inside, windows do have a strong relationship with the outdoor space and can influence a building's openness or closeness. This relation has changed during the years with the introduction of new window opening types. (Orvell & Meikle, 2009). When referring to openness it cannot be thought about as visual transparency alone. In fact, it is related to all senses. It can be seen as the medium to regulate the functional between interior and exterior." (Ayoub & Koba Yashi, 2001). This paper is part of the graduation studio *Revitalising 20<sup>th</sup> century Heritage*, aims to research the process of assessment of the role the window openings present in the three buildings of the Rotterdam Harbour Police station play in defining the building's openness or closeness. This research is positioned in larger research on how window openings help define a building's openness or closeness towards the surroundings and creating a helpful 'design options palette' when having to intervene in a building's openness or closeness. The research concludes that most of the windows present in the oldest building present a high openness, as well as in the 1994 building. On the contrary, the 1940 building presents window typologies with a high closeness. However, this research needs to be further developed in relation to other elements.

## 1. INTRODUCTION

Windows have a long history during which they have evolved. They are elements which are part of a building's appearance. Despite this, they had a functional role first (Hirst et al., 2007). Windows make air and sunlight passage possible but can also be viewed as a form of ornamentation (Robilant, 2014). In fact, windows reflect the architectural expression of a place and the period in which they were placed (Hirst et al., 2007). Depending on the dimensions, style, and material windows can transform the appearance of the building and its relationship with the surroundings. In fact, this appearance can make a building be perceived as open or closed towards the surrounding public space, which is an important place where social interactions take place. The impact a building generates can make these increase or decrease (Faroldi, 2020). Although people spend a great time inside, windows do have a strong relationship with the surroundings. This relation has changed over the years with the introduction of new window opening types, for example display windows, which create a more fluid relation between the inside and the outdoor space (Orvell & Meikle, 2009). In Modernist architecture, glass and steel facades have been largely used to create a sense of continuity between the interior and exterior which resulted open facades (Ayoub & Koba Yashi, 2001). The typologies and the number of window openings impact the openness or closeness of a building towards the surrounding spaces. This paper aims to research this impact taking as case study the Rotterdam Harbour Police station (figure 1).

This paper aims to research the assessment of the role the window openings present in the Rotterdam Harbour Police station play in defining the building's openness or closeness. It is important to underline that this research is part of a larger research within the graduation studio *Revitalising 20<sup>th</sup> century Heritage*. This graduation studio is part of the Heritage and Architecture department which focuses on the redesign and reuse of existing buildings and is part of the faculty of Architecture of the Technical University of Delft. The research conducted within the graduation studio refers to how window openings help define a building's openness or closeness towards the surroundings and creating a helpful 'design options palette' when having to intervene in an existing building's openness or closeness.

The relevance of this research lies into the fact that it tries to create a method to define and apply the concepts of openness and closeness in cases of renovation and heritage conservation. The challenge relies in keeping in consideration the existing openings and their values when having to modify them to create more openness or closeness to adapt to a new function or/and user. To create this method knowing how window openings help define a building's openness or closeness towards the surroundings is a necessity. Therefore, the question this graduation research tries to answer is: *How do window openings help define a building's openness or closeness towards the surroundings?*



Figure 1: Rotterdam Harbour Police (Boss-19, 2005)

In the following chapter the Rotterdam Harbour Police station and its variety of window typologies is analysed, consequently the concepts of openness and closeness are discussed. Afterwards, the assessment of the level of openness and closeness of the window typologies of the Rotterdam Police station is shown. Lastly, a conclusion on the conducted research is drawn and a short summary on the following steps which must be taken is presented.

## 2. METHOD

In the first part of the research, the concepts of openness and closeness have been reviewed from literature. Secondly, through archival research, literature review and site visits, the window opening typologies present in the Rotterdam Harbour Police station have been inventoried and their materiality, glazing, type of opening, size, glass transparency were mapped and analysed. Consequently, the results of both are used to assess the openness and closeness of the Rotterdam Harbour Police's window openings.

### **3. OPENNESS AND CLOSENESS**

On an urban and architectural scale, the concepts of openness and closeness have been defined in a multitude of ways. An example of urban scale in which closeness is visually represented is the Nolli map created by Giovanni Battista Nolli in 1748 (Torres Bustamante, 2021). It was introduced to represent spatial relationships prevalent in public use. Building parts and interior spaces which were closed for the public were indicated as solid masses (Benko, 2010).

When looking at the architectural scale, Ayoub & Koba Yashi (2001) question the meaning of openness for human beings and conclude that the perception of openness is related to our senses. In fact, the just as human senses, openness allows view, to breath, and understand the surroundings (Cornn, n.d.). It can achieve different expressions and configurations in order to fulfil the human's functional needs between interior and exterior. In their article, the concept of limit is introduced to explain how openness can be the communicating medium between two spaces which are 'the here' and 'the beyond', the latter symbolising the other side of the limit. The limit can be seen as closeness and is thus strictly related to the concept of openness. When looking closer at the concept of openness related to the existential space, it is clear that it is needed in order to fulfil human needs such as view, air, light, sound and connection with the exterior (Ayoub & Koba Yashi, 2001). The concepts of openness and closeness and their application in architecture can vary and assume different meanings depending on the culture of a specific place. For example, in Japan, openness is often given a texture in order to blur the look towards the exterior by making use of opaque screens. This allows who is inside not to be seen but at the same time to see (Plummer, 2003). This concept is largely used in the country, whereas in the Western culture it is less used, and openness and closeness are used differently. For example, in the United States, starting from the 1970's the pursuit of a connection with nature grew, becoming an important factor determining the character of openings, which have then become elements allowing view, therefore, allowing this connection (Ayoub & Koba Yashi, 2001).

Within this research, the concept of openness has been taken in consideration as an element of spatial and temporal articulation between an interior and an exterior which is not only visual transparency but is related to all senses. Moreover, as an element which can be seen as the medium to regulate the functional needs i.e. the window (light, view, aeration, and spatial and temporal articulation) between interior and exterior. When these are not present, neither is openness (Ayoub & Koba Yashi, 2001). The concepts of openness and closeness, as described above, have been applied to the window typologies present in the Rotterdam Harbour Police station and have been used to assess their level of openness to help defining the suitability for renovation and adaptive reuse of the building.

### **4. ROTTERDAM HARBOUR POLICE STATION**

To determine the openness or closeness of the windows present in the Rotterdam Harbour Police station, their capability to be openable has been analysed, together with their sizes and glazing transparency. The analysis of the state of conservation, material, and glazing typology has been carried out to determine whether the window needs an intervention.

The Rotterdam Harbour Police station is an ensemble of three buildings built in different years (1933, 1940, 1994). The three buildings present different architectural styles and very different window typologies (figure 2,). This mostly due to the different periods in which the buildings were designed and due to the different functions, these needed to host.

In fact, the smallest building of the ensemble, built in 1940, was used as a naval article shop on the ground floor and had a residential function on the first floor. Despite it was purchased by the Rotterdam Harbour Police in 1994, the window typologies have remained the same. Today, the 1940 building still presents the original windows. These are the oldest ones which can be found on site. Some of them have similar shape and decorations to the windows of the 1933 building.

The middle building, built in 1933, represents the first on-ground Harbour Police office. It underwent a renovation in 1994, during which most of the windows were replaced with new

ones (Manneke, 1995). These maintained the original form and shapes but not the original materials. In fact, the new windows, which can be seen today, are made of aluminium and most of them have double glazing.

In 1994 a third building was built. It presents modern double-glazed windows and two glass walls.

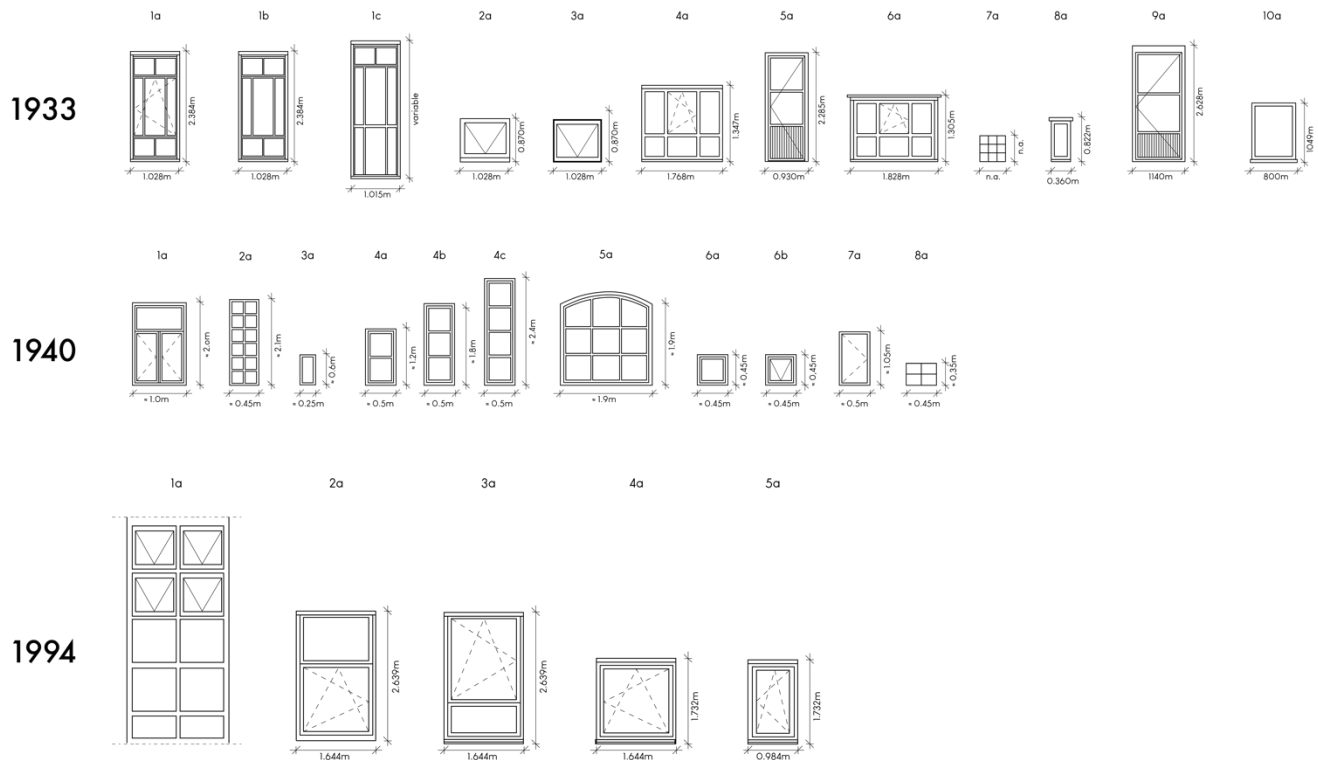


Figure 1: Window typologies Rotterdam Harbour Police (own work)

The 1994 building presents the least number of window typologies, in fact, it only has five. It can be noticed that, overall, the window openings present in the 1994 building present bigger measurements in comparison to the ones of the other two buildings. Apart from two glass walls, typology 1a (figure 2), it presents openable 'tilt and turn' aluminium windows. These can both be opened by rotating towards the inside or be tilted towards the inside. Aluminium window frames have been used both in the renovation of the 1933 and the 1994 building. This material started being used during the inter-war years together with non-ferrous metals such as bronze. Starting from 1950's aluminium became cheap enough to become widely used as material for windows (English Heritage, 2014). The aluminium frames of the 1933 building have a bronze-grey tint, whereas the 1994 building's ones have a dark grey tint.

All the windows present in the 1994 building present double glazing. During the period this building was built, double glazing had become largely used in any type of buildings due to its specifics and subsequent increment of thermal comfort and reduction of economic expenses (Forughian & Aiini, 2017). It is therefore not surprising that double glazing was chosen for all the windows. When looking at the glass transparency of the windows of the

1994 building it is noticeable that most of them are transparent. A small number of windows are present reflective glass.

The 1933 building presents a large variety of window typologies as can be seen in figure 2. As said, the windows have undergone a renovation in 1994 in which except for typology 7a and 8a have been renovated. The new windows present the original style. Overall, the 1933 building presents transparent windows. When looking at the opening typology of the 1933 building's windows, we encounter four typologies. Typologies 1b, 1c, 7a, 8a, 9a, 10a, which are present on the North and South façade, are fixed and cannot be opened. The most common typology is the 'tilt and turn' window present in typologies 1a, 4a, 6a. Another typology present in this building is the awning window (typology 2a, 3a), this window opens towards the outside and presents hinges on the top. Although the windows placed during the 1994 renovation follow the original style, it is not possible to know whether these have the same opening direction as the original ones.

The 1940 building presents a vast number of original window typologies (figure 2). All of them present single glazing, since double glazing was introduced in the market between the 1970's and 1980's. Typologies 1a and 7a present wooden frames, the remaining typologies all present steel frames. Most of the windows are fixed and are present on all floors (typologies 2a, 3a, 4a, 4b, 4c, 5a, 6a, 8a). The second most common typology is the casement window (typology 1a). This typology is only present on the first floor and consists of both parts being openable towards the inside. Another typology present is the awning window (6b). This typology opens towards the outside and has hinges on the top, these windows are present on both floors.

## **5. OPENNESS AND CLOSENESS APPLIED TO WINDOW TYPOLOGIES**

After having defined openness and closeness, these concepts have been applied to the analysed window typologies present in the Rotterdam Harbour Police station. This has been done by testing and quantifying whether and to what extent each window typology allows sight, hearing, smell, and touch. To do so, glass transparency, type of opening, and openable area of the window have been taken into account and analysed. Based on these characteristics each typology can score a maximum of 10/10 which equals to a 100% within that category. This result then has to be added to the results of the other senses' scores. Each category can score a maximum of 25%, allowing the end result ranging from 0 to 100% openness or closeness.

The 1933 building presents a vast number of typologies which are analysed in table 1. Typology 1a (figure 2) allows openness since it permits all senses since it contains transparent glazing and belongs to the 'tilt and turn' typology. On the contrary, typology 1b (figure 2) presents closeness since, although having the same style as typology 1a, it contains frosted glass and is fixed, therefore, it does not allow any senses and scores a 100% closeness. Typology 1c (figure 2), as for style, is identical to typologies 1a and 1b, but it contains transparent glazing allowing sight. However, since it is fixed, it does not allow any other sense, therefore, it has a 75% closeness.

Typology 2a (figure 2) is an awning window, therefore it can be partially opened allowing hearing, touch, and smell. Furthermore, it does allow sight since it contains transparent glass. However, due to the awning typology it scores does not score 10/10 in each category (table 1), therefore, it results having 85% openness. Typology 3a (figure 2) is very similar to typology 2a since it is an awning window with transparent glazing and scores 85% openness.

Typologies 4a and 6a (figure 2), although having different styles, all allow openness since they are all openable and present transparent glazing. Typologies 5a and 9a (figure 2) contain transparent glazing and a small aluminium part which does not allow sight. However, both typologies are openable and therefore score 95% openness (table 1).

Typology 7a (figure 2) is not openable and contains stained glass, not allowing sight, therefore it presents 100% closeness. Typologies 8a, 10a (figure 2) are fixed windows, therefore they do not allow hearing, smell, and touch, however they do allow sight since they contain transparent glazing. Therefore, they present a 75% closeness.

Most of the windows present in the 1933 building have a certain degree of openness. However, none of them present a 100% openness.

TYPOLOGY	SIGHT	HEARING	SMELL	TOUCH	OPENNESS/ CLOSENESS
1a	YES 10/10	YES 6/10	YES 6/10	YES 6/10	70% OPENNESS
1b	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS
1c	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS
2a	YES 10/10	YES 8/10	YES 8/10	YES 8/10	85% OPENNESS
3a	YES 10/10	YES 8/10	YES 8/10	YES 8/10	85% OPENNESS
4a	YES 10/10	YES 4/10	YES 4/10	YES 4/10	55% OPENNESS
5a	YES 8/10	YES 10/10	YES 10/10	YES 10/10	95% OPENNESS
6a	YES 10/10	YES 4/10	YES 4/10	YES 4/10	55% OPENNESS
7a	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS
8a	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS
9a	YES 8/10	YES 10/10	YES 10/10	YES 10/10	95% OPENNESS
10a	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS

Table 1: Openness and closeness 1933 building (own work)

The 1940 building, as well as the 1933 building, presents a vast number of window typologies which are analysed below (table 2). Typology 1a (figure 2) is a casement window which opens towards inside, it contains transparent glazing and allows therefore all senses. However, it presents a small part which is fixed. Therefore, the overall score is 85% openness. Typologies 2a, 3a, and 5a (figure 2) allow sight since these contain transparent glass but do not allow the other senses. Therefore, the overall score is 75% closeness. Typologies 4a, 4b and 4c contain frosted glazing and are fixed. Since they do not allow any sense, these typologies score 100% closeness. Typology 6a and 6b (figure 2) are very similar since both contain transparent glazing and have the same style, however, typology 6a is fixed and 6b is an awning window. Therefore, typology 6a scores 75% closeness and typology 6b scores 85% openness. Typology 7a (figure 2) is a casement window, is fully openable, and it contains transparent glass. Therefore, it scores 100% openness. Lastly, typology 8a (figure 2), does not allow sight since it contains frosted glass, furthermore, it does allow hearing, smell, and touch since it is a fixed typology. As a result, this typology has a 100% closeness.

The 1940 building presents a large number of window typologies with a high percentage of closeness (table 2). However, most of these windows do allow sight.

TYPOLOGY	SIGHT	HEARING	SMELL	TOUCH	OPENNESS/ CLOSENESS
1a	YES 10/10	YES 8/10	YES 8/10	YES 8/10	85% OPENNESS
2a	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS
3a	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS
4a	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS
4b	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS
4c	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS
5a	YES 10/10	NO 0/10	NO 0/10	NO 0/10	75% CLOSENESS
6a	YES 10/10	YES 0/10	YES 0/10	YES 0/10	75% CLOSENESS
6b	YES 10/10	YES 8/10	YES 8/10	YES 8/10	85% OPENNESS
7a	YES 10/10	YES 10/10	YES 10/10	YES 10/10	100% OPENNESS
8a	NO 0/10	NO 0/10	NO 0/10	NO 0/10	100% CLOSENESS

Table 2: Openness and closeness 1940 building (own work)

Regarding the 1994 building's window typologies five window typologies are analysed (table 3) Firstly, typology 1a (figure 2) allows sight since it has been observed that transparent glass has been used, it does partially permit hearing since it is made of mostly fixed glass parts and few openable parts. It does as well permit partial smell and touch. Therefore, this typology has scored a low percentage on the openness level, in fact, as can be seen in table 3 it scores 67,5% closeness.

Typology 2a, which can be seen in figure 2, is made of a small, fixed part and a 'tilt and turn' part, both parts present transparent glass. This typology allows sight and partial hearing, smell, touch due to the fixed part. Since the majority of the window is openable it scores a 77,5% openness. Typology 3a (figure 2) is similar to typology 2a, since it has a fixed part and a 'tilt and turn' part and contains transparent glass. In this case, the openable part is slightly bigger than in typology 2a. Therefore, this window has a higher percentage of openness, being 85% (table 3). Typologies 4a and 5a (figure 2), although having a different size, have scored a full 100% openness. They both belong to the 'tilt and turn' typology and contain transparent double glazing.

All the 1994-buildings' windows allow sight. The differences relate to the other senses. However, it can be said that, overall, these windows typology allow openness.

TYPOLOGY	SIGHT	HEARING	SMELL	TOUCH	OPENNESS/ CLOSENESS
1a	YES 10/10	YES 1/10	YES 1/10	YES 1/10	67,5 CLOSENESS
2a	YES 10/10	YES 7/10	YES 7/10	YES 7/10	77,5% OPENNESS
3a	YES 10/10	YES 8/10	YES 8/10	YES 8/10	85% OPENNESS
4a	YES 10/10	YES 10/10	YES 10/10	YES 10/10	100% OPENNESS
5a	YES 10/10	YES 10/10	YES 10/10	YES 10/10	100% OPENNESS

Table 3: Openness and closeness 1994 building (own work)

The analysis has concluded that the majority of the window typologies present in the 1933 building present a high percentage of openness, on the contrary, the majority of the window

typologies present in the 1940 have a high percentage of closeness. The 1994 building's window typologies present a high percentage of openness except for one.

The conducted analysis and its results refer to a single window without considering its dimensions and number within the Rotterdam Harbour Police. Within a design process, when to take decision about an existing window, these results alone are not enough. In fact, the analysis only quantifies the openness and closeness of a particular typology. Since dimensions and quantity have to be taken into account in order to take decision, the above results have been further used and applied to determine whether a window needs interventions (which can include transformation, restoration, replacement) or not. This has been done including, along the percentage of openness or closeness, the state of the frame material, the state of glazing and its typology, the originality of the window, and the suitability for a chosen new function.

## **6. CONCLUSION**

Within this research the concepts of openness and closeness in relation with human senses have been applied to window openings. It is a new approach to define how open or closed a window is, and how this can impact a building's façade. As previously said, this analysis alone is not enough to define this impact, neither it can be used in a larger design process and decision-making process. However, within the graduation studio *Revitalising 20<sup>th</sup> century Heritage* it has been very useful once it has been further developed by relating the results with other factors. This has allowed the creation of a 'design options palette' which can help architects choosing the best solution for a window which is need of an intervention within a renovation project.



## 7. BIBLIOGRAPHY

- Ayoub L., Koba Yashi H. (2001). *The concept of openness in the Architectural context*. Architectural Institute of Japan. Retrieved November 20, 2021, from: [https://www.jstage.jst.go.jp/article/aija/66/546/66\\_KJ00004226333/\\_pdf/-char/en](https://www.jstage.jst.go.jp/article/aija/66/546/66_KJ00004226333/_pdf/-char/en)
- Benko, M. (2010). *The 'closed/open' duality in contemporary urban form*. Open House International 35(3): 47-55
- Berkelbach, C., Devolder, A. M., & Damen, H. (1995). *Architectuur 1970–1995 Rotterdam*. Uitgeverij OIO.
- Cornn, M. (n.d.). *Le verre et la ville*. Revue Urbanisme, n. 162.
- Costanzo, M., & Hibelings, H. (2004). *Dutch touch: sulla seconda modernità in Olanda* (Ser. Percorsi = paths, 03). Kappa.
- Faroldi, E. (2020). *Public space and the contemporary city. A narrative of places, time, relationships*. TECHNE 19 (2020): The public space. DOI: <https://doi.org/10.13128/techne-8852> Published May 5, 2020
- Forughian, S. & Aiini, M. (2017). Comparative Study of Single-glazed and Double-glazed Windows in Terms of Energy Efficiency and Economic Expenses. Journal of History Culture and Art Research. 6. 879. 10.7596/taksad.v6i3.884.
- Hirst, E., Louw, H., Pearce, J. & Tutton, M. (2007). *Windows: History, Repair and Conservation*. Routledge.
- Jürgenhake, B. (2014). *The Facade – A Reflection on the Change of the Public Sphere. On the example of the mass housing in the Dutch cities of the 20th century*. Cloud-Cuckoo-Land, International Journal of Architectural Theory. Vol. 19, Issue 32, 2014. [cloud-cuckoo.net/fileadmin/hefte\\_](http://cloud-cuckoo.net/fileadmin/hefte_)
- Manneke, P. (1995). *Dienders te water*. Phoenix & Den Oudsten. P. 23, 47-49, 74, 85, 98, 109, 110
- Orvell, M., & Meikle, J. L. (2009). *Public space and the ideology of place in American culture* (Ser. Architecture, technology, culture, 3). Rodopi. Retrieved October 28, 2021, from <https://tudelft.on.worldcat.org/v2/search/detail/644525117?queryString=public%20space%20architecture&clusterResults=true&groupVariantRecords=false>
- Plummer, H. (2003). *Light in Japanese architecture*. A and U, Japan.
- Robilant, M. di, Maak, N., Koolhaas, R., Boom, I., & AMO Harvard Graduate School of Design. (2014). *Window* (Ser. Elements). Marsilio.
- Torres Bustamante, C. (2021). *Learning from the Nolli Map: Representing the Landscape through Figure-Ground*. Landscape Jrnl. vol. 39 no. 1 39-53.

## 8. IMAGE CAPTIONS

- Boss-19. (2015, December 28). Zeehavenpolitie Bureau Sint Jobsweg [Photograph]. <https://www.flickr.com/photos/boss-19/26163580841/sizes/h/>