Diagnostics and Monitoring the quality of Dutch Heritage

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Abstract. Over the last century, housing has been one of the major concerns of government intervention in the Netherlands. Especially after World War II, housing supply for a fast growing population came in the first place. Natural demographic growth, immigration from the former colonies and from the Mediterranean called for a response in the production of dwellings - for the major part in the public sector. In the 21th Century there has been an effective shift in policy. Nowadays, financial engagement of Government in Housing is reduced, which does not mean that all problems have been resolved. Present challenges for the Dutch historic cities are: the effects of climate change and increasing vacancy of properties which could be used for housing. Recently, various methods have been developed and implemented to diagnose and monitor the situation in these fields. The results of these analyses are applied in operational policies for Urban Renewal. This review of policies and instruments is structured in two sections, each of which focused on the diagnostics and monitoring of foundation problems and the vacancy of old buildings:
- The period since the 1970s, in which Urban Renewal shifted from physical interventions (mainly demolition and substitution) towards reuse and changes of use;
- The upcoming decades, until a planning horizon of 2050, when consequences of climate change (raising water level, draught) and the growing vacancy of utility buildings have to be tackled.

This paper highlights the importance of monitoring as a preparation for public interventions in historic cities over time [1].1

1 The author’s principal experience with diagnostics and monitoring for Urban Renewal and Transformation regard the City of Amsterdam (1980-1990) and the Ministry of Housing (2005-2015). At present, he works on Urban policies for Climate Adaptation at the Ministry of Internal Affairs. His comprehensive theoretical approach and case studies have been published in the book *Redevelopment by Tradition – Urban Renewal in World Heritage cities* (Kupka, Cluva Venezia, 2012).
1. Urban Renewal: monitoring decay in constructions
In the First years after World War II, in the Netherlands great effort was made on housing production and the reconstruction of Historic Cities. In 1953, in addition to this construction task, came the flood disaster with devastated great part of the province of Zeeland. Both building quality as the quality of sea dikes asked for more efficient monitoring and reconstruction of infrastructures.

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In the post-war years, the quality of life in historic city centres was under growing pressure. This could be verified by social indicators, such as the concentration of inhabitants with lower incomes, as by the disappearance of economic activities. These phenomena were both a cause as a consequence of the worsening quality of historic buildings. Since the 1970s, Urban Renewal - as a public intervention - followed the diagnosis of the building stock at the level of properties and single houses:

1. The priority of intervention units was based on a district-wise monitoring of the external conditions of the properties. This was a global and external inspection of the buildings;
2. The first step was the individualisation of run down, vacant or under-utilised buildings;
3. The diagnostics of adjacent properties was necessary to decide the extent of the project;
4. If there are doubts about the underground construction (wooden piles, as used between 1880 and 1945) posed doubts, these foundations had to be inspected by partial excavation;
5. If the quality of the building remains ambiguous, the owner can be given a period to repair his property, otherwise the property can be included in an expropriation procedure.

Deterioration of wooden foundations is a problem in many old districts of Dutch cities. According a rough estimate about 750,000 dwellings (approximately 10% of the total stock) in the Netherlands are built on a wooden pile foundation. The number of residential buildings with foundation problems has been estimated between 70,000 and 200,000. Deterioration of foundations has negative effects on the capacity of the building for its proper use. It can be verified in damages of the brick facades, distortion or decay of the construction.

De Lange summarises the causes and consequences of foundation damage as follows: “Wooden pile foundations with insufficient capacity and wood degradation due to fungi or bacteria. In case of carrying capacity problems the (draft) directive diagnosis describes a method to decide whether a foundation should be repaired or not based on the predicted future deformation of the building” [2]. Her thesis describes a draft directive method to calculate the residual capacity of the wooden piles in time. Based on this, one can assess the remaining life time of the construction and decide whether the foundation needs to be restored or not.

Analyses of the lifetime of wooden foundations has been applied as a diagnostic and monitoring method to decide the boundaries of urban renewal projects. Generally the reconstruction projects regarded new (social) housing between elder properties in good state in need of minor repair. De Lange’s directive is consistent with this practice. It allows the delimitation and the determination of partial foundation repair of properties: “The directive can be used to test whether a recommended recovery solution meets the damage criteria. The directive provides a technical solution for foundation problems within low-rise residential blocks. In practice, whether the recommended recovery unit will be realised, depend on the attitude and financial situation of the building owners and municipal policy” [2].

Over the period 1970-2000 these criteria guided the processes of Urban Renewal, together with the substitution and reuse of vacant properties.
1.1. Actual situation and perspectives
By the year 2000 the Housing Ministry made a national scan of foundation quality among municipalities regarding the data of local government Building Inspection offices. The properties resulting from these data are divided into 4 categories regarding their expected maintenance period and cost of repair:
- Category 1: 25 years and longer;
- Category 2: up to 25 years;
- Category 3: within 10 years due to foundation restoration;
- Category 4: within 5 years demolition and reconstruction.

The State provides subsidies to municipalities with a large stock of (old) properties in bad conditions. As there are more than 7 million houses of which roughly 10% are built on wooden piles in the Netherlands, accurate diagnostics are difficult, also because the foundation quality is affected by changing climate conditions. It is estimated that in the upcoming decades about 10% of these wooden pile foundations will need repair. Problems with this type of foundation are mainly caused by wood decaying fungi, bacterial degradation and insufficient load-bearing capacity. If no measures are taken to deal with these problems, houses will undergo unacceptable subsidence and become uninhabitable over time. Foundation repair is essential to prevent this happens.

Figure 1. Historic Dutch (canal) house with wooden pile foundation
Figure 2. Example of distortion because of foundation decay (Amsterdam Centre)
2. National Monitor of Vacant Properties
Since 1-1-2018 the National Vacancy Monitor is operative [3]. It consists of data from the Municipal Use Registers, the Register of Real Property, local taxes and building permits. All types of utility buildings are monitored and on the basis of this local authorities can incentive owners of vacant buildings to proceed towards transformation. The State provides some subsidies in this field, especially for buildings with Heritage Values. Municipalities can fine and ultimately occupy vacant properties according to the Housing Act (Wet Kraken en Leegstand). The monitor is based on 4 (municipal) data sets:
- BAG – Basis Registration of Uses for Locations and Buildings;
- WOZ – Value of the Properties for Taxation;
- BRP – Basis Registration for Persons (inhabitants at addresses);
- HR – Register of Commercial Activities.

Vacancy is recognised evident if there is neither an inhabitant (BRP), nor a registered used for taxation (WOZ), nor commercial activity registered. Vacancy shares vary in cities in and different parts of the country and by original use of the building:

| (original) use | Amsterdam | Haarl.meer | Nijmegen | Rotterdam | Netherlands |
|---------------|-----------|------------|----------|-----------|-------------|
| office        | 12        | 42         | 37       | 23        | 17          |
| industry      | 7         | 34         | 28       | 17        | 14          |
| shops         | 5         | 10         | 18       | 12        | 10          |
| public services | 5      | 7          | 25       | 7         | 8           |
| dwellings     | 0         | 2          | 3        | 4         | 3           |

2.1. Case: Vacancy of office space, 1991-2015 (PBL)
In the Netherlands, there is a surplus of office space. On the average, in 2015 more than 17% of office space was unoccupied and this percentage is still growing.

![Figure 3. Floor space and vacancy of office space.](image)

The office stock has gradually grown over the past two decades, just as the vacancy of other buildings, some with important heritage values like churches, barracks or farms. By the year 2000, growth of office vacancy accelerated as a result of the bursting of the internet bubble and the need for investors to look beyond shares and find alternative investment opportunities. PBL diagnosis: “The use of office space did not go hand in hand with stock developments. This led to higher vacancy rates. Since
2008, when the economic crisis set in, in 2015 vacancy rates have climbed to more than 17 percent. Other more structural factors also contribute to higher office space vacancy rates. This has led to a reduced demand for business and office space. Businesses and organisations have adopted more flexible working methods, which means that fewer square metres (m²) are required per individual worker. All these factors have contributed to an oversupply of office floor space. The largest volumes of office space are found in the Randstad region. More than half of total office space in the Netherlands is located in the provinces of North Holland (Great Amsterdam) and South Holland (Rotterdam-The Hague). The Randstad also has the highest vacancy rates, sometimes an excess of 20 percent. This is partly caused by the fact that many investors are active in this region, unlike in the peripheral regions where offices are often in the hands of owner-occupants. In addition to macro-economic, social, local and regional factors, geographical location and object characteristics are also important factors contributing to the attractiveness of office buildings. Within the office market of Amsterdam, for example, vacancy rates in the suburban regions are considerably higher than in the centre of Amsterdam” [4].

2.2. Transformation towards residential use
Over the past 10-15 years, a large area of new office space was added to the rental market. The amount of new additions was much higher than the amount of withdrawals due to demolition or renovation for other purposes. Since 2006 the State (Housing Ministry) facilitates transformation of empty utility buildings, especially towards residential functions. Several properties resulted to be adequate for student housing or hotels – especially in the larger cities. But also ‘standard’ dwellings have been accommodated in old factories, barracks etc. Compared to the pre-recession era, the total amount of m² annually added has been reduced to one fourth. Since 2013, more office premises are withdrawn from the stock than added, but as yet the vacancy rate is not falling because the use of office space is declining too rapidly. The Netherlands are facing a problem of vacant buildings. There have been studies focusing on vacant office buildings and the possible solutions for their reuse.
The transformation or reuse of buildings is gradually growing. Statistics reveal a number of about 6,000 new dwellings in all kinds of utility buildings in 2012 and over 8,000 dwellings in 2016. Especially in the big cities like Amsterdam or The Hague an active reuse policy has been followed by the municipality. This has been a good start and an inspiring example for other municipalities.

![Image](image_url)

**Figure 5.** Reuse as dwellings and ateliers of the former Philips factories in Eindhoven.

### 3. Climate Change: new challenges

Since the 1953 flood disaster (2,000 dead) onwards, Dutch government implemented large programmes for sea shore defence and inland water regulation. Since 2012, in view of expected developments in climate over the 21st Century, new policies have been developed. The Netherlands need to prepare for the consequences of the rising sea level, land subsidence and rising temperatures. This means looking further ahead and making effective plans for the long-term. It’s not only about the future, however. Currently, flood protection falls short in some areas. The government states to “is carry out a number of projects to remedy this. These projects are included in the annual Delta Programme.

In January 2016, when the Netherlands commemorated the floods that affected the Zuiderzee area 100 years ago. These and other flood disasters that have hit the Netherlands in the past underline the urgency of continuing the Delta Works. With the Delta Programme, we do so in a new fashion that is unique in history” [5].
Figure 6. Map of the Delta Plan on Spatial Adaptation, (urban) areas affected by flooding (red); shortage of water (orange); heat (yellow); possibility of soil subsidence (gray).

The Delta Programme 2018 is the first one to include monitoring instruments on Spatial Adaptation. This sets out how municipalities, district water boards, provinces, and the national government intend to expedite and intensify the spatial adaptation process. The Delta Plan contains seven points of ambition to this end. It indicates the goals pursued by the parties, how they intend to attain these goals, and how they will visualise the results.

“The core of the Delta Decision on Spatial Adaptation is to have the Netherlands designed in a climate-proof and water-resilient manner by 2050. The public authorities will ensure that damage ensuing from heat stress, water logging, drought, and urban flooding will be kept to a minimum. This aim will be taken into account in the construction of new residential areas and business parks, the renovation of the existing built environment, sewer replacements, and road maintenance. Climate scenarios will be used to that end” [6]. Also foundation repair and monitoring is a part of this strategy. Deltares estimated the cost of foundation repair at almost 50% of total cost to reach a “Climate Sustainable City” [7]. Therefore close collaboration of the authorities with the private sector and NGOs is essential. This will proceed in 3 steps:

- “Analysis”: analysing the impact of climate change for the various functions in an area in the period up to 2050 (looking ahead to 2100);
- “Ambition”: setting concrete goals for improving water-resilience and climate-proofing in the period up to 2050, and formulating a strategy to achieve these goals;
- “Action”: setting down the goals and the strategy in plans, legislation, regulations and programmes pertaining to implementation, management and maintenance [6].
The central government, municipal authorities, provinces and district water boards conduct an annual survey to gauge the progress made. The monitors, conducted in 2015 (benchmark), 2016 and 2017, have revealed that all the government authorities have set to work on the topics; the district water boards appear to have made the most headway. All the parties are aware of the impact of climate change in terms of waterlogging, flood risk management and drought. Heat stress appears to be of lesser concern. The interim evaluation conducted in 2017 has shown that acceleration and intensification of the strategy is essential. For that reason, the parties have drawn up the Delta Plan on Spatial Adaptation.

A standardised stress test will be compiled to assist municipalities, district water boards, provinces, and the national government in mapping out the vulnerabilities of their area. The knowledge portal also features the revised Climate Impact Atlas, enabling the quick visualisation of various climate effects (heat, waterlogging, and drought). The effects may also be combined with information on, e.g., vulnerable groups, swimming water, or depths. The Climate Impact Atlas constitutes a sound basis for a stress test. In addition, the portal comprises an overview of ongoing adaptation projects.

Dutch central government ensures that “national vital and vulnerable functions (energy supply, telecom and IT facilities, public network and emergency communication), the wastewater chain, the supply of drinking water, healthcare, pumping stations and sluices, road transport, chemical companies and laboratories will be more resistant to flooding by 2050 [6].

Figure 7. Conditions for “the Climate Sustainable City” (by Deltares, 2012)
Damage in billions of Euro’s (if no precautions are taken):
Caused by rain/floods: €29 mrd. Nett: €10 mrd
Damage in properties: Buildings (45); Infrastructure (12); public space (14)
Caused by draught: €42 mrd. Nett: €12 (of which ca. 50% on foundations)

4. Local initiatives
An example of local elaboration is presented by the Climate Change Adaptation Plan of Rotterdam [8]. This municipal plan combines resilience and urban regeneration, it manipulates and reshapes the ground of the town, merging into a single network of urban spaces and hydraulic works into a desired landscape.

De Cristina and Massa compare the goals of the Rotterdam plan -controlling and slowing down floods by turning urban ground into a “sponge”- with those of the Venetian Republic as this “had done in the lagoon- pursued by adjusting the different types of urban fabric. Extended cross sections show the flow of water, through underground channels and surface paths, and its relationships with infrastructure, public spaces and building types. In order to distribute the costs of the actions, among the national government, public local institutions, businesses and private individuals, this strategy involves economic cooperation, and therefore encourages active social participation on vital targets recognized by all social subjects. The result of these actions are particular, hybrid and multipurpose, public spaces that did exist in old town but were almost forgotten in functional planning: squares that are flooded and become urban pools for a while; walking and cycling routes on the raised banks of rivers and waterways; flooding parks and gardens to be used as retention basins” [9]

Other Dutch authorities take action at a small scale. In 2018 the province of Brabant (2 million inhabitants) disposed of a subsidy budget of € 1,6 mln for (some 100) schools in order to convert (stone) school squares in green and water absorbing surfaces. Provincial government sees this – which is beside a climate measure – as a possible effect on education, reducing aggression among children.

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