



## Reducing heat stress at Middelburg bus station

### Summary

- The bus station is next to the Middelburg train station and is a built-up area with no greenery.
- This causes heat stress when high temperatures occur increasing a risk to the health and wellbeing of users some of whom will be waiting for transport.
- Adding a green wall and green roof will reduce heat stress in this location as well as contributing to the City's Climate Resilience Strategy



## Location

Middelburg is a municipality in the province of Zeeland, the Netherlands. It covers an area of about 53 km<sup>2</sup> and has a population of 48,964 people living in about 23,233 households located in three residential areas. Middelburg is a historical and cultural city which attracts a lot of tourists. The city centre and older neighbourhoods consist of mainly paved areas and do not have lot of green features. This may increase the heat stress experienced when high temperatures occur, particularly for the vulnerable elderly people and children.

## Site Description

The centre of Middelburg, the main shopping area, is only a few minutes' walk from the train and bus stations, so it is easily accessible by public transport. The University of Applied Sciences HZ and the University College Roosenveld are both located in the centre of Middelburg, about 10 minutes' walk from the train station and it is well used by students. The train and bus station areas are mainly paved with little greenery. This may cause heat stress for residents, students and tourists who make use of the public transport especially in hot weather in the summer; there are only few places where there is shade. The bus station is a relatively small location between the road (Kanaalweg), the train tracks and the train station. This location and the surrounding area are composed of hard surfaces with relatively dark coloured pavement. The train station has dark facades and roof. The dark pavement absorbs and holds onto the heat for a long period of time and this, with the busses that stop and start every 5-10 minutes, contribute to heat stress.

## The decision-making journey

The municipality of Middelburg wants to make the Stationplein and Kanaalweg areas more attractive make being there a more pleasant experience. The project at Kanaalweg also involves student housing developments, bike sheds, taxi parking and meeting places. Road safety needs to be improved to create a safe environment for students. Currently, the Kanaalweg and Stationsplein are largely built up of asphalt and concrete bricks, which negatively impacts the temperature of the city. The decision-making process is integrated with the urban planning and traffic engineering program that contributes to reducing heat stress while improving livability on the Kanaalweg and the Station

## Stakeholders involved:

- The Municipality responsible for maintenance of the green infrastructure and for involving others
- Owners of office buildings: construction of green facades and roofs
- Entrepreneurs: who see the positive impact of a green environment for their company, so contribute to greening of their own premises and working area.
- Residents/owners: clean up leaves, greening of their own house and yard.
- Students: help with the maintenance in exchange for a beautiful green environment
- NS and Connexion (the bus and train companies have policies that new construction is 'green' wherever possible. Use water from a commercial perspective. Improve facilities of the station
- Water Board: guarantee water quality, input of expertise
- Province: enable initiative and coordination shipping

## Implementation

The first step was to install a green, sedum, roof on the bus stop. The second intervention, on a small office right next to the bus stops was to install green walls with textile pockets for the plants. The third intervention is a water feature. This was commissioned by an alderman and attracted interest from the press and regional broadcasting. The installation process may have caused some inconvenience to residents and bus station users, but overall, the process went smoothly, with no problems

encountered. A timer has been placed on the water pump so that the bus drivers are not bothered by the noise of the pump during the day.

### Lesson learnt

- It is a labour intensive process to come to a successful intervention. Always unexpected things happen. **Start in time.**
- An independent body/ organization (such as local- or regional authority ) have to facilitate the process to come to a decision what intervention will be realized.
- Involve the stakeholders in the design. > creates support for the final design.
- Involve as much as possible young people and children in the realization of the pilots.
- Explain the added value and extra benefits for the different target groups/stakeholders. Make clear what is in it for them.
- A good participation process /decision-making –process gives great satisfaction, support and a sense of ownership of the design by inhabitants and other stakeholders. Continuity guaranteed.
- Not all colleagues are yet aware of the importance of preventing heat stress. Involve as much as possible the other colleagues in the implementation of the interventions at an early stage so that they also become enthusiastic.
- It is an integrated process.
- Gives insight into the future management and maintenance costs.

**Indicative costs:** please note that costs have been rounded and, while accurate at the time of implementation, can only be used as an indication of cost.

Capital Cost	€	£= 1.16€
<b>Green roof:</b>		
Green roof installation	11,700	10,118
Irrigation unit	1,100	951
<b>Total</b>	<b>12,800</b>	<b>11,069</b>
<b>Green Wall:</b>		
GTS-FR textile composite	5,200	4,496
Aluminum structure	5,600	4,843
Fertigation unit (to deliver water and liquid fertilizer)	2,600	2,249
Fertigation box container	1,825	1,578
Installation of the plant façade by CPC (100/m2)	4,000	3,460
SMS notification system (to alert if any fault)	420	363
Planting medium (DAKTUINSUBSTRAAT INTENSIEF)	Barely used	
Plants ( <i>Carex morrowii</i> ; <i>Geranium macrorrhizum</i> ; <i>Heuchera 'Palace Purple'</i> ; <i>Anemone honorine jobert</i> ; <i>Galium odoratum</i> ; <i>Sedum herbstfreude</i> ; <i>Pennisetum 'Little Bunn'</i> ; <i>Lythrum salicaria</i> ; <i>Hakonecloa marca</i> ; <i>Liriope muscari</i> ; <i>Helleboris niger</i> )	1700	1,470
<b>Total</b>	<b>19,645</b>	<b>16,989</b>
<b>Water feature for green roof and wall</b>		
Delivery	1,572	1,359
Installation of plate glass	1,100	951
Installation of water feature by Hydroblobs	1,250	1,081
<b>Total</b>	<b>3,922</b>	<b>3,390</b>

Total Maintenance Costs Green Roof and Green wall ( annual)	€	£
maintenance plants (cutting /replace)	350	303
Water and electricity	150	130
Total ( annual )	500	432
<b>Total</b>	10,000	8,650

Concerns raised during the public consultation	Reactions after completion
<ul style="list-style-type: none"> <li>Heat stress is no priority ... - ... relative to other societal &amp; infrastructure needs (incl. the acute Covid-crisis) –</li> <li>We have to identify and focus on</li> <li>locations where a health impact has been observed (= elderly &amp; children)</li> <li>Working towards implementation requires feedback from many different angles (installer, green service, CT partner, legislator, stakeholders, inhabitants, users)</li> <li>All parties should be identified for each intervention.</li> <li>Participation - Multitude of partners, decision makers, providers, and stakeholders, users, inhabitants each have their own priorities.</li> <li>The large number of involved parties may lead to a long &amp; complex decision-making process... but trivial considerations &amp; too many opinions from stakeholders may nip initiatives in the bud</li> <li>The occurrence, the frequency, and the impact of vandalism is to be determined.</li> </ul>	<ul style="list-style-type: none"> <li>In general, we received positive reaction after the completion, such as:</li> <li>“great initiative” and</li> <li>“looks very nice”,</li> <li>“we would hope to see more of these implementations”.</li> </ul>

MEASURE OF SUCCESS	EVIDENCE
Reduction of PET value (baseline vs result values, comparison with reference point)	Green wall: 6.33 °C London Plane tree 15.7°C
Size of the area (m <sup>2</sup> ) with improved heat resilience (the <b>total area that benefits from the measures approximate this by using the same approach used for the initial estimation in the application form</b> )	Green wall/green roof: about 20-30 m <sup>2</sup> This is part of a bigger greening effort in the Stationplein/Kanaalweg area, adding a total of 4.800m <sup>2</sup> of green, plants and trees.
Number of daily users benefitting from the intervention (if relevant/available: are there specific times of day or the year when there is heavy use?)	There are about 4666 passengers per day at the station. During arrival and departure of trains and busses, the area is heavy used (all year long).
Co-benefits achieved (e.g. biodiversity, pollution reduction, economic benefits, influence on property value, long-term savings, aesthetic improvement, psychological impact etc.)	Biodiversity, pollution reduction, aesthetic improvement, psychological impact.

### Signposting for further information

<https://www.middelburg.nl/cool-towns> and <https://allecijfers.nl/gemeente/middelburg/>