

# **DESIGNING FOR CITIES THAT LIVE**

**Title**

Designing for cities that live – a design strategy on urban heatwaves for the Red Cross

**Author**

Noemi Fabiola Fuentes Flores

4929284

**Project**

Master graduation project  
September 2020, Delft

**Programme**

MSc Strategic Product Design  
Faculty of Industrial Design Engineering  
Delft University of Technology

**Chair**

Dr. Rebecca Price

**Mentor**

Prof. ir. Jeroen van Erp

**Partnering Organisation Mentor**

Michel Becks, Humanitarian Innovation Lead  
Red Cross Netherlands



# Gratitude

I'd like to thank every single person that was part of this project, without your help this would not exist. To everyone I interviewed, got feedback from, pitched an idea or who called to ask how was I doing.

To Rebecca, thank you for being beyond a chair or teacher to me. Meeting you is one of my greatest finds in Delft. I kindly thank you for everything. You are a role model.

To Jeroen for always pushing me to go further, for confusing me and for always making me laugh.

To Michel for our long Wednesday chats, for you guidance and confidence in me through this whole project.

To the friends I met in the masters and helped me through this journey, I'm thankful for you all (Specially my J+).

To my family and friends back in Mexico, thank you for your love and cariño. I think about you constantly, even when I am this far.

To Johan for being with me from beginning to end, for your input, feedback, enthusiasm and for always listening to me. You are amazing.

To my mother. You are my rock, I could've never done this without you, thank you for your infinite support, I am the luckiest person for I got the worlds greatest mom.

And finally to you, Pepe, my dear friend. I wanted to quit, and the only thought that kept me going was that this would make you proud. I love you.

# Summary

Temperatures in the planet are rising, our cities are not designed for extreme weather and that makes urban heatwaves a deathly hazard. The Red Cross, an organisation who's vision prevents and alleviates human suffering partnered with the TU Delft for a strategic design approach to find solutions for this wicked problem. This project explores the collaboration of the humanitarian sector in the urban environment. Cities are alive and they can offer space for innovation and experimentation. This master thesis is the result of a highly collaborative process, in which experts from different disciplines were interviewed, a thermal image study was performed in the cities of Delft, Amsterdam and Utrecht and literature review was executed. After collecting data, design directions began to arise. Heatwaves are invisible, people are not aware of the risks, the vulnerable groups are varied and vegetation can help bring the temperatures down. The result of this twenty weeks of work is a three step strategy to be followed by the Netherlands Red Cross. See, Share and Solve.

1. See the heat. Urban heatwaves are dangerous because they are invisible
2. Share the data. Show people how hot it can really get, also share solutions
3. Solve the problem. A call to action, connect citizens and volunteers with organisations that are working with vegetation in the city.

To share the data physical structures are proposed, cooling stations. By placing cooling stations in the city, the Red Cross can offer a temporary solution by providing shadow to the citizens but can also share information with citizens on how to cool down themselves, their homes and their neighbourhoods. Together with the Red Cross volunteers, neighbours can get involved in activities to bring vegetation on to the city in order to lower the temperatures and at the same time build strong communities with those who live next door.

1. INTRODUCTION
  - 1.1 Urban heatwaves
  - 1.2 Red Cross
  - 1.3 Methodology
2. LITERATURE REVIEW AND BEST PRACTICES STUDY
- 2.1 HEAT
  - 2.1a Extreme heat
  - 2.1b A major health risk
  - 2.1c Vulnerability
  - 2.1d Urban Heat Island Effect
  - 2.1e Heat effect's mitigation
- 2.2 BUILT ENVIRONMENT
  - 2.2a Cities that live
  - 2.2b Urban concepts
- 2.3 BEST PRACTICES
  - 2.3a Data and awareness
  - 2.3b City features vs heat
  - 2.3c Architecture
3. EXPERT INTERVIEWS
  - 3.1 Red Cross
  - 3.2 Built environment and architecture
  - 3.3 Greening practices
  - 3.4 User interviews
4. THERMAL STUDY
  - 4.1 Study set-up
  - 4.2 Insights
  - 4.3 Conclusions
5. DESIGN DIRECTION
  - 5.1 Red Cross assets
  - 5.2 How to cool down
  - 5.3 Problem re-framing
  - 5.4 Co-creation with greening practices
  - 5.5 Lessons from a pandemic
6. DESIGN STRATEGY CONCEPT
  - 6.1 See, share, solve
  - 6.2 SEE - Thermal imaging in the city
  - 6.3 SHARE - Cooling stations
    - 6.3a Design principles
    - 6.3b A cooling station for The Netherlands
    - 6.3c Architecture competition
  - 6.4 SOLVE- Greening the city
  - 6.5 A one year implementation plan
7. EVALUATION AND DISCUSSION
8. CONCLUSION AND RECOMMENDATIONS

# CHAPTER ONE

## **INTRODUCTION**

### **HEATWAVES & RED CROSS**

### **AS A STRATEGIC PARTNER**

# 1. INTRODUCTION

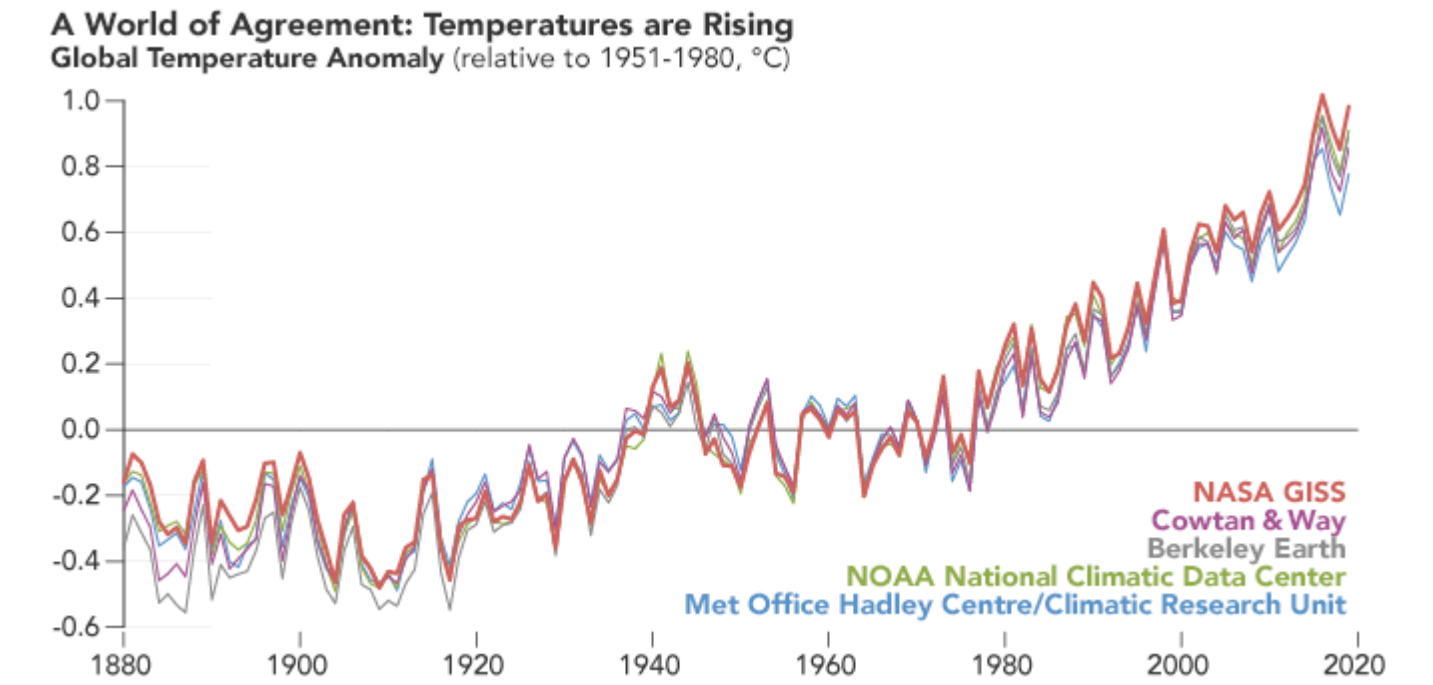
## 1.1 URBAN HEATWAVES

The world is facing an emergency, one related to climate. Through the past years we have seen temperatures raising, only in the last 20 years, 19 of the warmest years have occurred since 2001 (NASA GCC, 2020). The increased frequency, duration and intensity of heatwaves is one of the impacts that climate change has brought with it. (Comou & Robinson, 2013). Heatwaves impact livelihoods, health, infrastructure, nature and economy and it is expected that 420 million people will be exposed to extreme heat as established by the Intergovernmental Panel on Climate Change in the special report Global Warming of 1.5°C (IPCC, 2018).

NASA’s scientists at Goddard Institute for Space Studies conducted a study that showed the average global temperature on earth increased 1°C since 1800 and that two thirds of the warming has occurred since 1975 (Hansen et al., 2006).

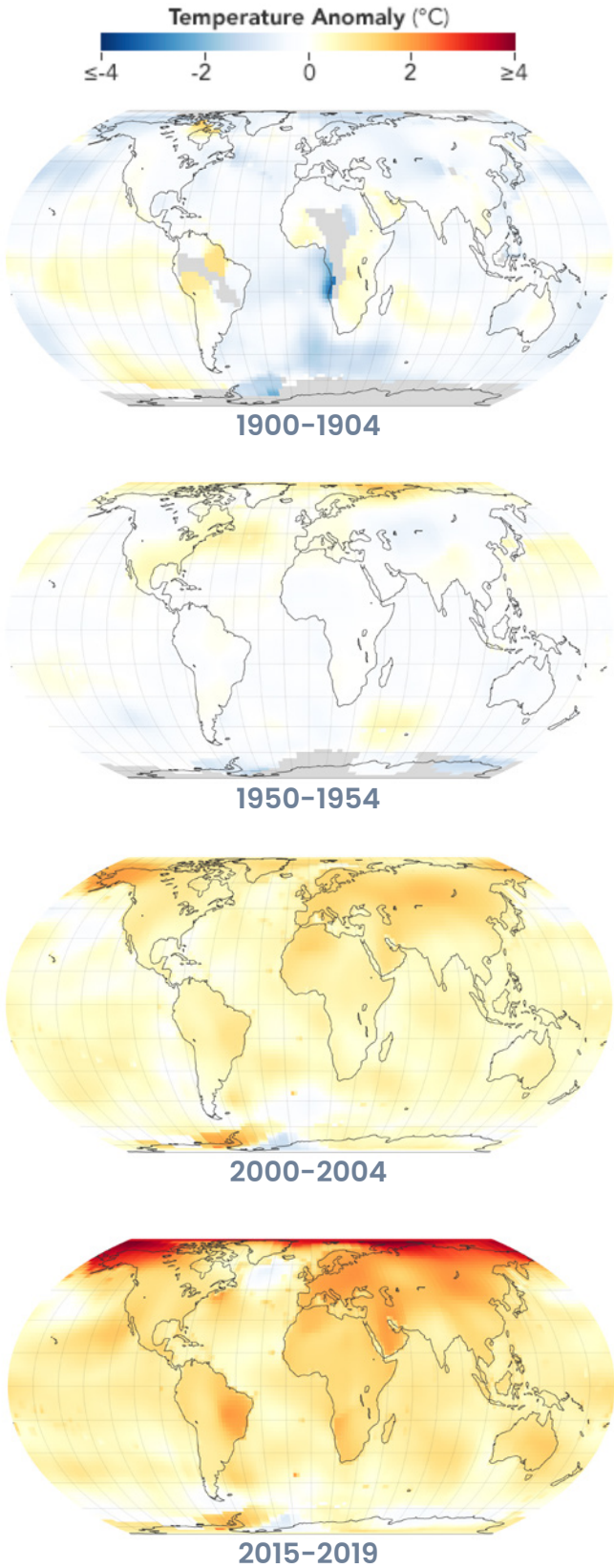
The global temperature is an average of the full planet surface and depends on the energy that planet receives from the sun and how much it radiates back to space (NASA earth observatory, 2020). This makes 1°C global change a significant increase since it takes a big amount of heat to warm up all the oceans, land and atmosphere. A five degree drop buried in a mass of ice a big part of North America 20,000 years ago (NASA earth observatory, 2020).

Urban heatwaves are deadly and increasing, every year lives of the elderly, children and people with chronic health conditions are affected or taken away by this weather phenomena. Currently 30% of the world’s populations is exposed to extreme conditions and it is expected that by 2100 the 30% will become 48% in a greenhouse gas emission scenario and 78% in a growing emissions scenario (Flouris et al., 2018).



Yearly temperature anomalies from 1880 to 2019 recorded by NASA, Cowtan & Way, the Berkeley Earth research group, NOAA and the Met Office Hadley Centre. With minor differences, they all show rapid warming in the past decades.  
IMAGE: NASA earth observatory

Temperature anomalies 1900–2019



IMAGES: NASA

5 billion people live in areas in which heatwaves can be forecasted (Singh et al., 2019), this allows for early action to protect the lives of the most vulnerable. In 2003 the European heatwave killed more than 70,000 people (Robine et al., 2008) and it is possible that this number under-represents the actual victims since deaths from heatwaves are not usually registered, they are attributed to illnesses which were made worse by heat, heart disease is an example (Singh et al., 2019).

Cities face higher temperatures due to the Urban Heat Island effect (Bornstein, 1968). Urban resilience and social infrastructure are necessary, they can provide adaptation to new climate conditions by mitigating heat exposure and at the same time build strong communities to ensure citizens wellbeing (Sim, 2019) The world’s population is expected to have two thirds of it living in cities by 2050 (UN, 2018). Rapid urbanisation and the increase of urban heatwaves call for a solution exploration in a city level. How might we reduce the effects of urban heatwaves?

**“Cities are in the front lines of this public health emergency and are thus crucial in the leading of the fight to prevent unnecessary deaths from heat”**

– Francisco Rocca 2019



# 1.2 THE RED CROSS

## International Federation of Red Cross and Red Crescent Societies

The Red Cross is a non-profit organisation who’s vision is to prevent and alleviate human suffering. They are an organisation that contributes to the maintenance and promotion of human dignity.

The International Federation of Red Cross and Red Crescent Societies is the world biggest humanitarian network with 192 National Societies and more than 13 million volunteers. (IFRC 2020)

They act before, during and after disasters and health emergencies to improve the lives of vulnerable people. Currently, the organisation is following Strategy 2020, an action plan to tackle the challenges of these times. They established a commitment in the fast evolving environment to save lives and change minds. In their strategic aims for 2020 building on established service strengths to prevent and reduce the underlying causes of vulnerability is also highlighted (IFRC 2020 Strategy, 2010).



IMAGE: RODE KRUIS

### Strategy 2030

Looking towards the future, in their 2030 strategy, the IFRC recognises more complex problems that are a threat for humanity and people’s liveability, climate change being one of them. The IFRC is a network of independent but connected organisations, the new strategy in addition, tries to transform into a distributed network, in which the different organisations can collaborate more effectively.

### The Netherlands Red Cross

The mission of the Netherlands Red Cross is to protect lives and health to prevent and alleviate human suffering worldwide while ensuring respect for humanity. The Netherlands Kingdom includes the Caribbean territories and they work with communities vulnerable to and affected by disasters. Their purpose is to enable the federation partners to fulfil their common mission, through a people centred approach (Strategy 2030 NLRC-IH, 2019).

The Red Cross acknowledges there is more to humanitarianism than just giving people support to survive and recover from crises. The new strategy aims to go “beyond resilience” to ensure communities can thrive. (IFRC 2030 strategy, 2018)

Governments and municipalities can aim for climate-resilient cities, but they cannot do it alone (Colenbrander et al., 2019). The Red Cross role as analysers of disaster effects and consultants of government and local municipalities on how to be ready for future disasters makes this combination a good match for collaboration.

Urban heatwaves are a threat for human livelihoods, this project looks for solutions to mitigate the effects this phenomenon.

The problem at the heart of this project is defined as:

**How can strategic design empower the Red Cross to act upon the wicked problem of urban heatwaves?**

### 2030 Strategy Goals

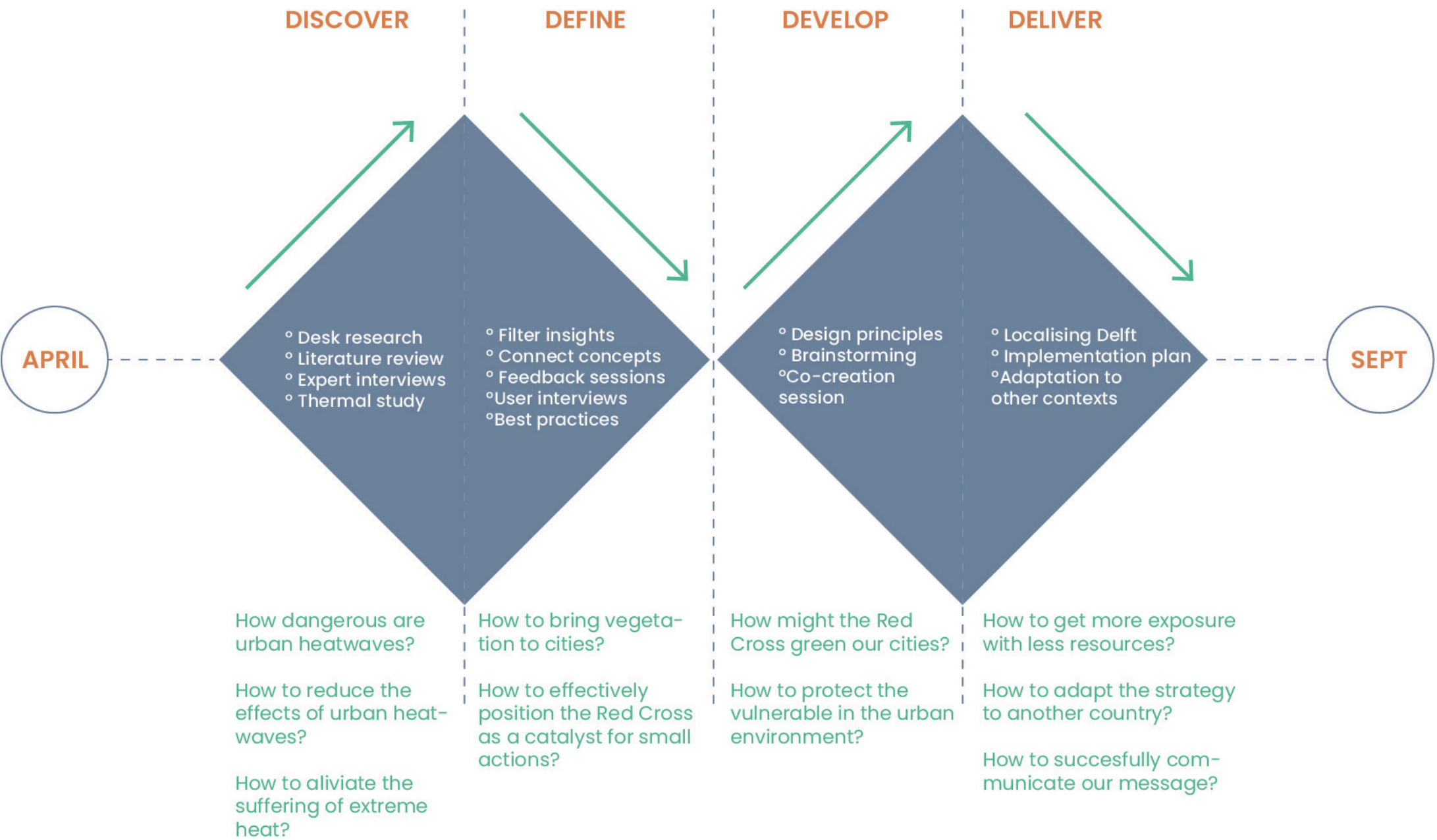
- GOAL 1:** PEOPLE ANTICIPATE, RESPOND TO AND QUICKLY RECOVER FROM CRISES
- GOAL 2:** PEOPLE LEAD SAFE, HEALTHY AND DIGNIFIED LIVES, AND HAVE OPPORTUNITIES TO THRIVE
- GOAL 3:** PEOPLE MOBILISE FOR INCLUSIVE AND PEACEFUL COMMUNITIES



# 1.3 METHODOLOGY

## International Federation of Red Cross and Red Crescent Societies

This 20 week project followed a four phased process inspired in the double diamond method. The general strategy was to converge and diverge during the process in order to collect data through literature and interviews to further design a concept to test and iterate on. It is important to mention that some modifications had to be made in order to respond to the current world's situation. A global pandemic. This limited the testing phase but some alternatives were implemented.



### Discover

This phase began with three landscapes for exploration: The Red Cross, the built environment and heatwaves as a weather phenomenon. During this stage desk research was the first approach to fully understand the three landscapes. Expert interviews followed the research, architects, urbanists, climate experts, design strategists were some of the interviewees. Finally a thermal study was carried through with a thermal camera around the cities of Delft, Amsterdam and Utrecht. In this explorative stage it was possible to collect relevant data for the project to stir in a certain direction.

### Define

After collecting data through different channels, information had to be filtered and carefully distilled. Connections between the three different landscapes were made and together with best practice studies and feedback sessions it was possible to achieve a more specific problem definition. User interviews were carried out to get a grasp of user perspective. At this stage of the project, a user was anyone who had experienced an Urban Heatwave.

### Develop

With a clear problem in mind, the third stage began, design principles were defined and brainstorming generated ideas for a concept to be implemented. A co-creation session was organised together with start-ups and urban experts to iterate and explore the concepts. After the session there was a need to go back to the definition phase and make some adjustments.

### Deliver

The last stage of the project includes a closer zoom into the strategy proposed, localising the design to Delft and a proposal for future implementation in different contexts is suggested. An implementation plan is delivered for the organisation to take the first steps in a one year plan.

During the whole process experts, peers and professionals were consulted for iteration and validation. This design is the result of a highly collaborative process, connecting different disciplines and nationalities.

# CHAPTER TWO

## **LITERATURE REVIEW AND BEST PRACTICES**



# 2. LITERATURE REVIEW & BEST PRACTICES

## 2.1 HEAT

### 2.1A EXTREME HEAT

Extreme temperatures have catastrophic consequences, over the last decades many lives have been lost due to these types of natural events. Extreme heat is a risk to health but also to infrastructure and wellbeing (Singh et al., 2019). One form of extreme heat is a heat-wave, which is a period of time where temperatures are unusually high.

The last years there has been an increment in heatwaves around the world which have affected ecosystems and society (WMO, 2011). The duration and intensity of heatwaves has increased due to Climate Change (Comou et al., 2013) and it will also lead to the intensification of chronic heat exposure for weeks or months (Curran et. al, 2019). Understanding temperature extremes can help develop strategies for the risk management of such a phenomena (McGregor, 2017).

### 2.1B A MAYOR HEALTH RISK

Heat stress is the main cause of weather-related death. The United States Environmental Protection Agency estimates that heat exposure has caused more deaths than hurricanes, lightning, tornadoes, floods and earthquakes together (Voiland, 2010). During the 2003 Europe heatwave 70,000 people lost their lives (GHHIN, 2017), but being exposed to extreme heat also leads to dehydration, heat exhaustion, heat strokes and loss of consciousness (Singh et al., 2019).

Heatwaves also increase pre-existing conditions like heart disease or respiratory illnesses that can have deadly consequences. Extreme heat can be a dangerous weather condition because of its invisible ability it becomes an under-appreciated risk (Singh et al., 2019).

The main causes of death and illness during a heatwave are from pre-existing respiratory and heart-related diseases (Singh et al., 2019) that heat aggravates. Heat can also worsen chronic lung conditions, kidney disorders and mental illness.

In addition to pre-existing conditions, there are heat-related illnesses, these include: Heat cramps, Heat rash, Heat oedema, Heat syncope, Heat exhaustion and Heat stroke. For a more detailed description of the illnesses see Appendix.

### 2.1C VULNERABILITY

The Global Heat Health Information Network lists the most vulnerable people that can suffer from health hazards due to extreme heat. They are the following:

- Children
- Elderly
- Outdoor workers
- Athletes and attendees of outdoor events
- People with disabilities and health conditions
- The poor, displaced and homeless

The Heatwave guide for cities from the Red Cross Red Crescent Climate Centre adds to the vulnerability list the following groups:

- The socially isolated
- Pregnant and lactating women
- Individuals with low socio-economic status
  - Overweight individuals
- Individuals unable to read and non-native language speakers
  - Tourists
  - Animals/pets

## VULNERABLE POPULATION

## RISK FACTORS

Adults over 65	Less aware and adaptable to extreme heat
Individuals with chronic medical conditions	These include heart disease, lung and kidney conditions and mental illness. Those taking medications that can worsen the impact of extreme heat are especially vulnerable
Children under five years old	Sensitive to the effects of extreme heat and must rely on others to keep them cool and hydrated
Women and girls	May not have access to a variety of media, sleep in ill ventilated rooms, lack private bathing space, especially during menstruation.
Pregnant and lactating women	Pregnant women are more likely to go into early labour in the week following a heatwave. This risk goes up with more consecutive days of extreme heat. <sup>18</sup> Lactating women require more drinking water as breastfeeding is extremely dehydrating
Outdoor workers (inlc. traffic police and security guards)	Often engaged in strenuous labour while directly exposed to sunlight as well as heat and air pollution. More likely to become dehydrated and suffer from heat-related illness.
People living alone	May not access help quickly
Individuals with disabilities	May not be able to access help quickly
Overweight and obese individuals	May be more sensitive to extreme heat and have difficulty thermoregulating
Individuals of low socio-economic status	May not have access to clean drinking water and other cooling measures. May not be able to access information about heatwaves and cooling centres
Migrants and refugees	May not have access to current information about heat advisories and health risks, or may experience heat conditions that are different to their place of origin
Homeless people	May not receive warning messages, may be unaware of cooling centres and may have limited access to other cooling measures (e.g. cool showers or baths)
Individuals unable to read and non-native language speakers	Cannot read current information about heat advisories and health risks. Non-native language speakers also may not be able to understand advisories broadcast on TV and radio.
Tourists	May not be able to understand advisories in local languages. May not know how to access cooling centres, green spaces or other resources, including emergency management systems. May be from cooler climates and less adapted to the heat.
Animals/pets	Dependent on owner for adequate protection from heat

Vulnerable population and risk factors (Singh et al., 2019) Image: Heatwave Guide for Cities. Red Cross Red Crescent Climate Centre

“Reducing vulnerability to meteorological extremes should be an essential part of the complex adaptation to climate change” -WMO 2011.

Different groups are at risk of this climate hazard, the table above shows the vulnerable groups and the risk factors. Demographic trends and changes are crucial to consider for the development of an action plan to reduce the impact of heatwaves on human health (Singh et al., 2019).

## 2.1D URBAN HEAT ISLAND EFFECT (UHI)

Cities face higher temperatures due to the Urban Heat Island effect (Bornstein, 1968). The vulnerability of cities increases not only because of higher temperatures, but this increase can raise the intensity and durations of heatwaves within them (Tan et al., 2010).

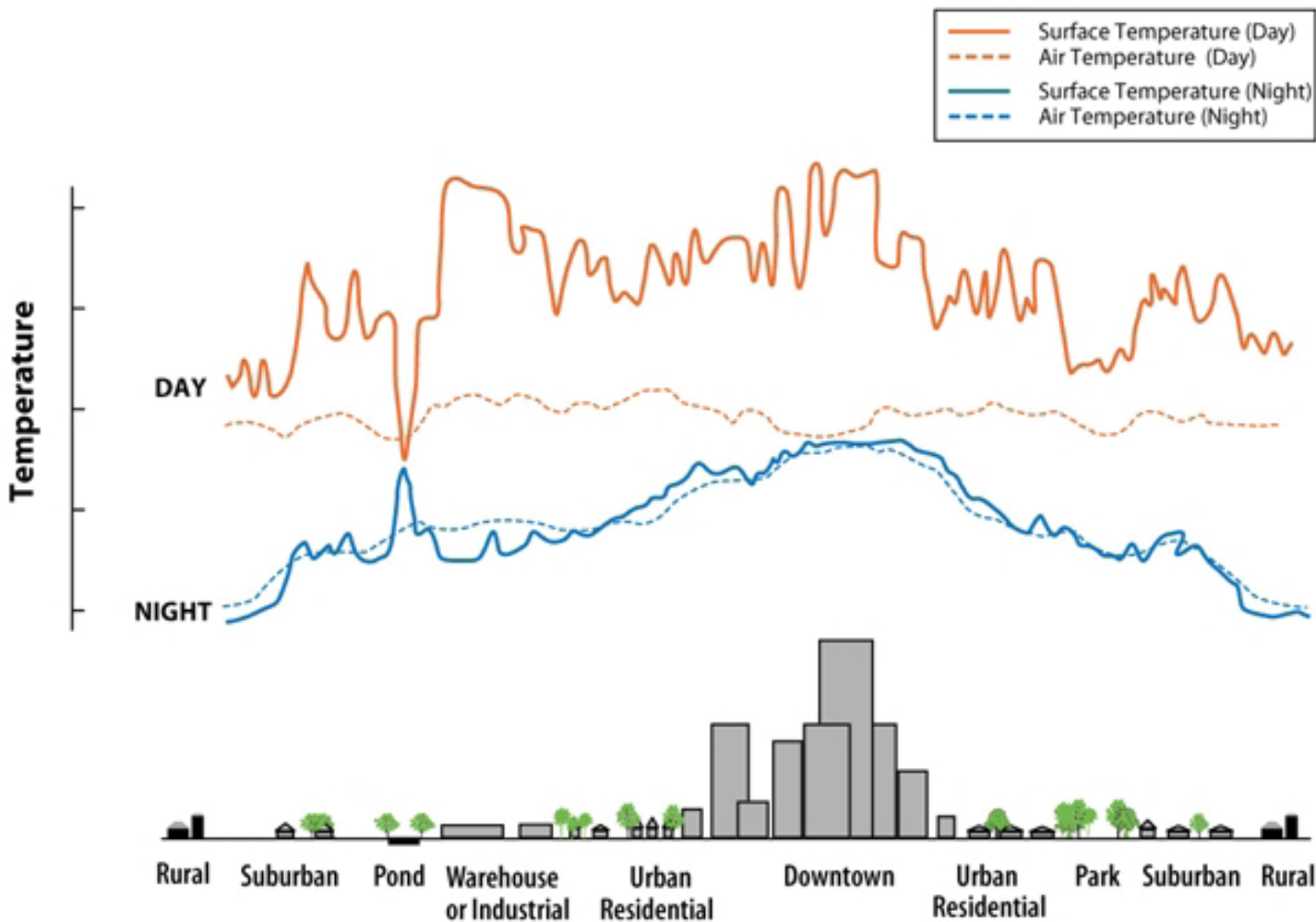
It is expected by 2050 to have one third of the world population living in cities (REF) it is predicted that up to one third of the world's population will be likely to live in unsuitably hot environment for humans (Fountain, 2020).

An urban heat island develops when the city experiences warmer temperatures than the surrounding rural areas. The difference in temperature is a consequence of how surfaces in each setting absorb and reflect heat (NASA Climate, 2020). Cities are composed of buildings, roads and pavements that make urban areas absorb and retain heat, in addition there is heat generated by cars, factories and pollution, which also contributes to the development of the UHI effect (Voiland, 2010).

Heat in cities is particularly dangerous at night, it is during the night that surfaces can cool down while there is no direct sun exposure. During periods of extreme heat, hard surfaces absorb a vast amount of heat and it is not enough time during the night to release it and completely cool down. In addition the release of this heat stays in the surroundings keeping high temperatures in the built environment (Worland, 2016). Similarly to surfaces, human bodies need to rest from the heat, with hotter nights the cooling down process is postponed causing over heating and discomfort.

The current rapid urbanisation trend, expecting to have two thirds of it living in cities by 2050 (UN, 2018) and the increase of urban heatwaves due to the increase of temperatures call for a solution exploration in a city level.

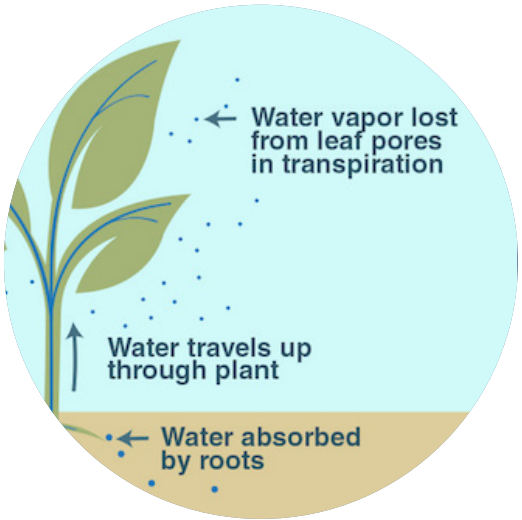
**How might we reduce the effects of urban heatwaves in the built environment?**



## 2.1E HEAT EFFECTS MITIGATION

### Urban greening

Urban greening is an effective method for the reduction of heat in the built environment (Voiland, 2010). A study found that vegetation in urban environments lowers down the air temperature locally up to 8.4°C at 10 cm above and 2.5°C at 70 cm (Stache et al, 2020). The same study revealed that abiotic building materials reach a surface temperature up to 60°C and above when vegetation is irrigated only warms up a maximum of 38°C



### Bennefits of greening

One of the multiple benefits that green infrastructure provides to cities is natural cooling. Shade, transpiration and low heat storage are three qualities that vegetation can offer in order to reduce temperatures in the city. Low heat storage is specially important during evenings and nights, dense built areas store heat at night and transfer it to its surroundings (Mathey 2011).

Integrating greenery in the urban environment has three positive effects according to Stache et al. (2019):

1. It can solve urban environmental and social problems
2. Improve urban sustainability
3. Revitalise degraded urban areas



## 2.2 BUILT ENVIRONMENT

### 2.2A CITIES THAT LIVE

Cities are usually seen as passive elements, however, cities are alive. We should stop seeing cities as static stages where life happens, and instead we need to consider them active factors and key environments for change (Concilio & Tosoni, 2018). The exploration of the built environment is an opportunity to include the Red Cross into city-making decisions and actions. Through our built environment we can create safer, healthier and happier communities (Sim, 2019).

In the following paragraphs some concepts from urbanism and architecture related to city-making will be defined, in the hope of using some of these principles to guide the Red Cross along the solution of the Urban Heatwaves through urban interventions.

### 2.2B URBAN HEALTH

The World Health Organisation has added a section to its health topics called Urban Health. The WHO recognises that the well-being of citizens is a city's most important asset, it also acknowledges that cities bring challenges, however they can also bring opportunities.

Cities can take climate action, strategic urban planning will be the key to create good environments for health. (WHO, 2020) The design of the city has gained importance through time, cities can not only affect how we behave, but they can also affect how we feel. (Ellard, 2015). Now more than ever it is crucial to take a look and redesign the spaces we inhabit.



TACTICAL URBANISM. A NEIGHBOUR PAINTING A CROSS ROAD. IMAGE: TEAM BETTER BLOCK



TACTICAL URBANISM. NEIGHBOURS PLANTING A GREEN SPACE IN THE STREET IMAGE:

### 2.2C TACTICAL URBANISM

Tactical urbanism is defined as low cost, temporary interventions that can improve local neighbourhoods. They are small scale, short-term interventions meant to inspire long-term change (Pfeifer, 2013). Tactical urbanism gained momentum in 2007 when the transportation commissioner of New York City Janette Sadik-Khan implemented tactical urbanism strategies across the city, they were supported by a data driven approach to urban planning. This methodology allowed her to try fast and cheap interventions and generate data on the results so that the mayor would accept the investments after seeing the benefits. (Sadik-Khan & Solomonow, 2017)

### 2.2D URBAN ACUPUNCTURE

Best defined as a hyper-localised healing treatment through place activation to enliven and recreate cities (Houghton et al, 2015). Urban decision makers manage interests of the community, politicians and different stakeholders. City planners are looking into participation and community engagement for some decision making.

Urban acupuncture plans for small scale interventions at strategic locations can create catalytic spinoffs (Hoogduyn, 2014).



## 2.3 BEST PRACTICES

The following are projects, campaigns, tools and designs that are currently being implemented and have design principles that can be transformed and adapted for a strategy to mitigate the effects of Urban Heatwaves in cities.

### DATA AND AWARENESS

#### “SEE HOW YOUR CITY’S CLIMATE MIGHT CHANGE BY 2020” a National Geographic feature

This feature allows you to see the development of climate change in different cities around the world. It maps out current data with future meteorological projections if carbon emissions continue to rise. It uses data from IPCC using the worst-case scenario assumptions.

This tool allows you to visualise a possible future for the climate conditions in your city. In addition, it gives you the degrees of difference that summers in different cities will differ from now until the next 70 years.

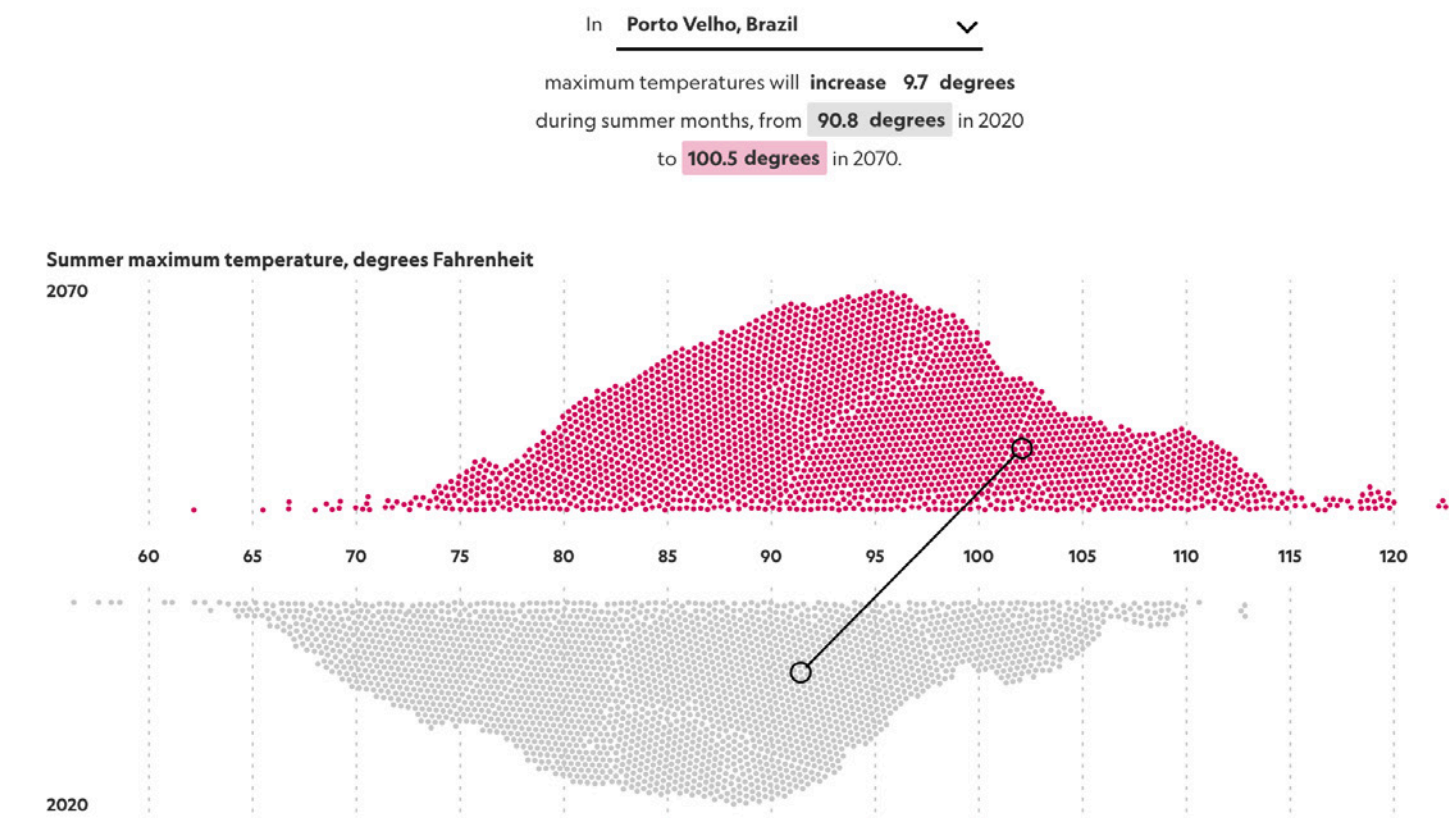
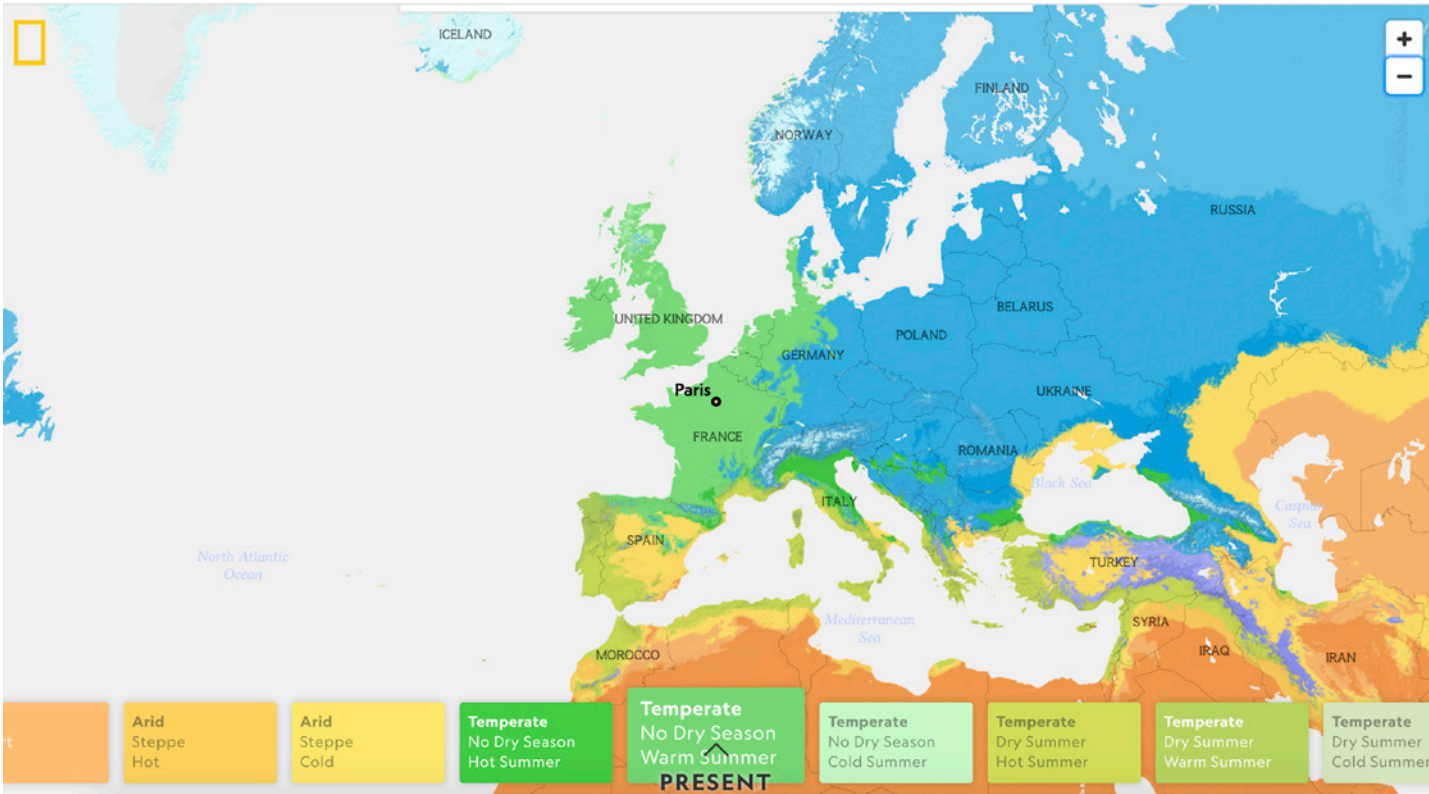
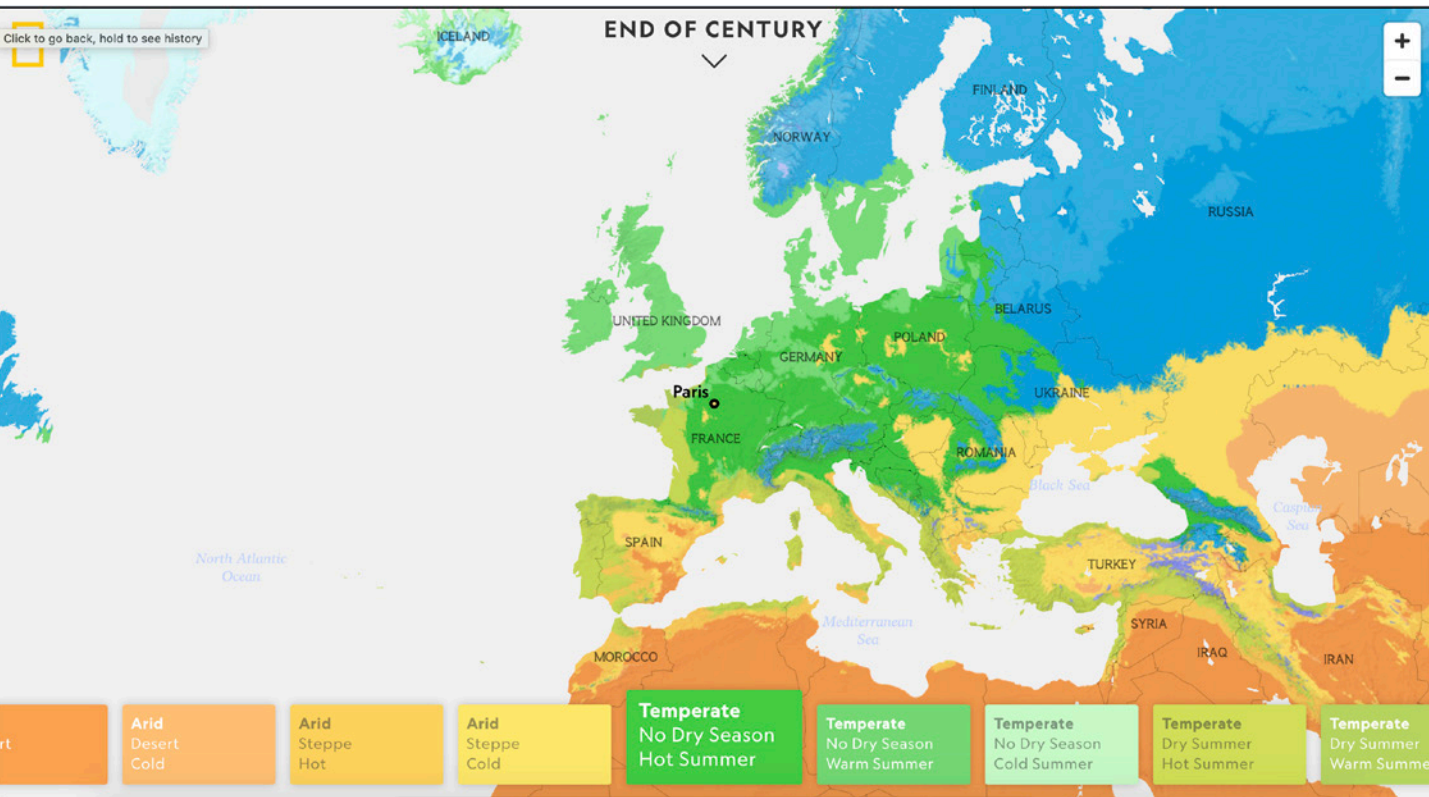


IMAGE: NATIONAL GEOGRAPHIC



EUROPE TODAY  
IMAGE: NATIONAL GEOGRAPHIC



EUROPE IN 2070. WORST CASE SCENARIO PROJECTION  
IMAGE: NATIONAL GEOGRAPHIC

Through an interactive map, it is possible to see the difference of weather conditions around the world. The images above show Europe’s climate conditions today and a projection for 2070.

This illustrates the impact of climate change through time and generates awareness on the issue through the sharing of data in an easy and attractive ways for the user.



DATA & AWARENESS

URBAN CANOPY  
By Living Labs San Francisco

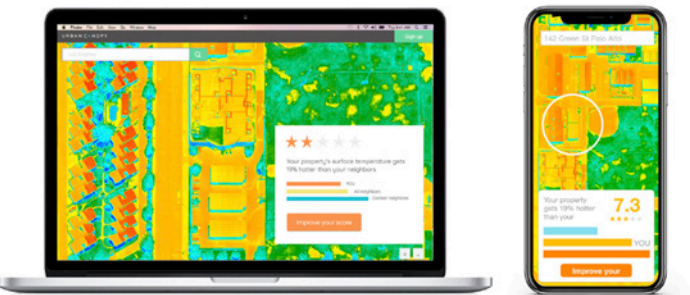
Urban Canopy is the prototype of a computer software start-up that takes high resolution thermal images by aircraft. It assigns “heat scores” to land parcels and allows for neighbours to compare the average thermal readings of their properties. It envisions augmented reality views of the collected data to make the problem visible and inspire people to make a possible change.



AUGMENTED REALITY SCENARIO. ELECTRICITY USAGE SCORES. IMAGE: URBAN CANOPY

An initiative like Urban Canopy helps make the problem visible. Inspired in learning from game designers, they propose to use the data to produce property scores and community green actions, combined with rewards and levels of achievement to get motivation to drive action. The image above shows an augmented reality scenario of the electricity usage in a neighbourhood displaying the scores and performance of each building. The image on the right shows the interface to compare the scores with your neighbours.

Find your property's heat island score and how it compares to your neighbours



RATING OF HEAT SCORES. IMAGE: URBAN CANOPY

CITY FEATURES VS HEAT

THE RHINE  
Basel, Switzerland

The Rhine is a very important waterway in Europe. For decades the river was polluted, many fish species disappeared and it was considered a risk to swim in it. International co-cooperation and strict regulations have helped rescue this natural feature.



SWIMMING IN BASEL. IMAGE: THOMAS LOISL MINK

Today, thousands of citizens in Basel use the river as a summer leisure activity and even to commute to work. Around the river many bars and restaurants have opened due to the amount of people gathering in the area. During the hot season it is the most lively spot of the city where people from different age groups gather to enjoy the public realm. People carry their belongings in a fish-bag, a colorful plastic container that keeps their clothes dry.

The take away lesson from the Rhine is how much vitality can be given back to a city with collaboration and regulation changes. The recovery of what was a lost natural feature has given Basel citizens a new area of their city. Along with the public life comes the business opportunities and the revitalisation of a lost space. This case study shall serve as a reminder to look around and find “lost” features or areas in our own cities and get them back.



# CITY FEATURES VS HEAT

## SPRINKLERS Japan

This device sprinkles people in the public space with water. It produces an artificial mist called “dry mist”. This structure can be found in big cities around Japan and it is used through the hot months. The device freshens you up by imitating the transpiration process of plants, when the water evaporates, the temperatures are lowered. Since the water evaporates before it reaches you, people do not get wet. The effects have confirmed to cool down the area 1 to 3 °C and 91% of visitors said comfort notably increased (Mori, 2009).



Paris Plage offers different programming for children to the elderly, as well as artificial pools, dancing stages, showers and urban furniture to enjoy the summer in the public space.

The take away from this case study is the temporary transformation of an existing space which adapts to weather conditions. The addition of urban furniture and a few extra features creates a brand new space in the middle of the built environment. This offers an opportunity for residents to socialise and enjoy their city without any cost.

# CITY FEATURES VS HEAT

## Paris-plages Paris, France

The artificial beach in Paris goes along the Seine river. This initiative was implemented by the office of the mayor of Paris and it started in 2007. It is a temporary modification to the city which holds different activities and infrastructure like sand and palm trees. People in France usually avoid Paris during the summer due to the hot temperatures, however there are many people that can not leave the city during that period, the Paris Plage came as an alternative for those people to be able to enjoy the summer in a refreshing way in the middle of the city.





# ARCHITECTURE

## THE FARMHOUSE STUDIO PRECHT

<https://www.precht.at/the-farmhouse/>

Precht Studio, is an architecture office in the Austrian mountains. Precht’s designs are a hybrid of architecture and agriculture, they design system-designed buildings that integrate agriculture into the spaces. Their mission is future oriented and they understand the building industry as a problem for the environment “Architecture needs fresh ideas. Currently, the building industry uses more than 50% of the global energy and produces 40% of CO2. We need to do better. It’s on us, the next generation of architects, to create a healthier future.” (Studio Precht, 2018)

Precht studio questions how can architecture be part of the food production in order to match the growing population, they believe that architecture can be part of a productive grid and be able to give back to the community and its surroundings (Studio Precht, 2018).



## VERTICAL FOREST BOERI SUDIO

<https://www.stefano-boeri-architetti.net/en/project/vertical-forest/>

Vertical Forest is the prototype building for a new form of architecture. It focuses on the relationship between humans and other living species. The first vertical forest was built in Milan. It consists of two towers that house 800 trees, providing the equivalent of 30,000 square meters of green space. (Boeri Studio, 2014). The plant based facade allows the space to create its own micro-climate as well as humidity regulation and the production of oxygen that absorbs CO2. The vertical forest is now home for about 1600 specimens of birds and butterflies and has won multiple awards for its innovative and biodiverse design.



## COPENHILL BIG - BJARKE INGELS GROUP

<https://big.dk/#projects-arc>

CopenHill is a waste-to-energy plant in Copenhagen which includes to its programme a ski slope, a hiking trail and a climbing wall. The mix of an industrial plant with a recreation centre is what makes this project a good case study. Rather than having the plant as an isolated architectural object, it is looked at an opportunity for the direct environment. The aluminium bricks of the facade double as plant pots for greenery to grow alongside the building. The Bjarke Ingels Group refers to CopenHill as “the new destination for families, friends and celebration, one that is economically, environmentally and socially profitable” (BIG, 2020)



## THE GROW ROOM MADS-ULRIK HUSUM AND SINE LINDHOLM

<https://space10.com/journal/space10-open-sources-the-growroom/>

The growroom is a pavilion for urban farming. It explores ways that cities can feed themselves through food-producing architecture. It is part of Space10 lab open source projects. The design of the architects caught a lot of attention and they received many requests to buy it, instead, Space10 released the Growroom as an open source design to encourage and inspire people to build their own and grow their food in their city alongside their neighbours. The open source includes the files for CNC cutting machines as well as a step by step guide on how to build it. The Growroom size is 2.8x2.5 meters, a relatively small footprint, making it an ideal design for cities in which space is reduced.





# CHAPTER TWO

## KEY INSIGHTS

1

The planet temperature is rising up. Heatwaves will be **more frequent** and **more intense**.

2

Besides being **deadly**, extreme heat can **affect the health** of individuals in different maners.

3

The **vulnerable** groups to are varied and with time more people will be vulnerable to extreme heat.

4

Heatwaves are **silent** and therefore dangerous. Many people are not aware of them.

5

Cities face highest vulnerability due to the **Urban Heat Island effect**.

6

**Urban Health** is a right for people and needs to be adressed now.

7

**Urban greening** can lower the temperatures down in cities.

8

Cities can provide **temporary or permanent infrastructure** to adapt to weather conditions



# CHAPTER THREE

## **EXPERT AND CITIZEN INTERVIEWS**

# 3. EXPERT INTERVIEWS

Eight experts were consulted for interviews in three different areas: the humanitarian sector (The Red Cross), architecture and greening practices or start-ups. Interviews were a mixture of validation of ideas, data collection and personal advise or feedback on the project's direction. Every interview was held online for geographical and pandemic reasons. Special thanks to every one whom I interviewed for this section, thank you for your time and input.

## 3.1 RED CROSS

**RAIMOND DUJISENS**  
**Community Resilience Advisor**  
**Netherlands Red Cross**



Insights:

- Community resilience looks into how can communities cope with risk. It is currently too linked with natural disasters.
- Preventive measures are currently more needed in urban environments
- Community resilience looks before, during and after a disaster, specially after into reconstruction and rehabilitation.
- For heatwaves there is the possibility of creating new structures, to build better.
- Community resilience and urban vulnerability are getting closer with time.
- There is not a lot of work being done in collaboration with architects

Advise:

- It is important to look at social structures and the physical layout of neighbourhoods
- Think of practical solutions and make it concrete
- There is a good link between architecture and the humanitarian work.

**JULIE ARRIGHI**  
**Urban Manager & ICRC Partnership Lead**  
**Red Cross Climate Centre – New York**

Insights:

- The mission of the Climate Centre is to support the Red Cross reduce climate change to vulnerable people
- The Climate Centre works through policy change, research or technical guidance.
- One of the biggest challenges is to get attention on the subject and to get more action.
- Seems like there is not enough area of interest
- An other challenge is to combine meteorological data with public health data
- It is important to advocate for social networks and neighbourhoods
- There is not a lack of information, it is out there, so what is the barrier?



# 3.2 ARCHITECTURE & THE BUILT ENVIRONMENT

**EVA STACHE**  
**PHD Researcher Materials & Sustainability**  
**Green as building material**  
**TU Delft**



Insights:

- Heating is an urgent problem and people are not aware of it
- Do not only look at the owners of buildings or the owners of the streets, but look into the space between buildings.
- The type of plants you need to mitigate heat needs to be researched, not every plant does the same job.
- Consider designers, gardeners, urbanists, architects, owners, users, water organisations etc.
- Every square meter of green helps bring down temperatures
- We found that vegetation may lower the air temperature locally up to 8.4°C at 10 cm above the vegetation and 2.5°C at 70 cm. The cooling effect of vegetation on the air temperature may increase if the surrounding building materials are also replaced by vegetation.
- We also found that abiotic building materials reach surface temperature up to 60°C and above. On the other hand vegetation if irrigated only warms up to max 38°C.

**JOSÉ MARIA PASTRANA**  
**Architect & Strategic Designer Design-it**  
**Oslo**



Insights:

- People are not used to extreme heat in the north of Europe
- The south of Spain is all white, people were anticipating hot temperatures, but what happens in places where the environment was not built for it?
- What are quick changes to make with the current system we have ?

Advise:

- Think of easy implementation for the Red Cross
- Choose one problem to tackle
- There will always be new things to the project, pay attention and focus on solving one at the time
- Context is important

**GUY LAFRANCHI**  
**Architect GLAD Architects**  
**Zurich**

Advise:

- It is important to look at current strategies for heat mitigation in cities and start from there.
- The problem must be tackled from a micro and a macro scale at the same time
- It is crucial to figure out who are the decision makers and map them to know where to implement changes
- Consider heatwaves before, during and after, not only when they are happening
- Don't forget the digital opportunities for awareness-boost like game design, social media, etc.
- Try to create customised generation actions for, kids, older generation, millennials, they all can get different triggers to be aware in the different stages,
- Awareness is not created by complex data communication but by playful emotional driven experiences



**JESUS OCAMPO**  
**MsC Art, Culture and Technology**  
**MIT Cambridge, Massachusetts**

The conversation with Jesus gave me insights on technology possibilities regarding mapping of heat. He introduced technologies like photogrammetry softwares and we explored the possibilities of prevention in the humanitarian sector with technologies.

We talked about the possibility for the Red Cross to open their doors to specialised volunteers, such as computer scientists, drone pilots and programmers. He introduced me to Proximity Tracking Location and the possibilities of offering a service to the community by utilising people's location.

Advise:

- These technologies are useful to capture before and after, to measure if you're having the impact you were aiming for with the current implementation.
- You have to do more than make the problem visible, people will say " So what? It is hot, because it is brick, what do I care?"
- Do not be afraid of technology
- Think about what happens when you move to a Latin American context



# 3.3 GREENING PRACTICES

## JAN HENK The Rooftop Revolution Amsterdam

Insights:

- The Rooftop Revolution is a networking organisation that brings people together
- Rooftops lower down temperatures because of heat absorption and water evaporation
- They look for sponsoring from municipalities since their work solves different problems from them
- Rooftops are unused spaces of cities, therefor a huge opportunity
- There is not enough space in the public area, so we have to look at the private area, from which 60% is roofs
- Some of the benefits of a green rooftop are climate, biodiversity, social and psychological.
- The steps for beginning a project (roughly) are:
  1. Make an analysis of the neighbourhood
  2. Look out for who is doing greening already
  3. Find out how do people talk to each other in that area
  4. Make inspiring images
  5. Launch a campaign to get people involves
  6. Decision making on which roofs should be green

## BEREND VAN ZANTEN Groene Morgen Rotterdam

I asked Berend one question “Why isn’t urban greening happening? Why aren’t there more tiny forests, green facades, green roofs already?”

“I think we’re in the middle of a transition into a more nature inclusive world... With governments and citizens understanding the importance of green in- and outside the city more and more.

So, in the first place I think it’s not happening YET, because (1) changing the law, (2) changing behaviour and (3) dealing with bureaucracy is tough...

(1) When we did DÂK for the first time the fire department literally told us that parkings were only for cars and no park could be there. Now there is an actual program to start using rooftops multifunctionally. Same for facade gardens. For public space like roads (in my opinion) there is not a good enough vision yet.

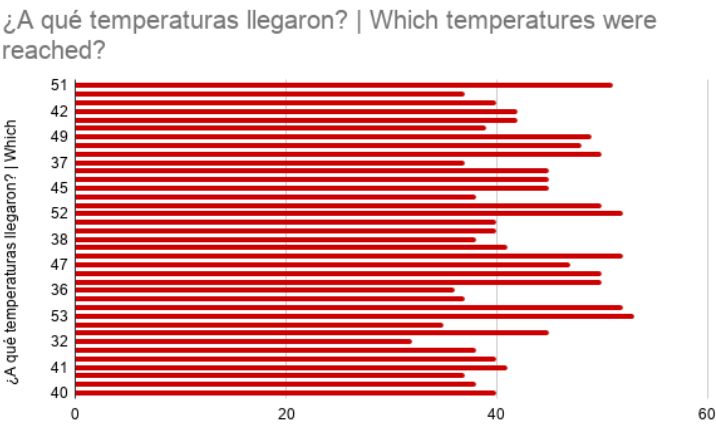
I think because peoples mindsets aren’t ready for that yet (2). Campaigns like 1000Geveltuinen and some others make citizens see the value of green, that will eventually open up the minds and make way for a bigger green programme by governments (1). ‘Simply’ by pointing out the personal importance for participants and making the rules of law understandable.

Lastly, people are ‘lazy’, I think they are willing to do maintenance of their own garden, but they’re (3) sick of jumping through bureaucratic hoops. This last problem (imo) should be the easiest to fix: see for example the Geveltuinen: the law on this is so simple: you can take out 45cm of tiles if you leave at least 180cm of sidewalk and anyone can decide for themselves.”

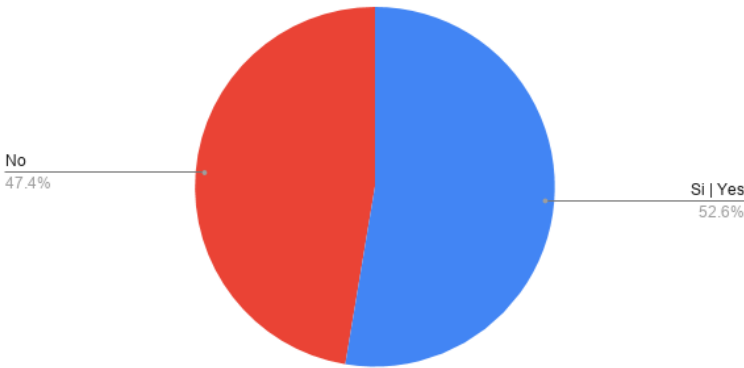


# 3. CITIZEN INTERVIEWS

For a first approach a brief questionnaire across acquaintances was conducted through social media. Looking specifically for people who had experienced a heatwave. Results came from different parts of the world and included participants from 5 continents. 40 people responded to nine questions that were sent through a google forms format.

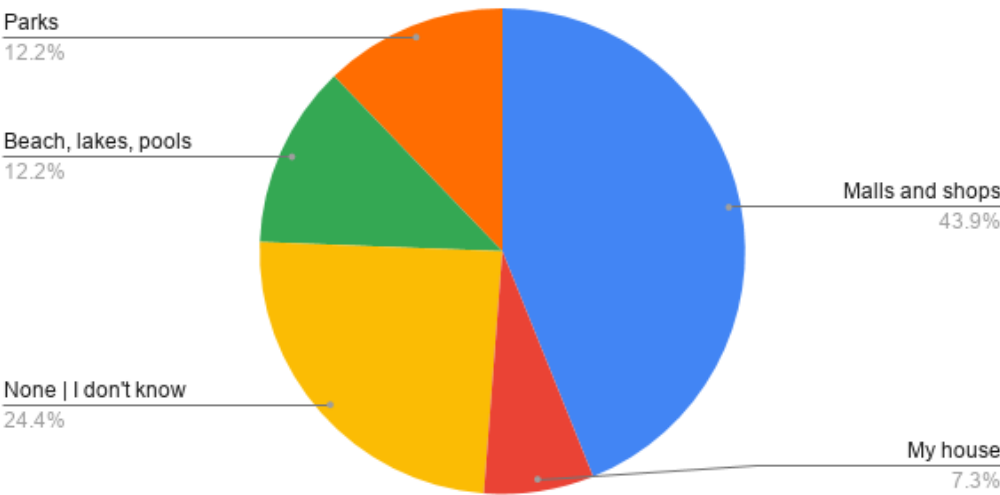


At that moment, were you aware you were experiencing a heatwave?



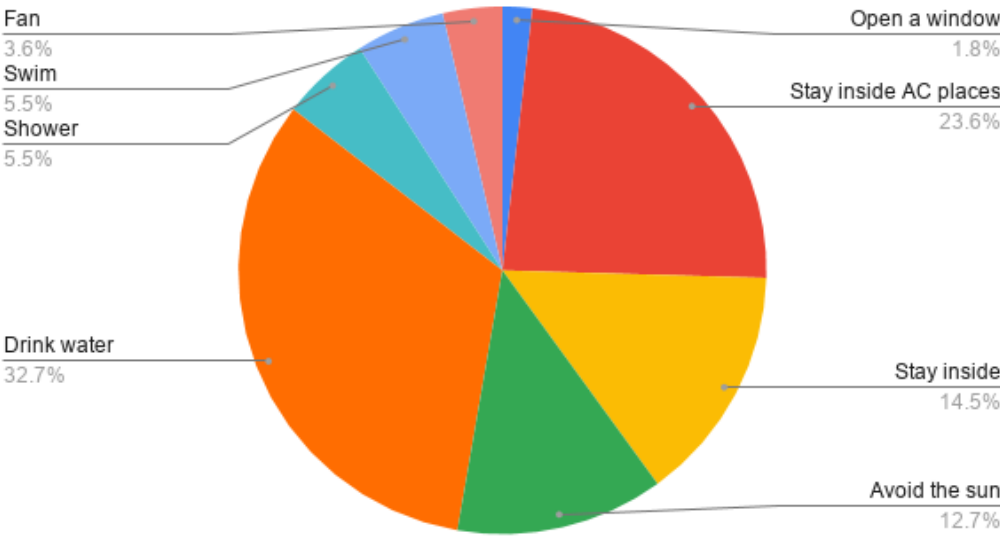
Half of the people knew they were experiencing a heatwave at the time. This showed how little awareness there is on the subject and how silent the heatwaves might be. The temperatures people experienced ranged from 32° C to 53° C.

When it is hot, which places are available in your city for you to go freshen up?



Two of the biggest insights from the survey were people's actions to stay fresh and their knowledge of places available in their city to freshen up. 25% of the survey respondents said they did not know of which places were accessible for them during a hot period in their own city. 7.3% said only their home and 44% mentioned malls and shops.

What did you do to stay fresh?



It is important to highlight the lack of awareness on the heat mitigation. In addition, the fact that people do not consider the city as a space to freshen up or cool down is a knowledge gap important to address

# CHAPTER THREE

## KEY INSIGHTS EXPERTS



"One of the biggest challenges is to get attention on the subject and to get more action." – Julie

"Every square meter of green helps bring down temperature" – Eva



"The south of Spain is all white, people were anticipating hot temperatures, but what happens in places where the environment was not built for it?" – José Maria

"Awareness is not created by complex data communication but by playful emotional driven experiences" – Guy



"You have to do more than make the problem visible, people will say " So what? It is hot, because it is brick, what do I care?" " – Jesús

"There is not enough space in the public area, so we have to look at the private area, from which 60% is roofs" – Jan



"We're in the middle of a transition into a more nature inclusive world... With governments and citizens understanding the importance of green in- and outside the city more and more." – Berend

# CHAPTER THREE

## KEY INSIGHTS CITIZENS

1

Not everyone is aware of what a heatwave is, nor if one is being experienced.

2

25% of respondents do not know which places are available for them to freshen up in the public realm.

3

44% of respondents mentioned closed indoor semi-private spaces to stay cool.

4

People are not aware of nature based solutions for staying fresh.

5

Only 12.2% highlighted parks and green infrastructure to cool down in cities.

6

When asked what they do to stay fresh during a hot period, nobody mentioned going outside.

# CHAPTER FOUR

## **THERMAL STUDY**



# 4. THERMAL STUDY

This study consists on images taken with a Flir Pro thermal camera attached to an android cellphone. Three cities in the Netherlands were thermally photographed: Delft, Amsterdam and Utrecht in different days across May, June and July between 13:00 and 17:00 when the weather forecast was around 20°C to 29°C for all of them.

First, images have been analysed based on the literature review, expert interviews and the following research questions:

- 1. How hot do surfaces get in public spaces (plazas, streets, side walks, etc.) around the city compared to the temperature from the weather forecast?
- 2. What is the thermal impact of greenery elements in buildings and streets?

Finally two comparisons are made, first one between two main squares in Delft and second one between two neighbourhoods in Delft. Six insights were found in the study and are shown in the following pages. Each insight is a sub-chapter that includes thermal images and a brief text.

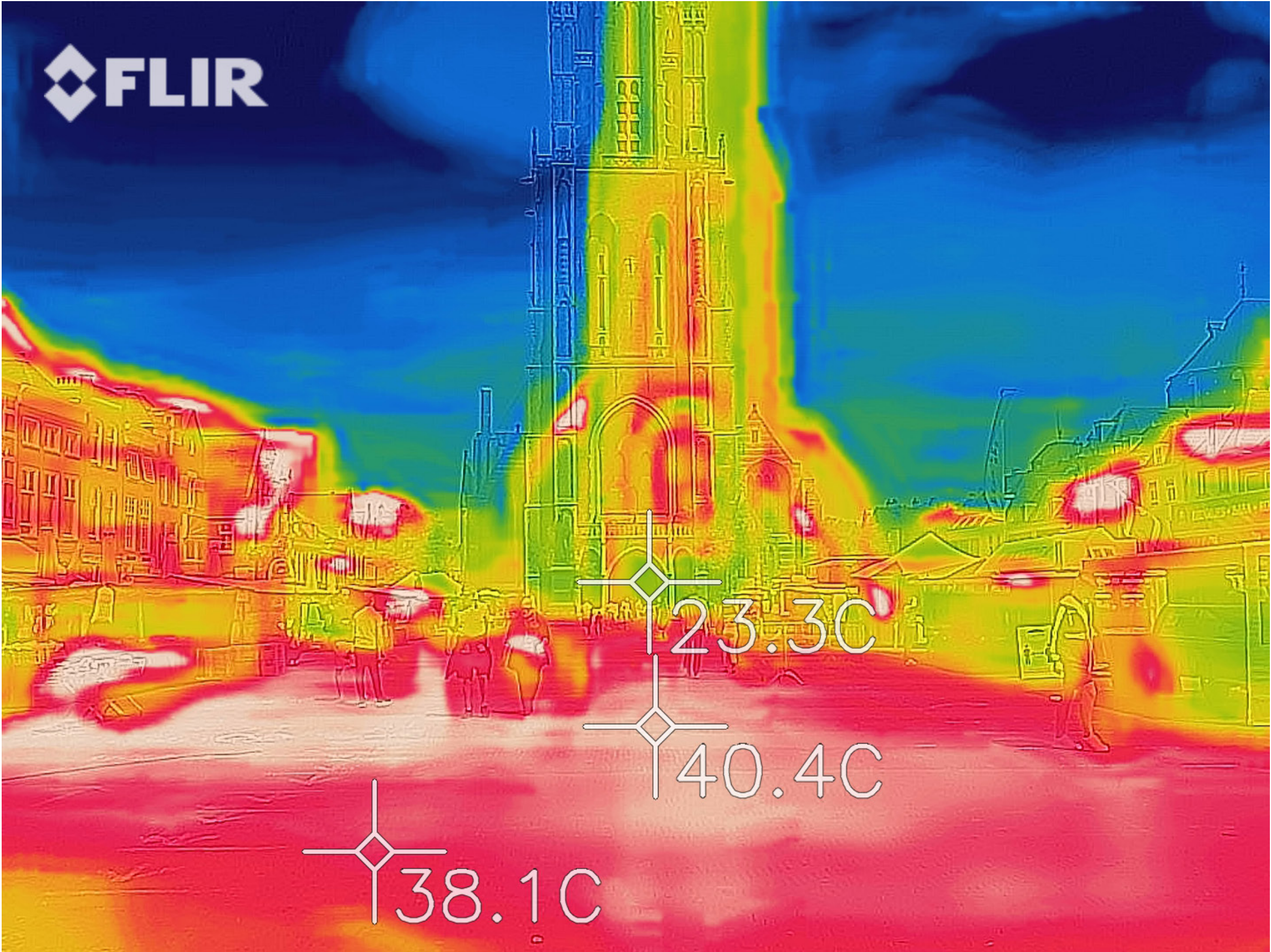


FIGURE 1



## 4.1 HOT SURFACES

The first insight was the difference of temperature in surfaces. The temperatures reached in comparison with the forecasted weather were extreme. In most cases around city squares and plazas the ground temperature was double as the forecasted data. Meaning some surfaces reached over 40°C on a 20° forecast.

Open areas with little or no shadow and with hard materials such as brick, concrete and asphalt were the hottest and the most dangerous around a hot day. The heat is not visible, and it was only with the thermal camera technology that danger zones were identified.

Figure 1 was taken in the city center of Delft shows a surface temperature of 40.4°C when the forecasted temperature was 20°C. Figure 2 with a surface temperature of 41.0°C was taken two streets away from Figure 1 and finally Figure 3 was taken in Amsterdam on a day forecasted temperature of 21°C

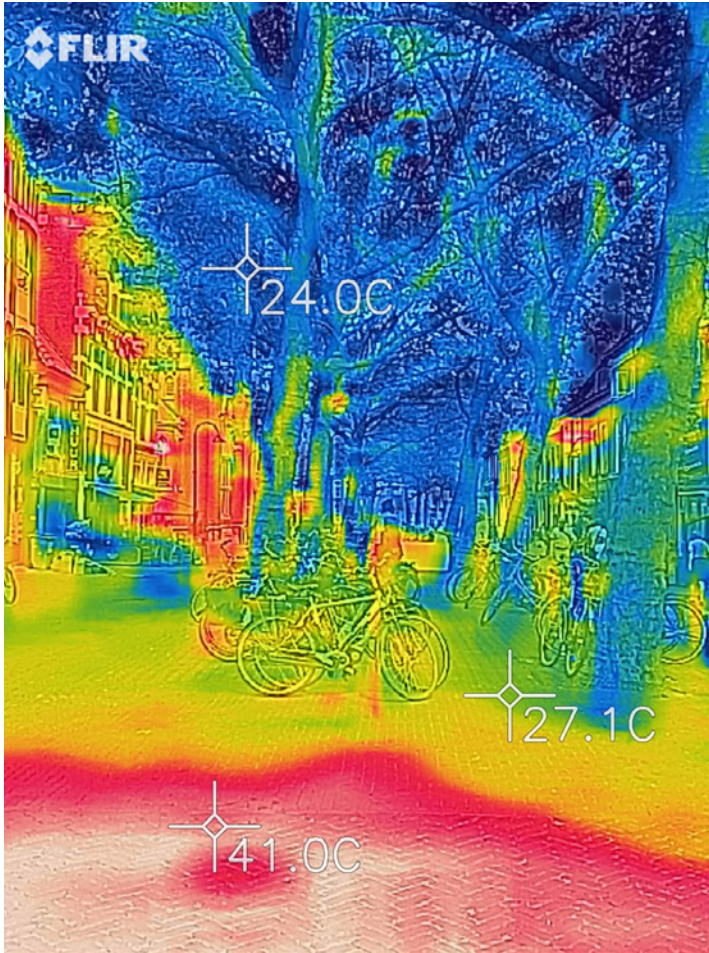


FIGURE 2

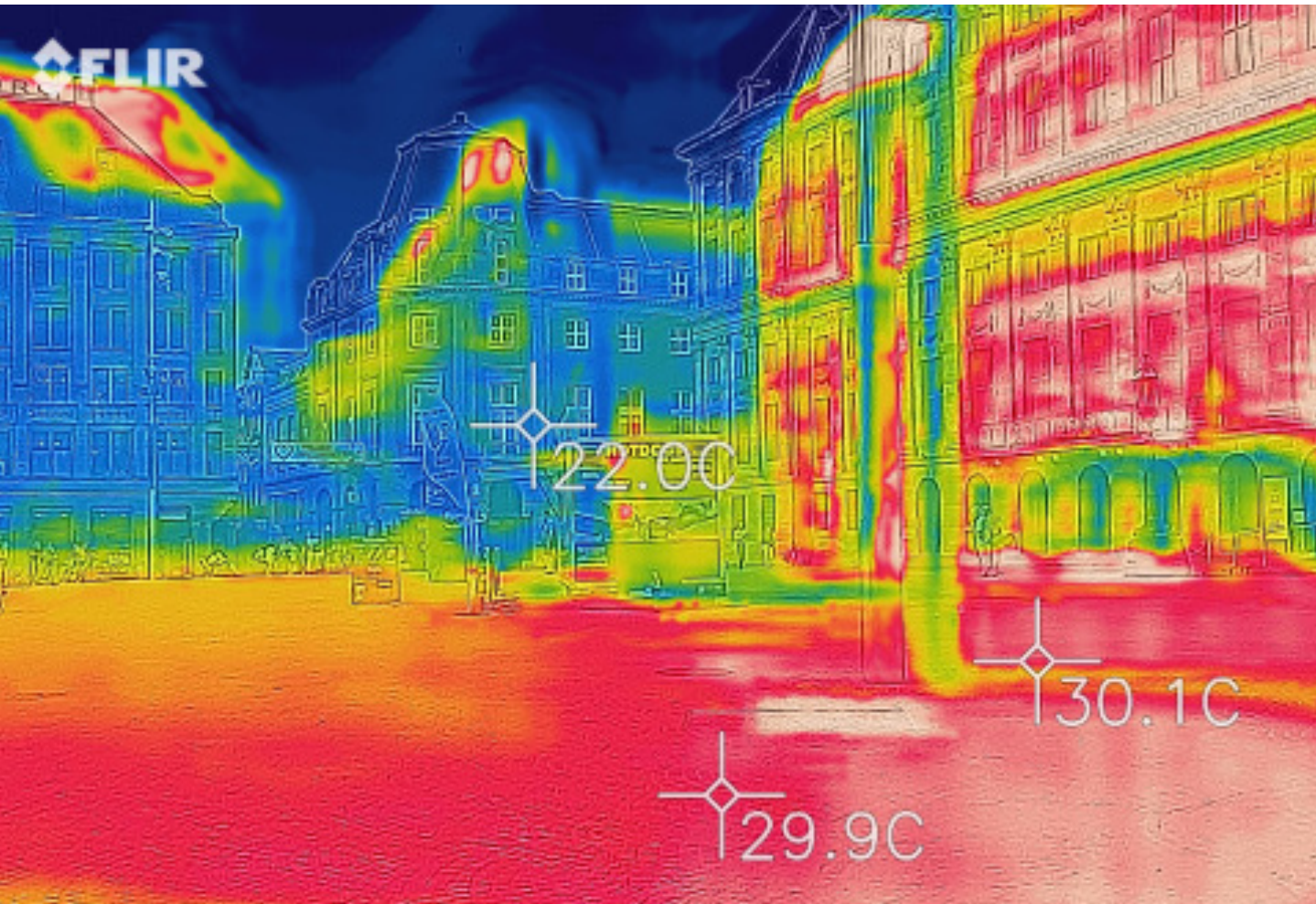


FIGURE 3

## 4.2 SHADOW FROM GREENERY

From the literature review held, it was expected that shadow from green elements would show a lower temperature than more strong surfaces like stone, concrete or asphalt. This was confirmed during the study, what was not expected was the degrees of difference could be so high.

Figure 2 and Figure 4 illustrate the temperature difference that shadow from vegetation can achieve. Figure 2 shows 27.1°C under the tree shadows and 41.0°C outside of the shadow. Figure 4 shows vegetation projecting shadow of 18.4°C when surfaces outside of the shadow reach 31.8°C

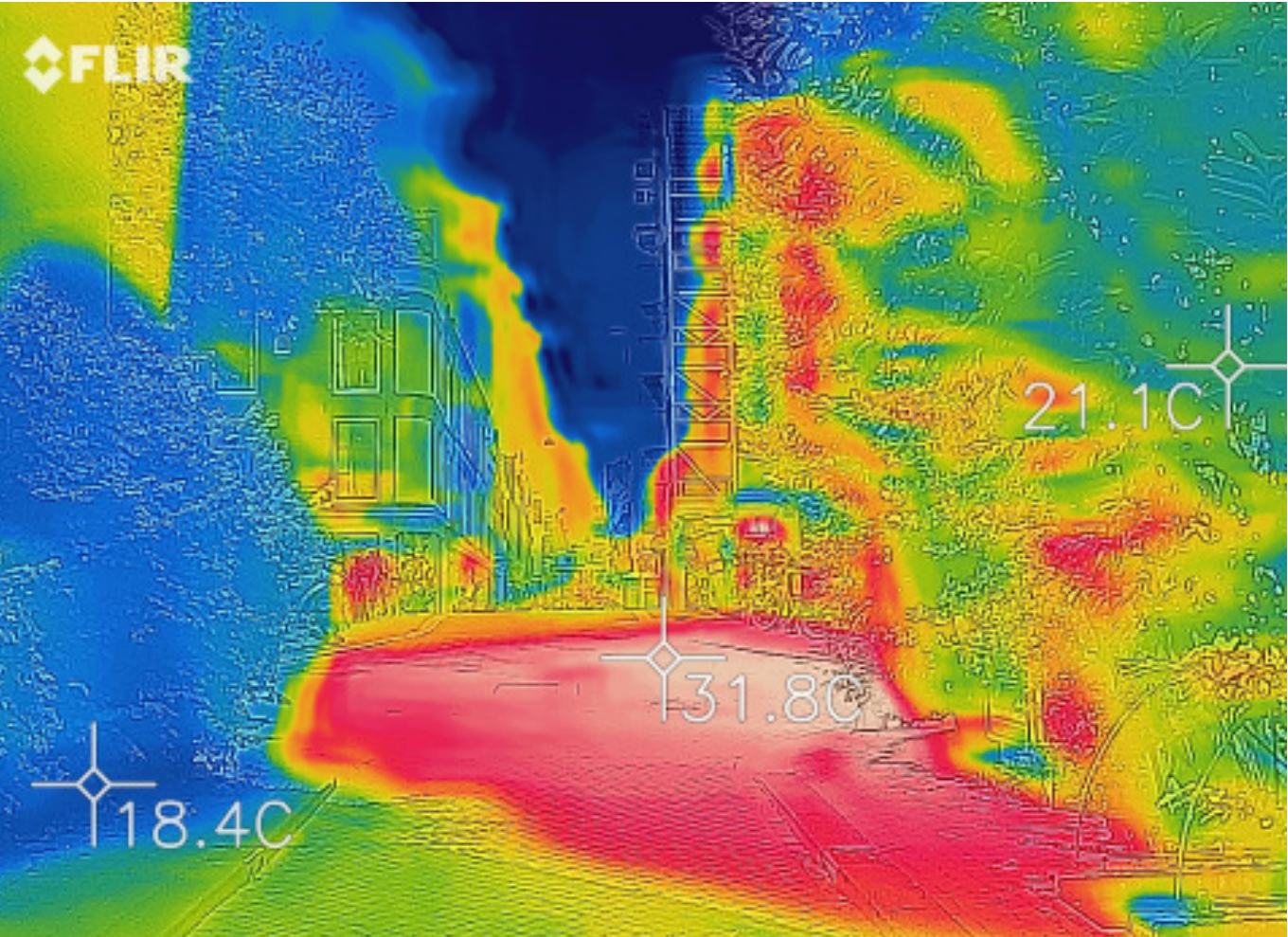


FIGURE 4



4.3 VEGETATION, LOWER TEMPERATURES

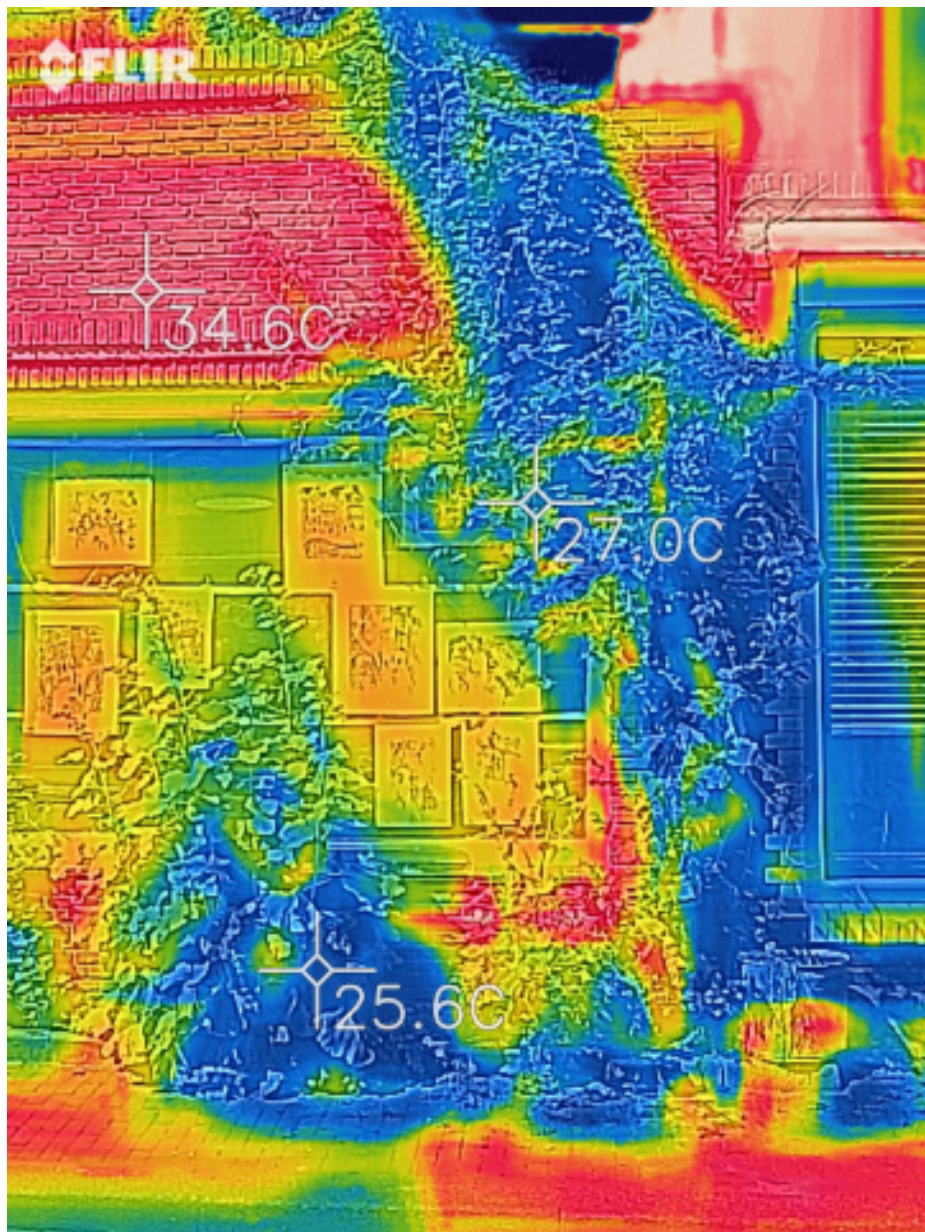


FIGURE 5

Another surprising finding was the amount of green needed to cool down a surface, this showed that it is a very small amount of vegetation that can make a difference on the temperatures and heat absorption. In Figure 5 we can see a temperature difference of 7.6°C from the climber plant (27°C ) to the tiled roof (34.6°C) and in Figure 6 we see a difference of 6.6°C between the climber plant in the fence of the house facade (22.8°C) and the brick flooring (29.4°C). Figure 7 shows a temperature difference of 9.4°C between the cycling path (37.4°C) and the grass surface (28.0°C)

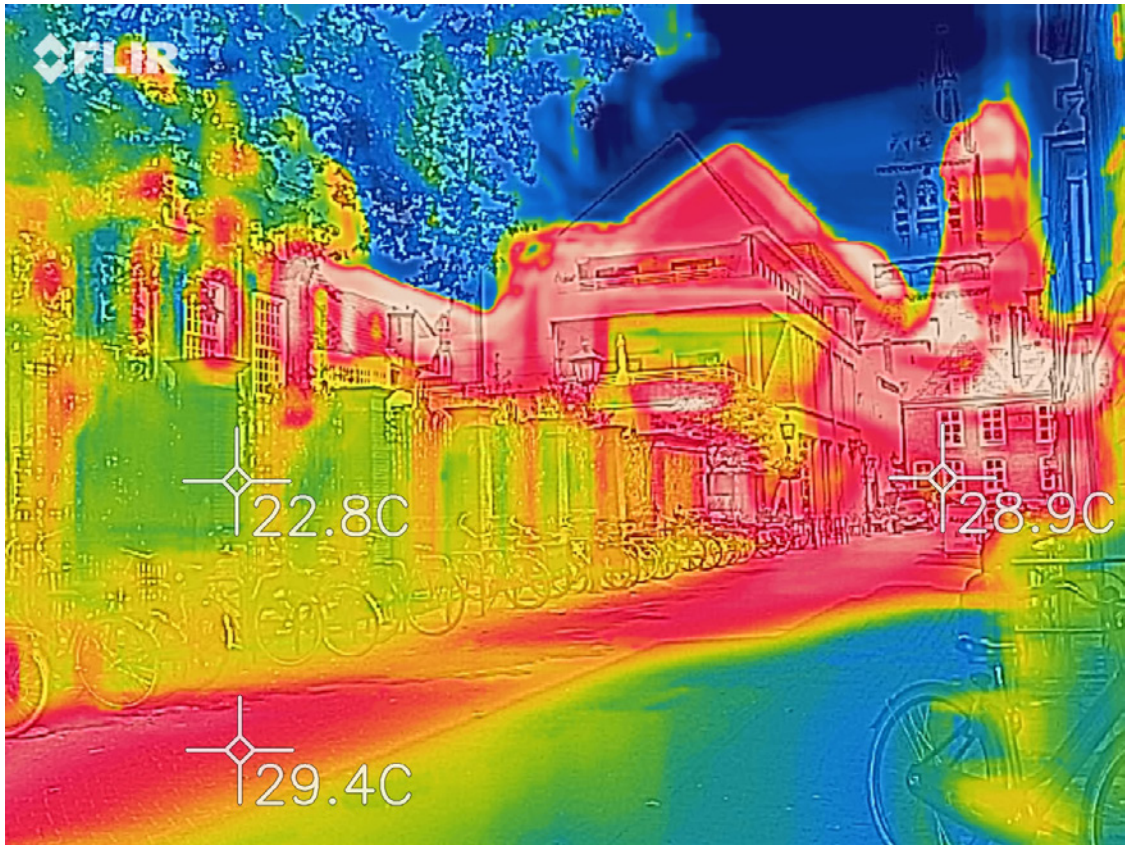


FIGURE 6

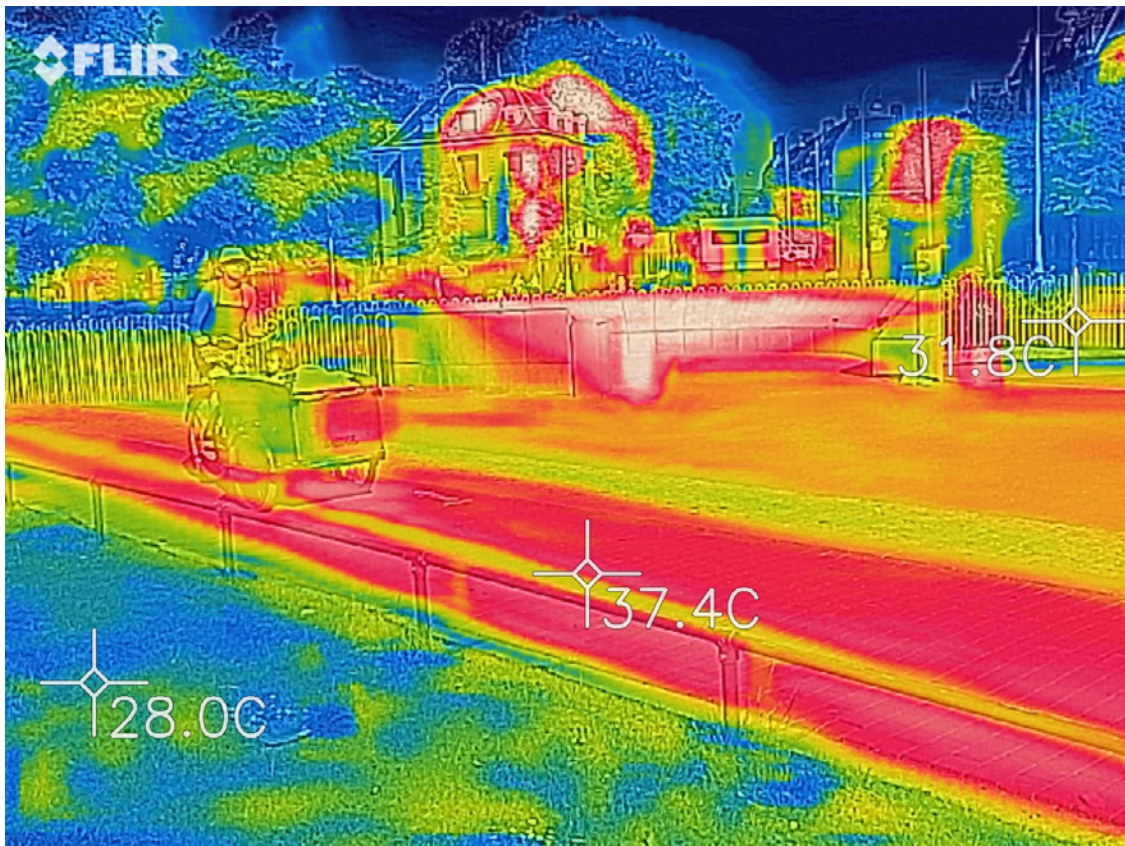


FIGURE 7



# 4.4 BUILDING ORIENTATION

There are other elements that influence the temperature of surfaces, one that was evident through the photographic study was the orientation of buildings. This could determine the shade they would get and also the wind directions. However this changes with sun direction through out the day. In Figure 8 we can see a difference of 9.8 °C between the building facade oriented to the South (38.2°C) and the North oriented facade 24.8°C

It is important to consider the sun movement throughout the day and paying attention to the changes of temperature in the building and street surfaces.

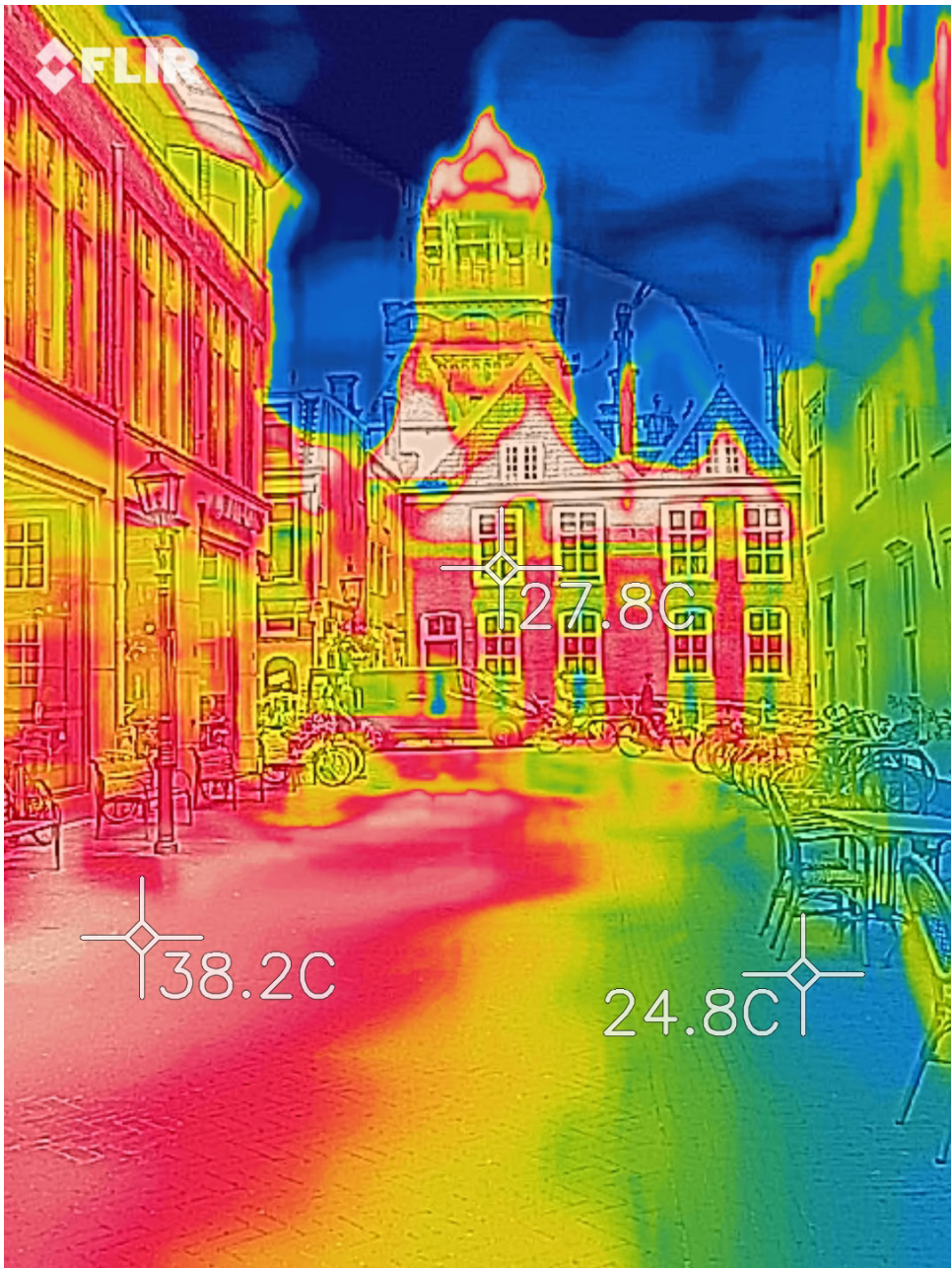


FIGURE 8



# 4.5 WATER

Temperatures in water were lower than the weather forecast. From literature review this result was expected. Even though in Figure 10 water was 10.4°C lower than the street surface temperature (30.3°C) water did not seem to have a cooling effect in its surroundings. The temperature of surfaces around the body of water were not lower or higher than without it. This result shows that water does not have an influence in surfaces around it. However, water can be used as a cooling method when it comes in contact with the skin it gives a refreshing sensation.

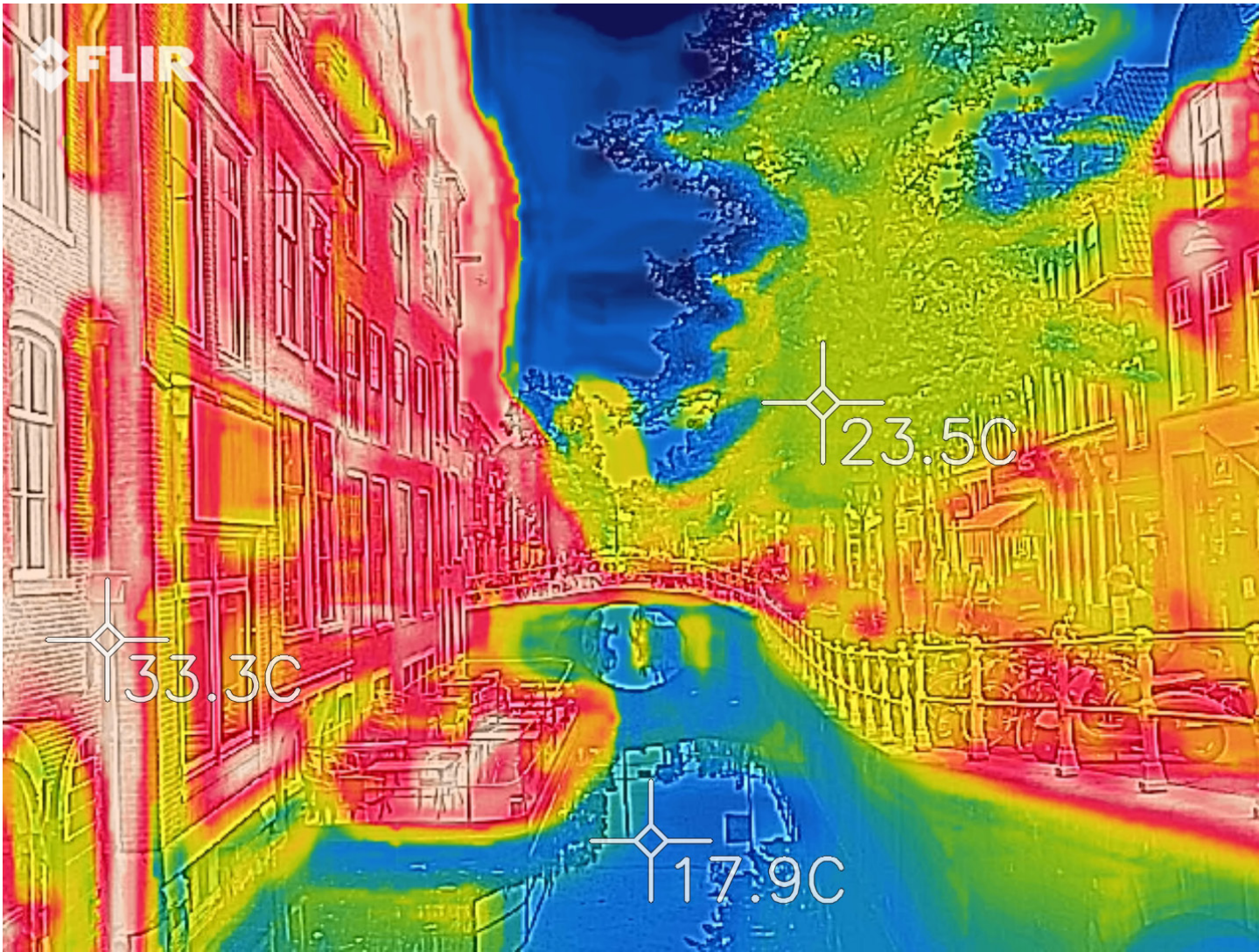


FIGURE 9

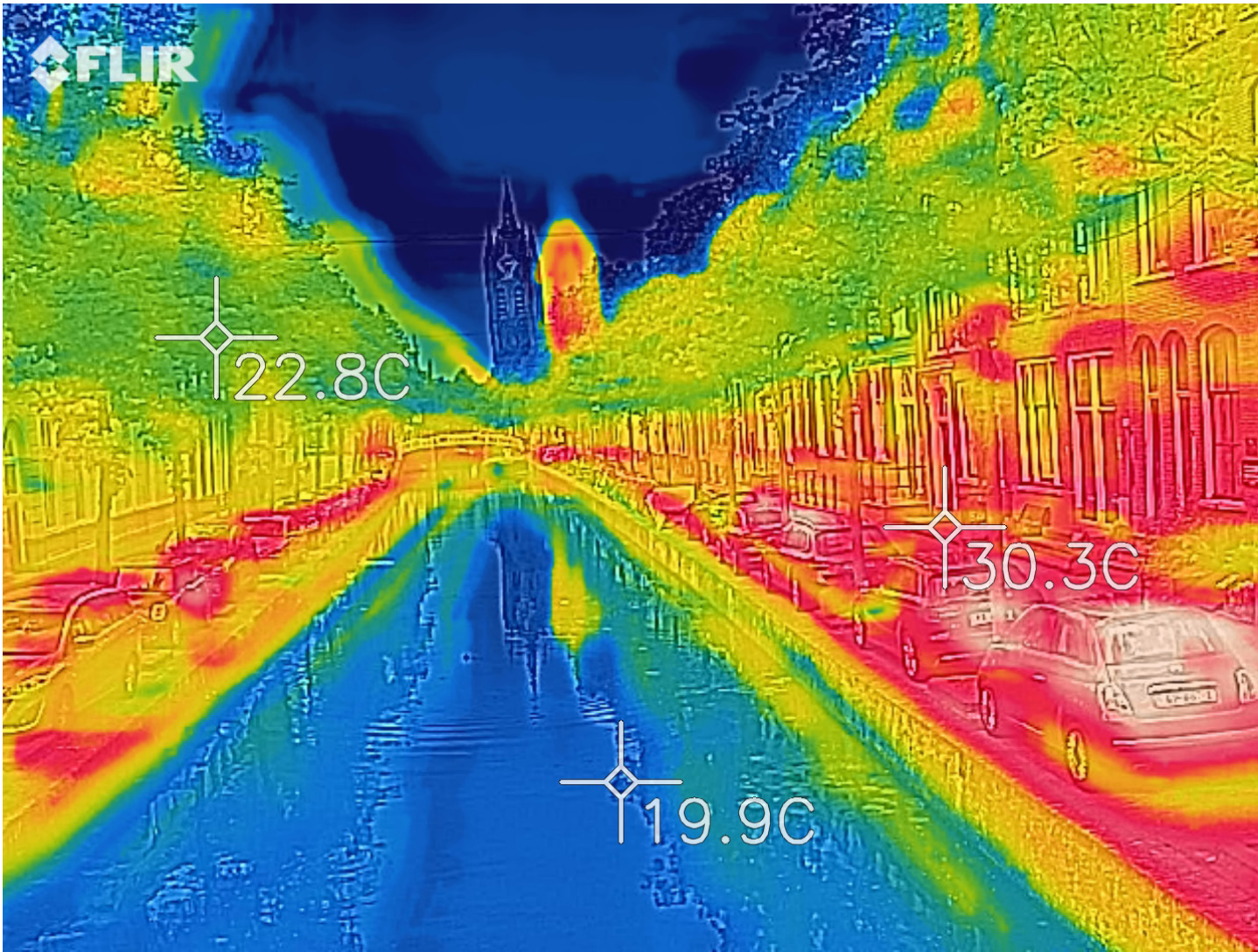


FIGURE 10



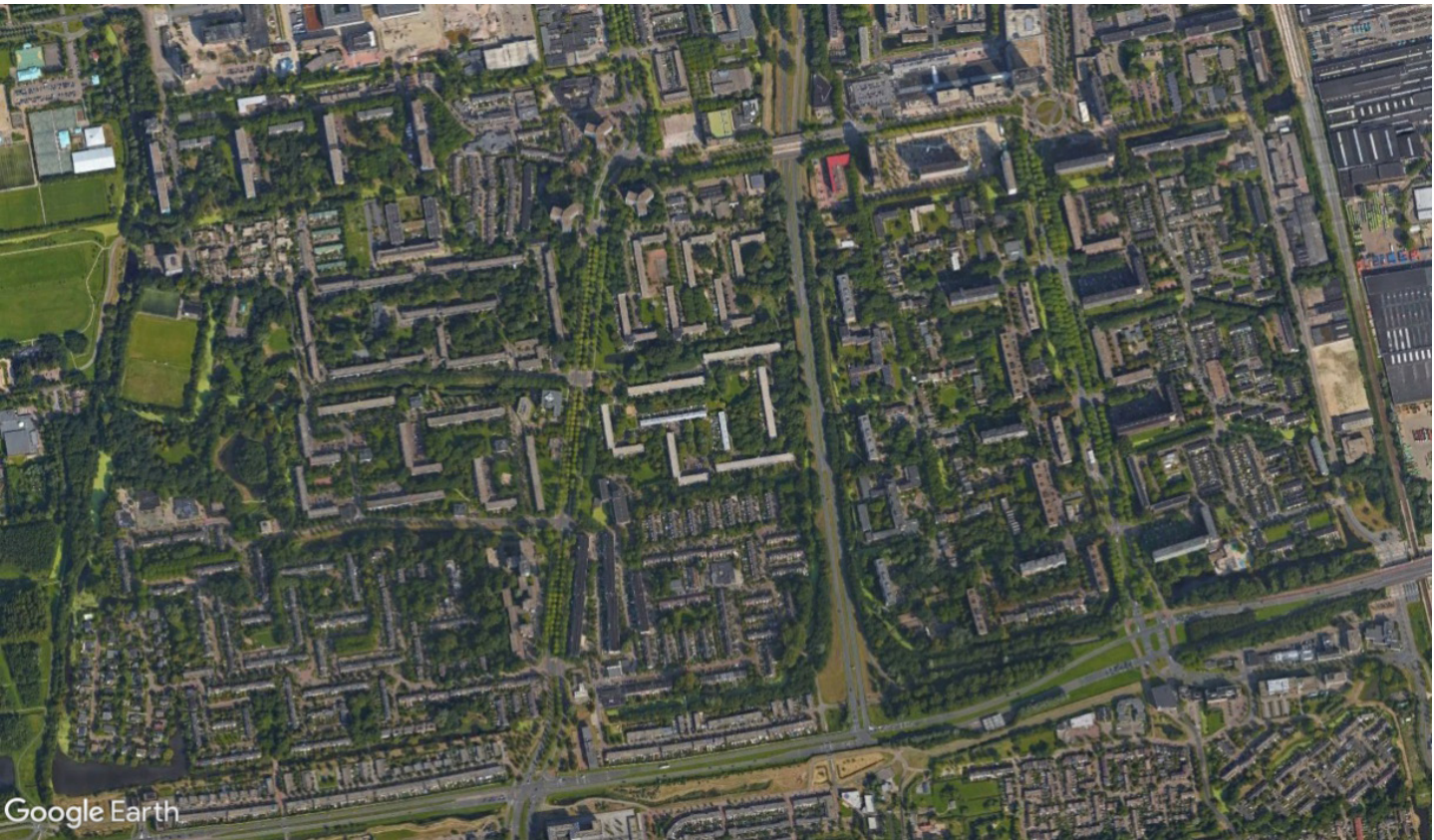
# 4.6 MICROCLIMATES

Two areas of Delft were selected for a comparison. The city center area which is the most dense and with less green areas and the south-west area of Voorhof which shows less ground space built and more vegetation.

The thermal photographs showed that in the case of Voorhof in spite of having more vegetation, the surface areas without tree shade were as hot as the areas in the city center.



CITY CENTER DELFT. IMAGE: GOOGLE EARTH PRO



VORHOOF DELFT. IMAGE: GOOGLE EARTH PRO

This shows that vegetation cooling of surfaces is immediate to the area of greenery or shadow projection. In Figure 11 we can see temperature reaching 45.7°C when the temperature was forecasted on 22°C. However, since the vegetation elements were more dense in this

neighbourhood, most of the streets surface temperatures were below the 20°C. See figure 12. This result shows that It is possible to create microclimates in the urban environment and that every sq meter of green counts, an insight obtained through the expert interviews.

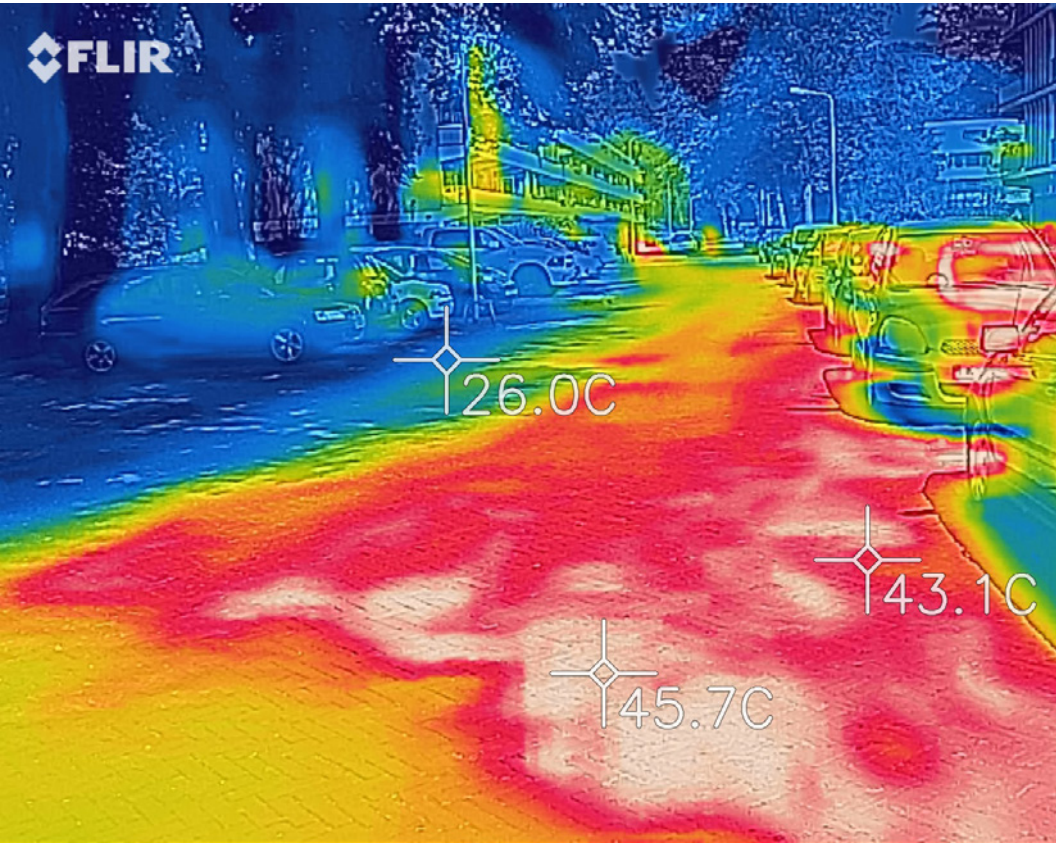


FIGURE 11

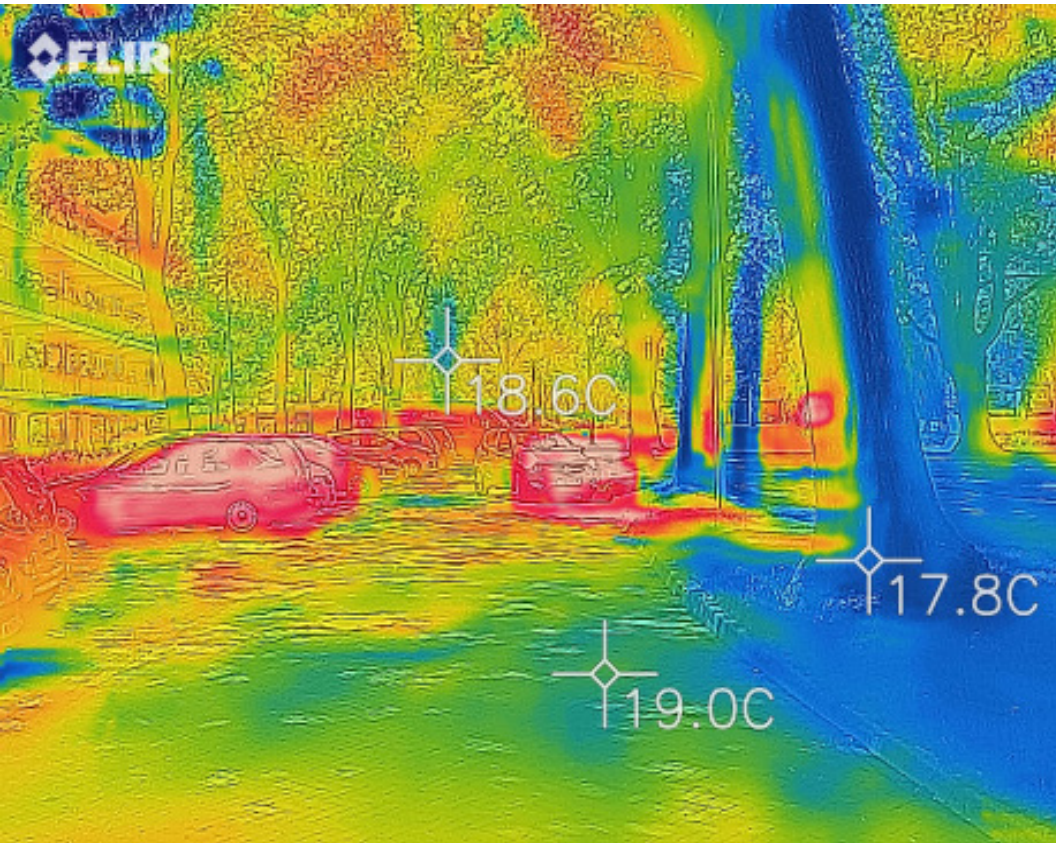


FIGURE 12



## 4.7 CONCLUSION

Figure 13, the last image of this study, illustrates all of the insights. The shadow on the right side of the photograph is produced by a green structure made out of trees. Temperature on the floor reaches 57.1°C when weather forecast marked 27°C. This is a 30.1°C difference.

Further research needs to be explored in temperature on neighbourhoods with different characteristics, this study only covers surface temperatures but did not measure the overall temperature perceived by the people. This study only shows the impact that a hot day can have in our built environment's temperature. Extreme heat is deadly and with this technology it is possible to see the real increase in temperature and identify hotspots around our streets in order to propose solutions to this increasing problem.

20° C is only an average temperature for a summer in the Netherlands, this first field research unveiled three powerful insights, first to identify how hot can the city actually get in spite of the weather forecast. Second the drastic temperature change from one surface to another, opening up the possibilities to micro climates in street level. And thirdly the effect of greenery in cooling down areas.

Many other factors affect the temperature of the surfaces, the material itself is one, but there is also wind directions, orientation of the buildings, shadows and the time they've been exposed to direct sunlight. Thermal imaging is used mostly in construction by technicians to indicate heat leaks in thermal insulation. By first identifying the heat difference there is already an awareness created by the visualisation of the heat instead of it being only a sensation.

The possibilities offered by thermal imaging in an urban context are many. Technicians use the phrase "See the heat, solve the problem" and that is exactly what this technology can provide to the Urban Heatwave wicked problem. The first step is to see the heat. We can see it now. How do we show it to the rest?



FIGURE 13 .DELFT, TAKEN ON JULY 31 AT 14:00. TEMPERATURE 27°C



# CHAPTER FOUR

## KEY INSIGHTS

- 1** Surface materials like brick, concrete and asphalt can get extremely hot after being exposed to sunlight.
- 2** Greenery can project a shadow that helps keep temperatures low.
- 3** Vegetation cools down its surroundings. In spite of how big or small the green area is.
- 4** Building orientation also determines the surface temperature.
- 5** Water keeps temperatures low but does not transmit it to its surroundings.
- 6** Microclimates can be created in the urban environment.



# CHAPTER FIVE

## **DESIGN DIRECTION**

# 5. DESIGN DIRECTION

## 5.1 RED CROSS ASSETS

The Red Cross is an organisation with a world-wide reputation. It has been around since the first world war and it is known and respected by many people around different countries. In order to design a strategy for such an organisation, it is important to identify its main strengths and assets, which are the following:

### 1. Trusted by the people

People trust the Red Cross, it is an organisation that inspires confidence (Charity Navigator) People believe the Red Cross does good and looks out for the interests of human health and safety.

### 2. Respect from governments and institutions

From many years the Red Cross has assisted governments before, during and after disasters, governments and institutions seek out for consultancy and advice from this organisation.

### 3. Interest of the private sector

Being a well known organisation, the private sector has big interest in working with them, the Red Cross has a big name that can open doors.

### 4. Big network of volunteers

The Red Cross has currently about 12 million active volunteers (IFRC 2020). Many people want to join their mission and help the vulnerable people around the world.

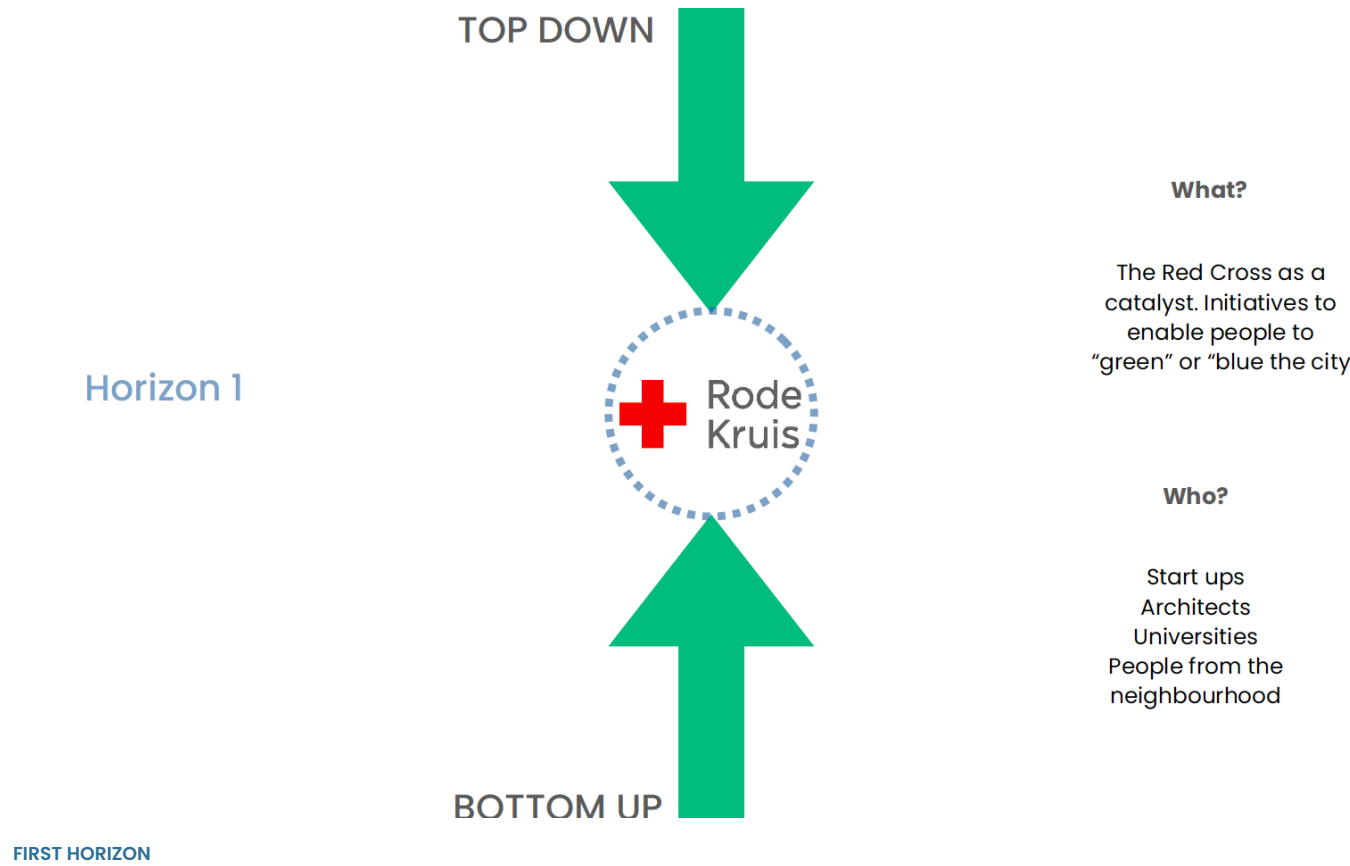


TOP DOWN-BOTTOM UP ANALYSIS

The organisation is highly trusted by the people, and at the same time it is profoundly respected by governments and institutions. This gives the Red Cross a strategic positioning to lead a project at an urban scale. Through an approach that combines bottom up and top down actions, it can be possible to empower the people to act upon urban heatwaves with the help of the Red Cross as a catalyst. At the same time, the organisation has the resources to generate top down change. It is through a combination of these two that systemic change can occur

First Horizon

As a first horizon, it could be beneficial for the Red Cross to begin a “middle out” action. Acting as a catalyst to enable people to take action on the climate crisis. Collaborating with architects, start ups, universities and people from the neighbourhood. The goal of the first horizon is to create awareness on the urban heatwaves risks but also on possible solutions that can involve citizens participation.



Second Horizon

Second and third horizon begin as reaction from the previous ones. Second horizon focuses on bottom up strategies, the use of tactical urbanism in the smallest scale to get solutions and give people ownership of their cities.

Third Horizon

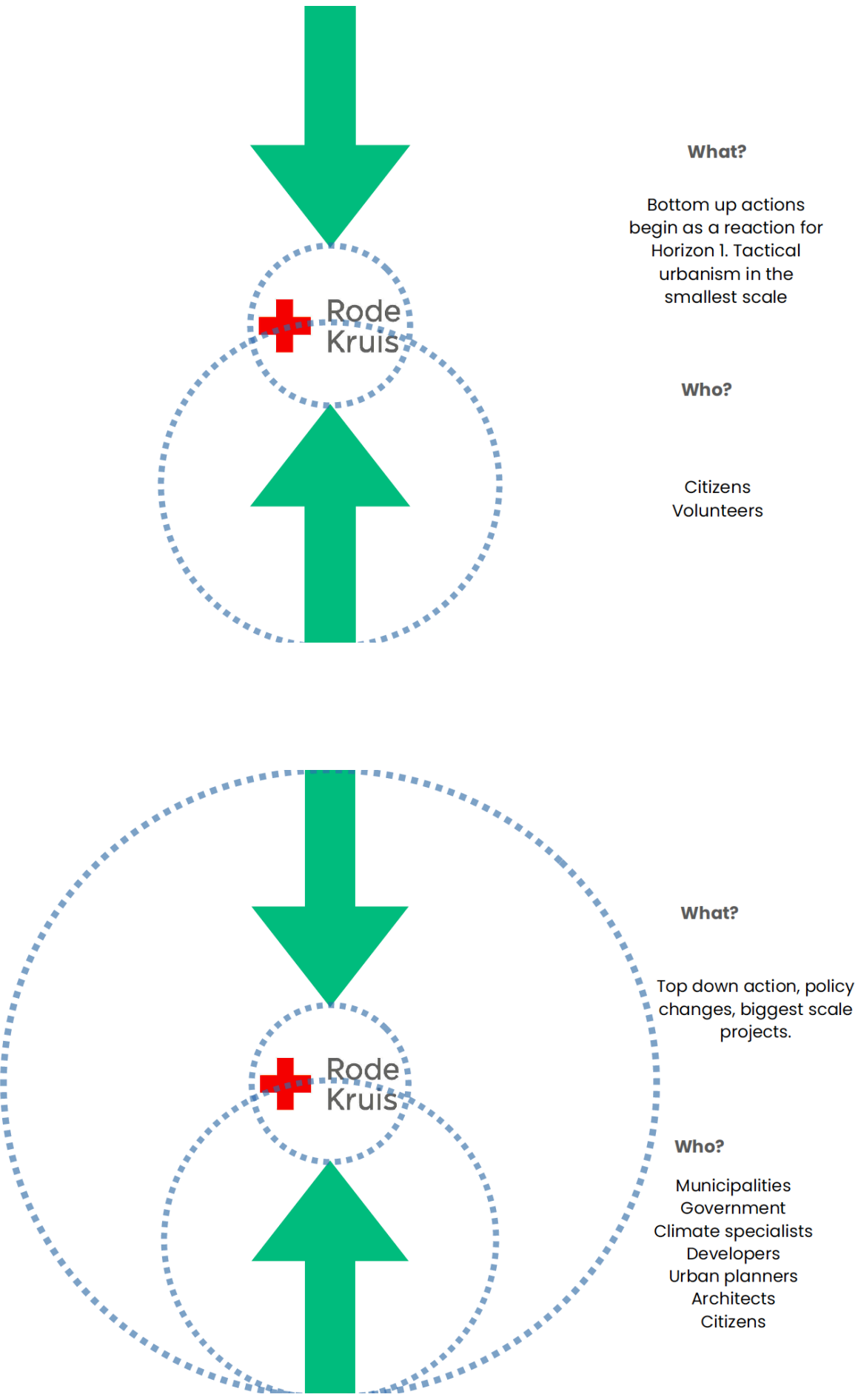
Third horizon tackles a top down action. Entering policy action and bigger scale projects, involving municipalities, government, climate specialists, developers, urban planners and citizens. Being part of a network of decision makers in the built environment.

Horizon 2

SECOND HORIZON

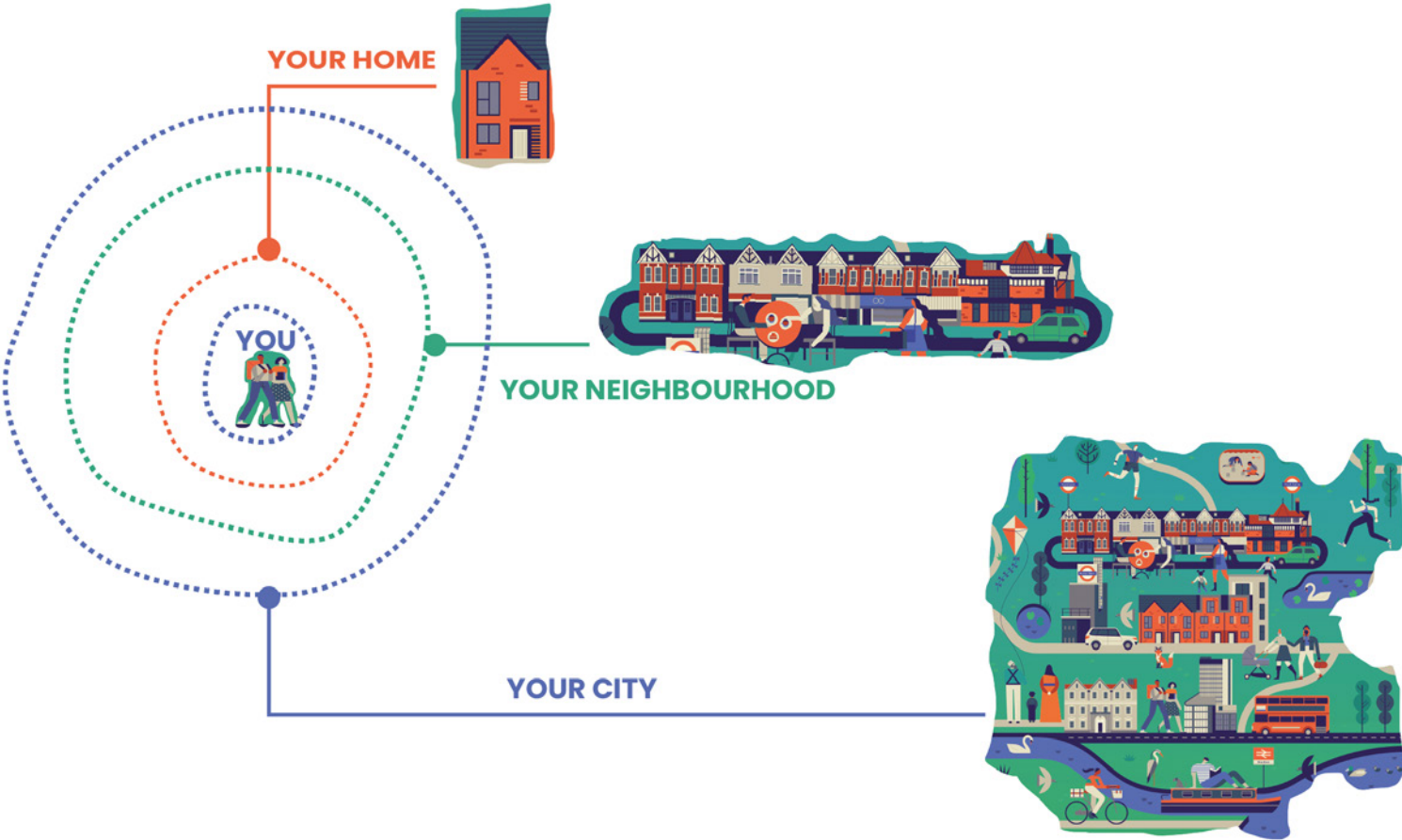
Horizon 3

THIRD HORIZON



# 5.2 HOW TO COOL DOWN

There are four levels in which advise for heat mitigation can be provided. The first one is for people to cool down themselves and the other three is to cool down their environments, as we go outside the circles the level of complexity increases. After yourself, the immediate environment to maintain fresh is your home, then your neighbourhood and finally your city.



## HOW TO COOL DOWN YOURSELF (WHO heat and health 2018)

- Drink water regularly
- Eat small meals and eat more often
- Wear light, loose-fitting clothes
- Wear a hat or cap and sunglasses
- Take cool showers or baths
- Stay in the shade
- Get help if you feel dizzy, weak, anxious or have in tense thirst and headache
- Identify a cool spot around you.



## YOUR HOME

### HOW TO COOL DOWN YOUR HOME (WHO heat and health 2018)

- Aim to keep your living space cool. Check the room temperature between 08:00 and 10:00, at 13:00 and at night after 22:00.
- Ideally, the room temperature should be kept below 32 °C during the day and 24 °C during the night. This is especially important for infants or people who are over 60 years of age or have chronic health conditions.
- Use the night air to cool down your home. Open all windows and shutters during the night and the early morning, when the outside temperature is lower.
- Reduce the heat load inside the apartment or house. Close windows and shutters (if available) especially those facing the sun during the day. Turn off artificial lighting and as many electrical devices as possible.
- Hang shades, draperies, awnings or louvers on windows that receive morning or afternoon sun.
- Hang wet towels to cool down the room air. Note that the humidity of the air increases at the same time.
- If your residence is air conditioned, close the doors and windows and conserve electricity not needed to keep you cool, to ensure that power remains available and reduce the chance of a community-wide outage.
- Electric fans may provide relief, but when the temperature is above 35 °C, may not prevent heat-related illness. It is important to drink fluids.



## YOUR NEIGHBOURHOOD

### HOW TO COOL DOWN YOUR NEIGHBOURHOOD (Red Cross Red Crescent Climate Centre 2020)

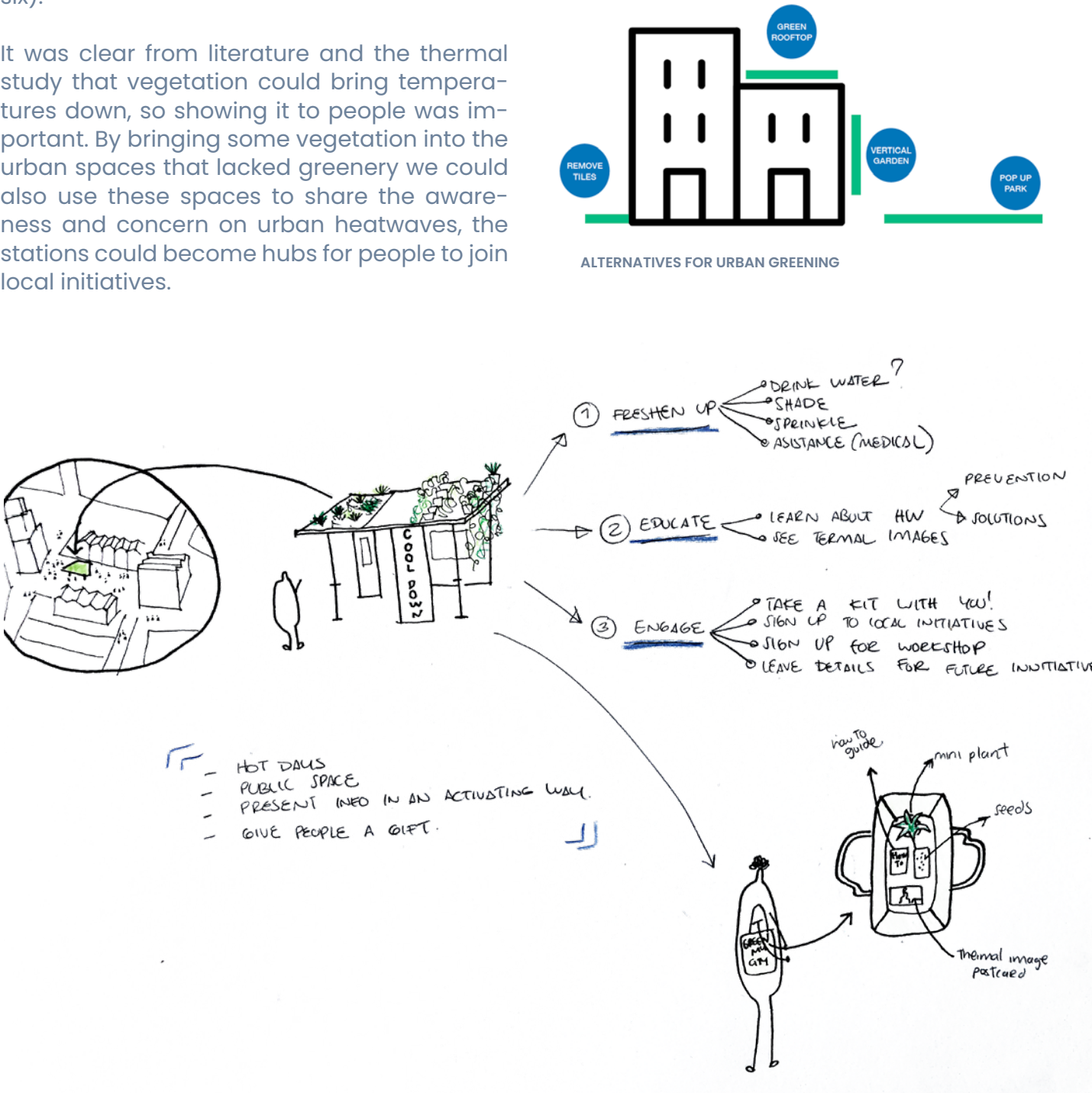
- Sheltered pavement and public spaces
- Urban greening
- Cool pavement
- Community participation
- Car-free zones
- Mainstream Heat rash into city planning



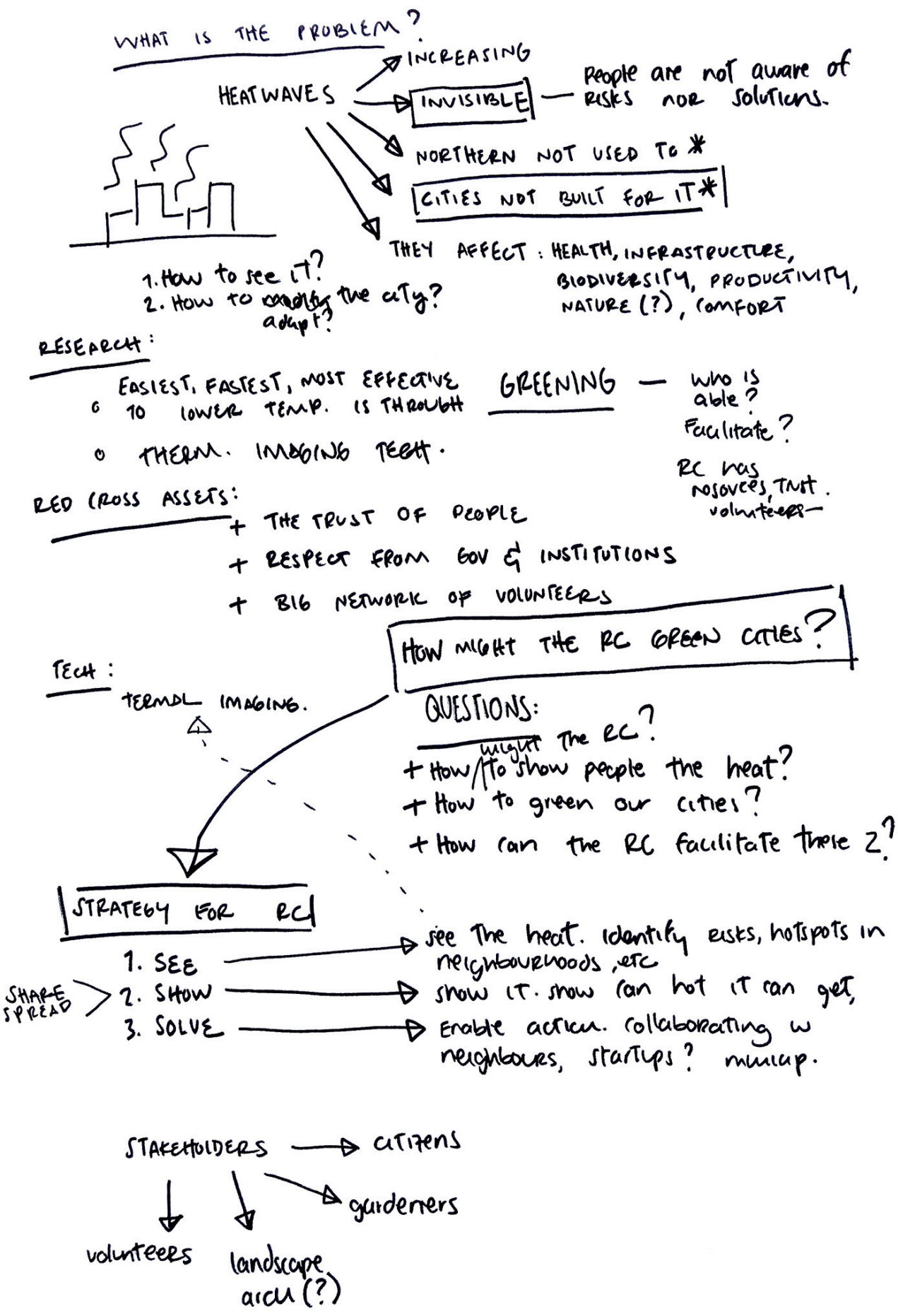
5.3 PROBLEM RE-FRAMING

At this stage of the project it was important to get an overview of all the data collected and start moving into some directions. The possibilities for urban greening were explored (See appendix for more on this ). By understanding what the underlying issue with urban heatwaves was, it became more clear that the solution had to be city based. The first problem that heatwaves present are its invisibility, so the first step was to be able to see them. Then sharing what we could see and finally doing something about it. This lead to a three step strategy for the Red Cross (See chapter six).

It was clear from literature and the thermal study that vegetation could bring temperatures down, so showing it to people was important. By bringing some vegetation into the urban spaces that lacked greenery we could also use these spaces to share the awareness and concern on urban heatwaves, the stations could become hubs for people to join local initiatives.



BRAIN STORM ON COOLING STATION



MINDMAP ON PROBLEM DEFINITION



# 5.4 CO-CREATION WITH GREENING PRACTICES

When dealing with a wicked problem such as urban heatwaves, it is useful to bring different parties to the table to listen to their experiences. Bringing vegetation to our cities has multiple benefits, therefore multiple parties with the same goal.

A co-creation session was held in the offices of Humankind, an Urban

The objectives of the session were:

- a) Meet partners with a shared purpose
- b) Ideate and exchange thoughts on the three step strategy (see Chapter Six) for the Red Cross
- c) Find where in the three step strategy we can collaborate with these parties
- d) Ideate on prototype stage to build “cooling pavilion” (see Chapter Six)



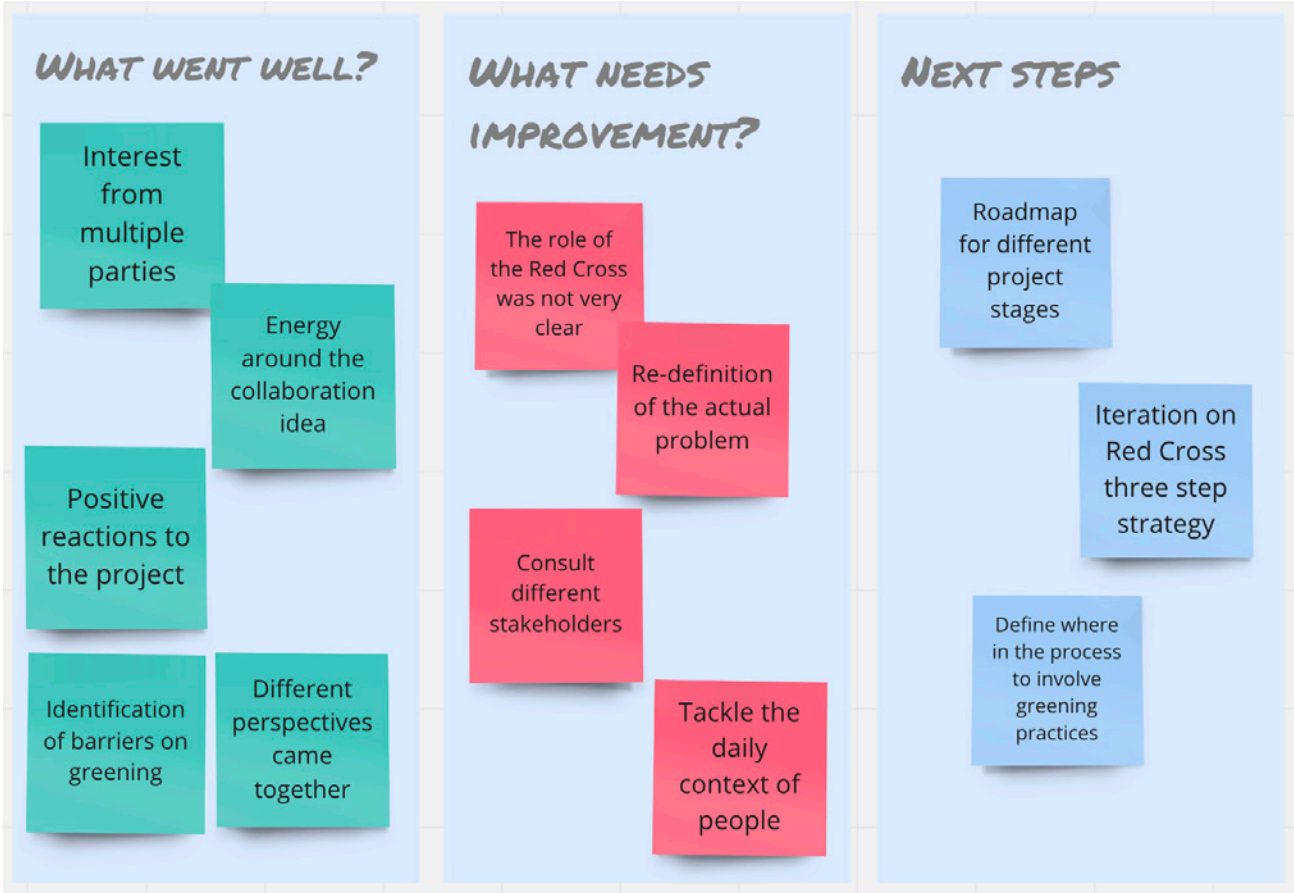
**Humankind**  
Is an urban agency specialised in accelerating urban change towards cities that are human and kind to ourselves, others and our planet

**The pollinators**  
They strive for a healthy living environment for pollinating animal species through local initiatives.

**The rooftop revolution**  
Who act as experts, advisors, process supervisors and intermediaries in sustainable green roof projects.



## SESSION RETROSPECTIVE





# 5.5 LESSONS FROM A PANDEMIC

On the 11th of March 2020 the World Health Organisation declared a pandemic after the outbreak of Covid-19. The virus was found in more than 188 countries and measures were taken by different governments around the world. The majority of the countries opted for a lock down of their inhabitants, with lifestyles changing from one day to another, and with this pandemic in the beginning of this project, some lessons regarding people’s relation with the city and public realm have been distilled :

The importance of city’s public spaces

Ownership of the streets

Action taking for long term benefits

“We are in this together”

The power of the masses

The importance of communities

Research-based decision making

## The importance of city’s public spaces

People have been forced to stay home. They have been taken away their “right to the city” and it is during this days people have noticed the benefits of streets, public squares, streets and other public infrastructure’s value to their daily lives. (O’connor 2020)

## Ownership of the streets

Without access to the big public spaces, people begun to take over their streets, in cities all over the world streets stopped belonging to cars and turned into tennis courts, football fields, skate arenas and picnic squares.



SPAIN DURING LOCKDOWN

## Action taking for long term benefits

Covid-19 has modified the way we see pre-vention. It is usual for people to make decisions that generate short term benefits (Sunstein &Thaler 2009) however, national response and governmental regulations have made that hard. Most people have coped well with the temporary trade-off for a long term benefit, which in this case is reducing the curve.

## “We are in this together”

A “We will be able to hug each other soon” campaign circulated around the internet, messages of hope in the streets with coloured chalk on sidewalks and hourly claps from neighbours to health workers have shown a solidarity union and given a sense of belonging. Climate change can do the same.

## The power of the masses

The difference that a single person’s actions can make has been highlighted during this pandemic. Big changes can be done by one person if there is people who follow the same direction.

## The importance of communities “You’re as healthy as your neighbour”

Neighbours have played a crucial role during pandemic times. Flyers around buildings from neighbours offering to do groceries for people who “could feel they might be sick” in order to prevent them to do outside and spread the virus. In addition, a feeling of companionship, even from confinement.

## Research based decision making

Most governments around the world have put science first and made decisions based on true facts rather than political interests. People at home have been careful to inform themselves with research based facts. Problems like this pandemic require experts. (Unicef 2020)

We can take these lessons to implement a strategy towards Climate Change. It is a good moment to act, these and more lessons are still fresh in people’s minds. The climate emergency can be tackled in some ways the same way that societies tackled this pandemic. More than ever people might be willing to cooperate for the greater good, for their neighbourhoods and for their cities.



# CHAPTER FIVE

## KEY INSIGHTS

- 1** The Red Cross has four big assets: volunteers, government respect, trust from people and interest from the private sector.
- 2** The organisation is in a strategic position for bottom up and top down actions
- 3** There are three levels for cooling down: Yourself, your house and your neighbourhood
- 4** Advice from organisations does not usually mention vegetation nor neighbourhood action
- 5** A physical structure with vegetation can offer people information on how to cool down in the three levels
- 6** Organisations are interested in participating, however the Red Cross' role needs to be more specific

# CHAPTER SIX

## **DESIGN STRATEGY CONCEPTS FOR HEATWAVE MITIGATION**



## 6. DESIGN STRATEGY CONCEPTS FOR HEATWAVE MITIGATION



**SEE  
SHARE  
SOLVE**

As a strategy to mitigate the effects of urban heatwaves a three step approach is proposed. The three steps involve different assets from the Red Cross and along the way suggest different collaboration with organisations, government and citizens. To kick off the project the steps shall be followed in order, however once the main structure has been set up, each step can be scaled up in parallel.



# SEE

## SEE THE HEAT

The first step to approach this wicked problem is to **See the heat**. The thermal imaging technology offers multiple possibilities to collect immediate data of the temperature in the surfaces around the city. With this technology is possible to identify the “danger” zones around the built environment. With the ability to see the heat, it is possible to create heat-maps of the neighbourhoods and use this data to identify safe routes for vulnerable groups during extreme heat but also this layer of information can indicate which “hot-spots” need interventions to reduce the temperature.

See the heat also includes identifying the risks. With the support of the Climate Centre the Red Cross can continue the collaboration on the Urban Heatwaves and continue the research on risks and mitigation.



**Stakeholders involved:** Red Cross volunteers, tech startups, Climate Centre.

**How:** For the first step it is crucial the Red Cross provides volunteers with the thermal cameras and guides them on how to map areas in the cities. After the data collection follows the mapping of the coolest and hottest areas in the zone for two purposes:

1. The hottest areas are “danger zones” and these are identified to avoid but also mapped out to improve in the future, the data can be shared with governments and municipalities for action to be taken.

2. The coolest areas will be mapped out to get an overview of safe zones and identify alternative routes vulnerable citizens can take through their cities using existing infrastructure.

**Long term:** Photogrammetry and Flir drone for bigger scale and more efficiency.

**Assets:** Big network of volunteers, experience in mapping danger zones, trusted by the people.

**Limitations:** Weather is a complex phenomena to map, sun inclination varies according to the season of the year and shadows behave differently, wind currents and the energy consumption of buildings surrounding the area also play a role in the temperature, the mapping of the areas will require collaboration with institutions specialised in climatology and data collection should be collected in different periods during the summer to avoid misinformation on hot and cool zones.



HOT AND COOL ZONES



# SHARE

## SHARE THE DATA, SHOW HOW HOT IT CAN GET

After identifying the hot (risk) and cool (safe) areas **spreading the information** is the step that follows. Showing how hot it can actually get is important to generate awareness around the issue. As mentioned before, one of the biggest threats of heatwaves is that they are silent and invisible. Showing the temperatures around people's neighbourhoods unveils a layer of information that is currently unseen.

Sharing also includes the spread of information about actions people can take to stay safe. **This stage of the strategy involves sharing advice for citizens how to cool down themselves, their homes and their streets.**

**Stakeholders involved:** Red Cross volunteers, municipalities, urban studios, architects and designers.

**How:** Building a physical structure in the city to get people's attention. These **"cooling stations"** will provide citizens with a space to cool down in the middle of a hot summer day and will also provide the information on how to cool down the environment around them (house, street, neighbourhood).

These cooling stations will form part of the network of city "cool spots" previously identified with thermal imaging. The placement of the structures will depend on the thermal conditions of the area.

The design of the cooling stations will be set up to an architectural competition, an open call to design these spaces will be launched through the Red Cross platforms and will provide the contestants with design principles these stations should follow. The design principles come from the result of the insights obtained in the step one.



By sharing the hot and cool spots around a city, we can generate cool networks to move around town and plan safe routes for different users, these routes can include not only the identified cool zones and the cooling stations, but also public buildings that can offer shade or a refreshing environment such as libraries or community centres.

**Assets:** The good relation with governments and municipalities, the access to the vulnerable, big network of volunteers, the interest from the design industry in humanitarian action.

**Limitations:** The platform to share this information will be a challenge. Users already have a navigation app. A collaboration with a meteorological app should be considered.



SAFE ROUTES ALTERNATIVE THAT INCLUDES COOLING STATION



# SOLVE

## SOLVE THE PROBLEM

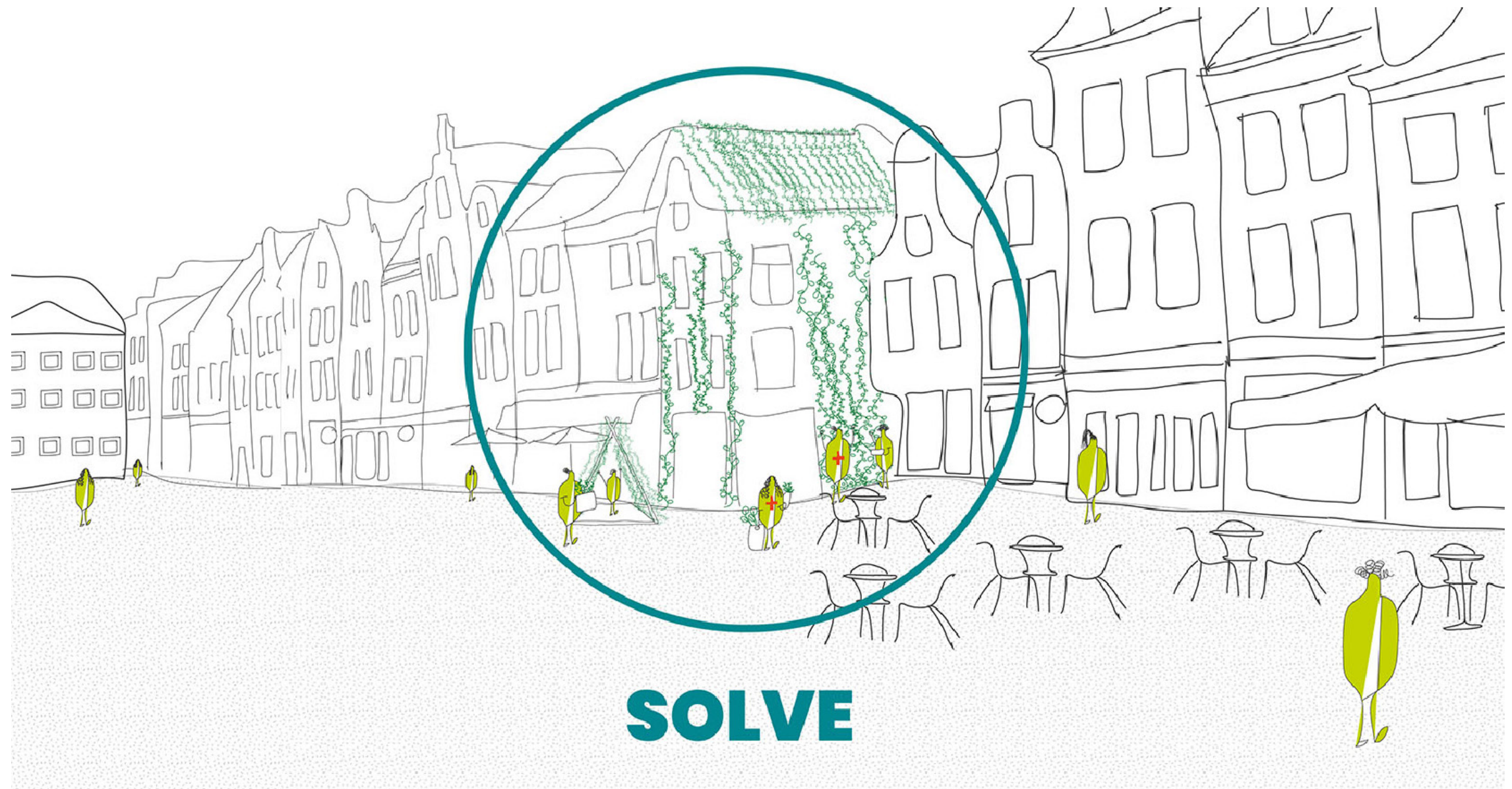
The last step of the strategy is a **call to action and the time to get things done**. For this stage the Red Cross has already collected data on specific areas of the city, spread awareness and shared shelter. From literature and the thermal imaging study, we know that **vegetation helps bring temperatures down in the city**. What comes next is for the Red Cross to act as a connector, where the organisation connects the citizens or municipalities with businesses and organisations who's purpose is to bring vegetation to the urban environment. The different organisations have different focuses like green rooftops, vertical gardens, tiny forests, green facades, biodiversity focused, etc. And each one operates with a different business model. The Red Cross can provide volunteers to help green the urban environment.

**Stakeholders involved:** Greening startups, municipalities, neighbours and Red Cross volunteers.

**How:** The Red Cross will provide volunteers to join this organisations and together with the communities, facilitate the vegetation spread according to each individual's preference based on the resources they can invest in the process of greening the city.

**Long term:** A big network of various experts that connects internationally to provide assistance on areas where there is a lack of knowledge or experience in developing economies.

**Assets:** The ability the RC has to mobilise communities, the trust that people have in the organisation, the interest of the private sector.



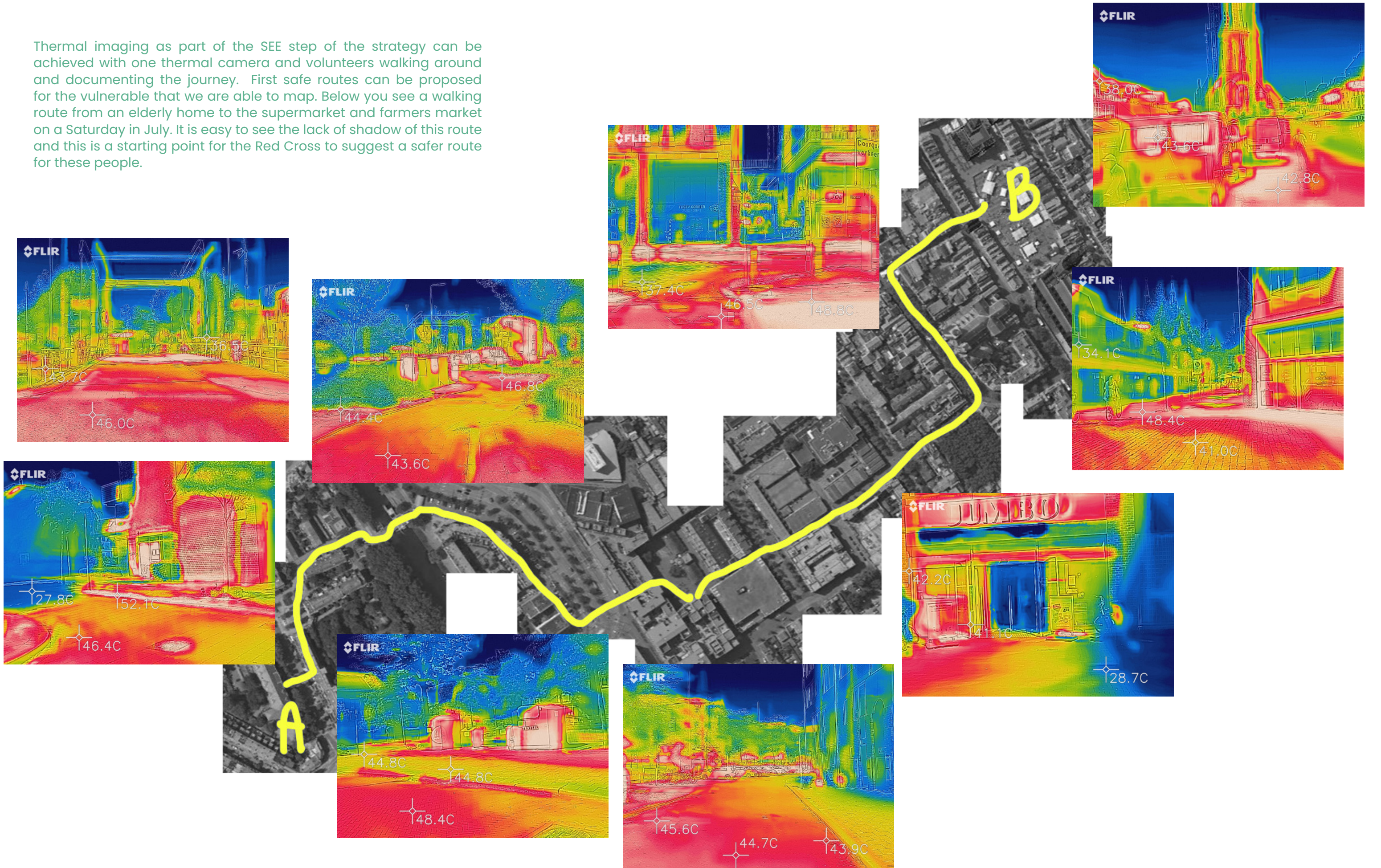
**Limitations:** The Red Cross needs to be careful with the networking of organisations and start ups in this stage since their image is important to be kept and they can not engage with malpractices. Another limitation is the citizen participation in developing economies, in a Dutch context we can expect citizens to engage and have time or interest in helping out, but in other economies in which people have other things to worry about this will be a challenge. A possibility is to propose citizen action that can offer a side benefit, such as orchards to grow their own food, or growing flowers to later sell are two examples.





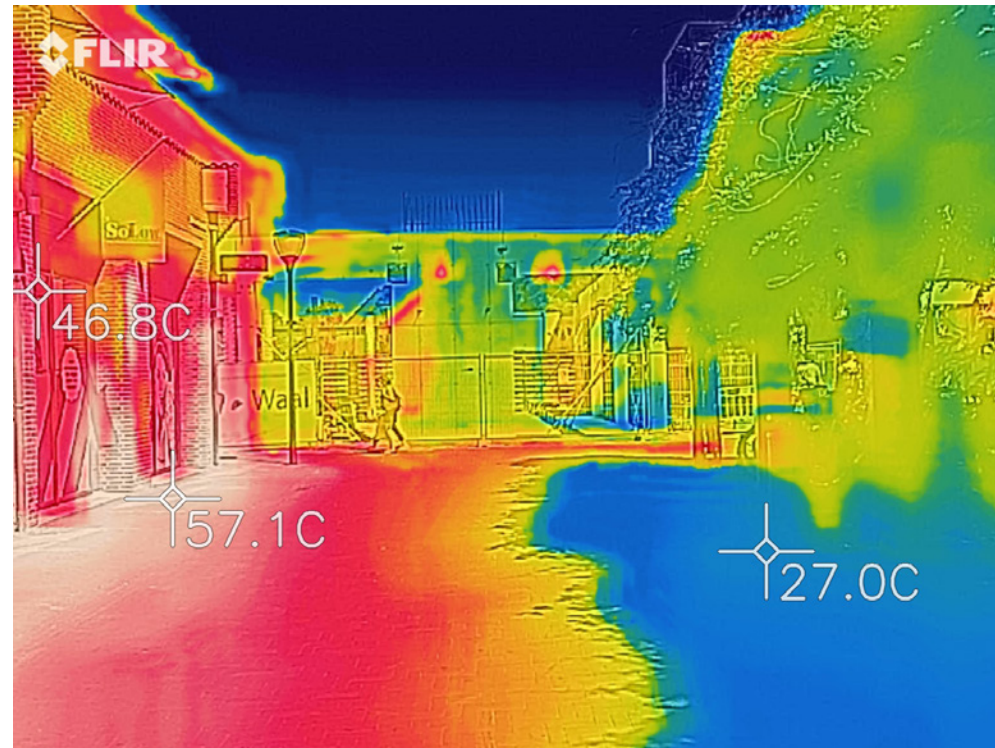
## 6.2 SEE – THERMAL IMAGING IN THE CITY

Thermal imaging as part of the SEE step of the strategy can be achieved with one thermal camera and volunteers walking around and documenting the journey. First safe routes can be proposed for the vulnerable that we are able to map. Below you see a walking route from an elderly home to the supermarket and farmers market on a Saturday in July. It is easy to see the lack of shadow of this route and this is a starting point for the Red Cross to suggest a safer route for these people.

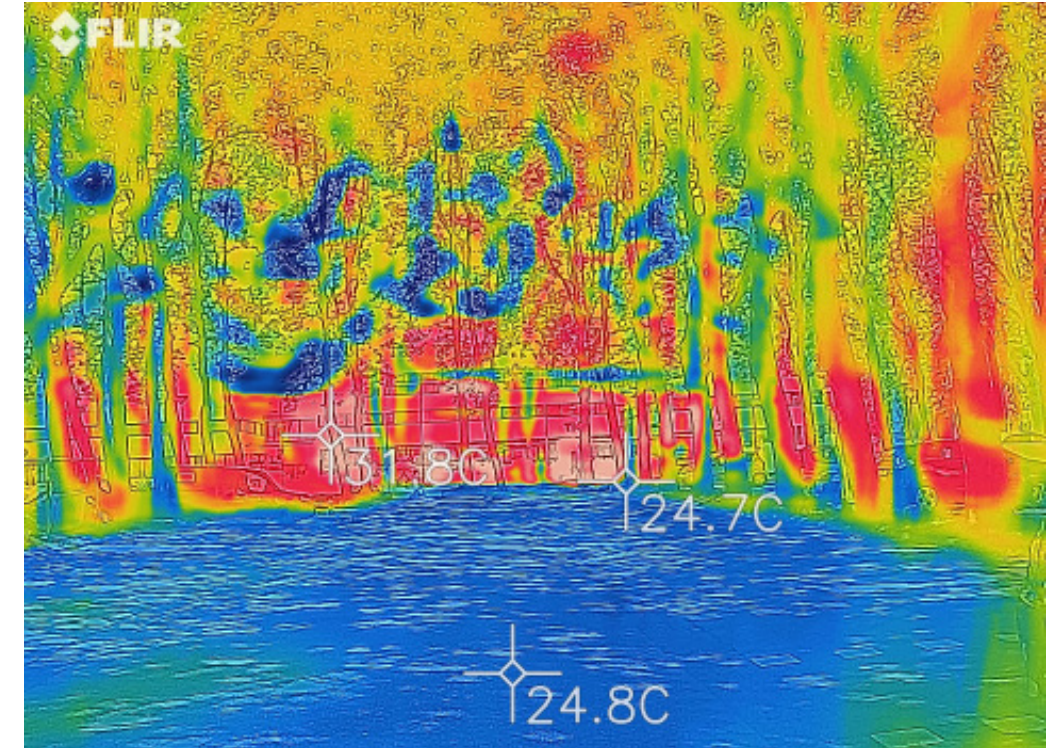




In addition to finding danger areas, it is also possible to identify existing cool spots that have a different function for now. In this page you see two spaces in Delft which have vegetation shadow and surface temperatures stay below 28°. However, today these spaces are used as parking lots for cars and bikes. These spaces can be reused during hot summers and offer shelter for people.



In these spaces, cities could explore temporary structures or urban furniture that is inclusive for everyone in the public realm, pop up restaurants or playgrounds for children to play under the shadow during a hot day. It is important to include existing infrastructure, as we can see here, there is no need to build a lot more, only change the use of the space.





# 6.3 SHARE – COOLING STATIONS

## 6.3A DESIGN PRINCIPLES

Through literature review, interviews and the thermal study carried out for this research, six design principles have been developed for the cooling stations. These principles will ensure thermal comfort inside of the cooling stations and will act as a guideline for further designs related to the extreme heat climate emergency.

### 1. Let it flow

Allow two opposite sides of the structure to be open in order for air to flow from one side to the other of the space. Crossed ventilation allows for constant air changes in order to reduce internal temperatures. Large openings provide greater ventilation that causes thermal equilibrium. Warm air is lighter than cold air. Sun breakers are mechanisms for natural ventilation, they can also regulate light and sun.

### 2. The floor is lava

Flat surfaces are exposed to direct sunlight more than vertical or inclined planes. This is the case of floors and roofs. In addition, flooring in cities is mostly stone, asphalt or concrete. These materials reach temperatures of above 60°C (Stache et al, 2020)

### 3. Context adaptation

The design must respond to its context. Local materials, local environment, weather, and people are things to consider when designing for a specific context.

### 4. Green is cool

Urban greening is an effective method for the reduction of heat in the built environment (Voiland, 2010). Vegetation in urban environments lowers down the air temperature locally up to 8.4°C at 10 cm above and 2.5°C at 70 cm (Stache et al, 2020).

### 5. Allow it to multiply

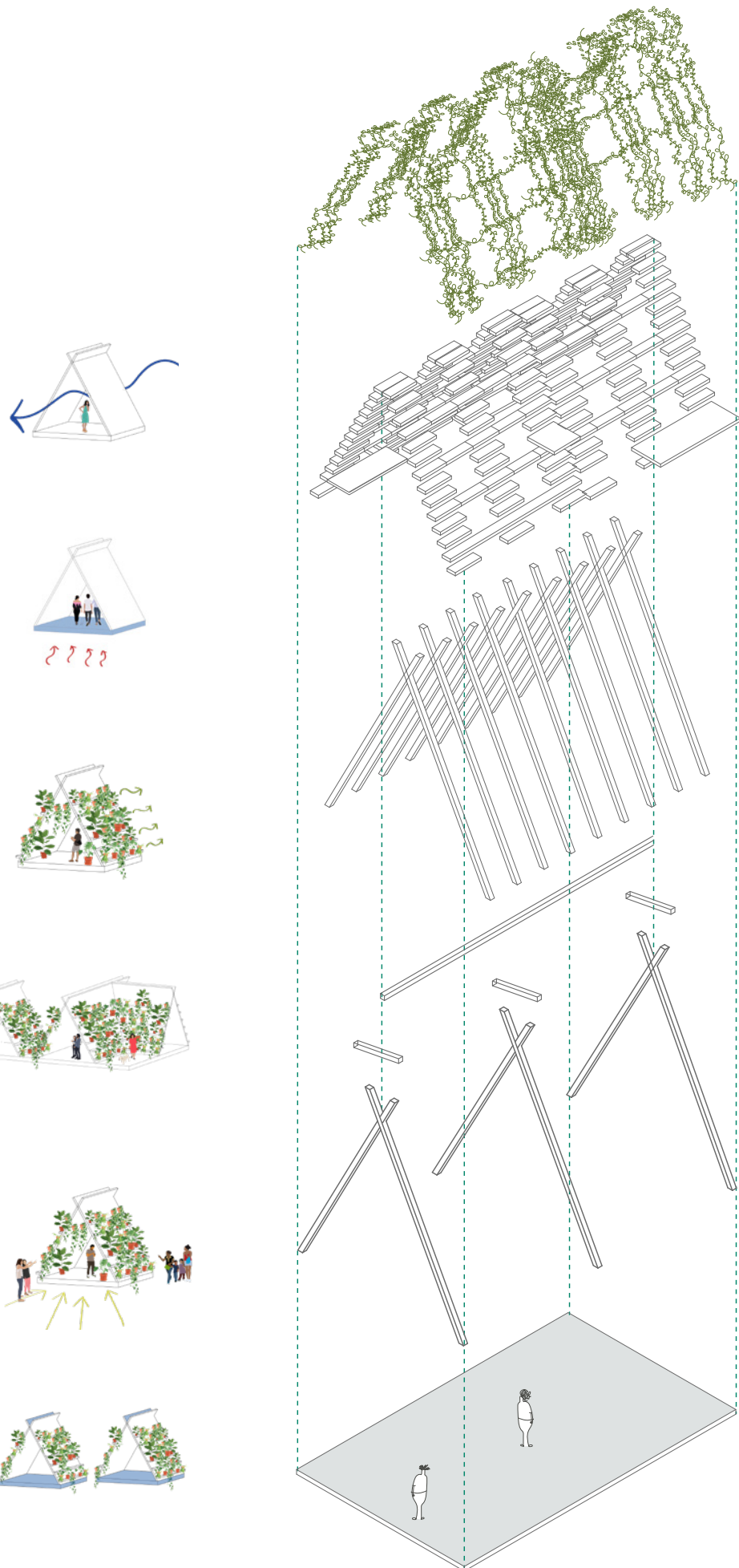
The size and program of the stations might change according to its location across the city. It is important that these structures have the ability to expand or reduce their size accordingly. Modules allow for flexibility.

### 6. Belongs to everyone

The city belongs to all. The cooling stations should be inclusive and welcoming, by being in the public space it automatically allows for appropriation. The design should be inviting and open for people to join.

### 7. Multifunction is sexy

Utilising these spaces for more than cooling down is another principle. Think of second uses when it is not very hot, like rain protection or a place to eat and meet with people.



## 6.3B A COOLING STATION FOR THE NETHERLANDS

As part of the pilot of the strategy for the Red Cross, the design of a cooling station in the Netherlands is proposed. The design follows the principles previously established as well as a simple shape. The inspiration comes from a teepee structure, which was originally used amongst nomads for its simple construction and capability to move from place to place.

The triangular shape allows for scaling up and down according to the needs of the space. The wooden beams besides acting as structural components, function as benches for people to sit as well as plant holders. The layer around the cooling station is vegetation.

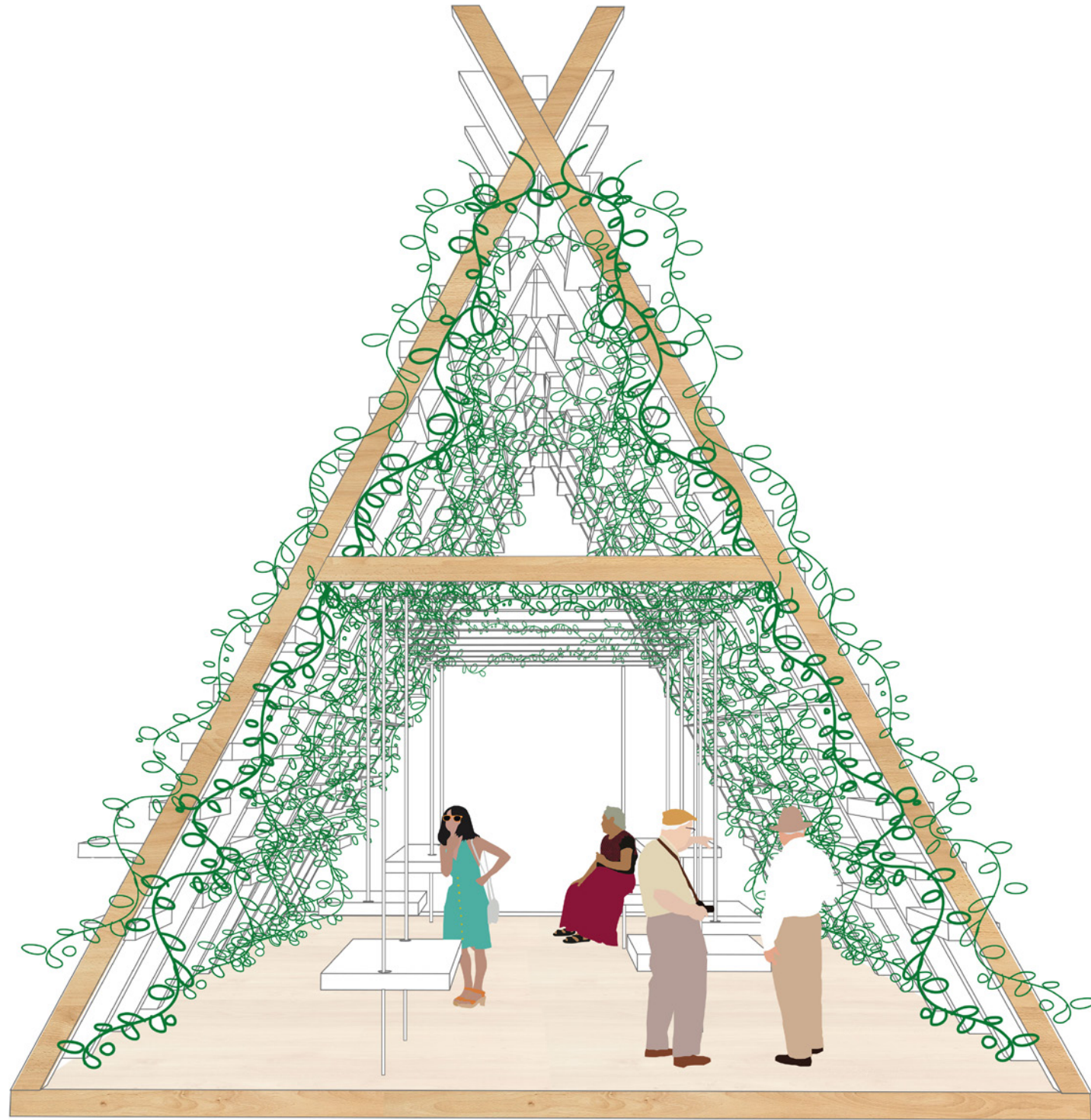
Creeper plants can be selected and planted five or six months before the summer period. If such time is not available, pots with grown plants can be placed in the wooden beams. The station is open on both sides, allowing air to flow and creating a big entrance that invites people to come in and join the refreshment under the cool shadow.

The structure utilises wood as its main material and vegetation as a second one. The life of the station depends on the use and the placement of it. The station can be demounted and the wood can be given a second life.

The main intentions of the cooling station are :

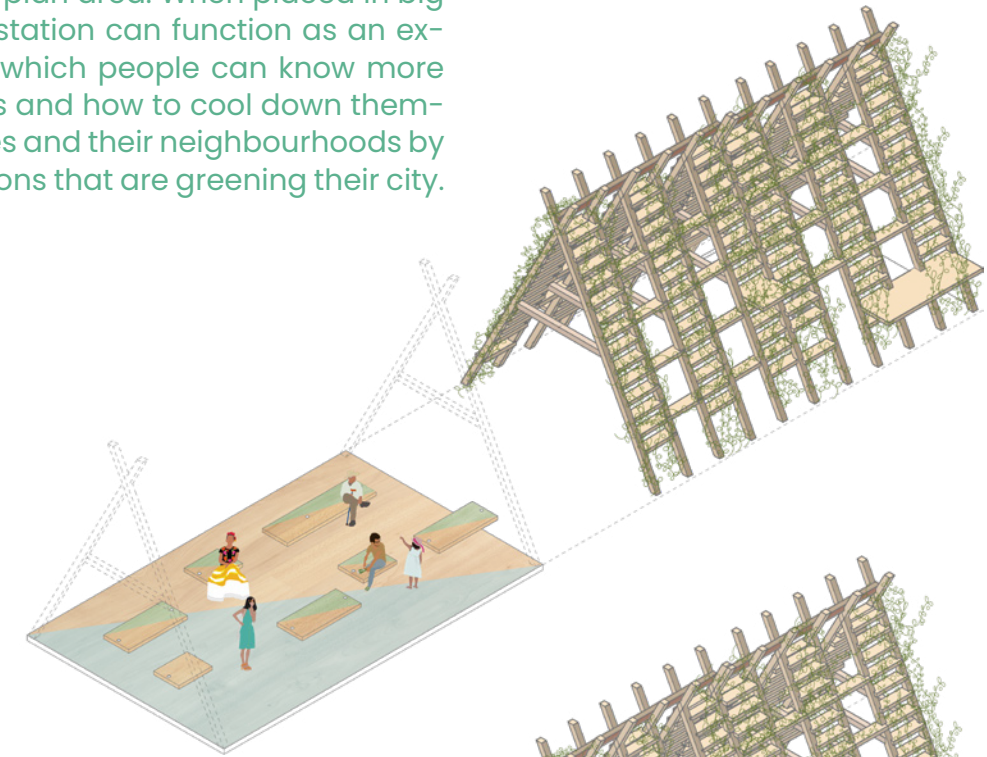
1. Provide shelter during hot days of summer to people in the city
2. To inspire users to build their own. Whether it is a small fort for children, a neighbourhood orchard, a shadow area for construction workers or a big structure for a music festival.



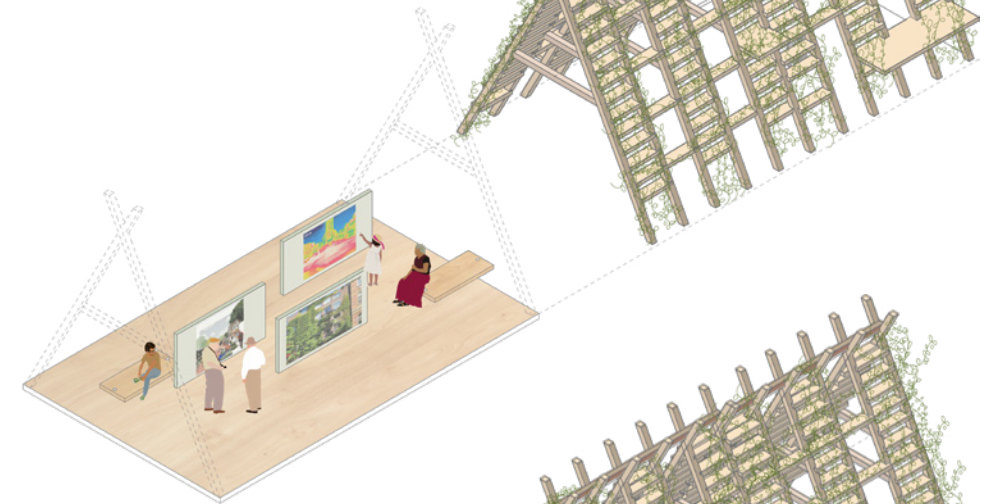


The interior of the station offers benches that are hanging from the horizontal beams. These benches are placed at different heights and can be moved if the space requires it. The interior is flexible in order to allow activities inside to change according to the user needs.

The flexibility of the interior allows for the space to become a free plan area. When placed in big public areas the station can function as an exhibition space in which people can know more about heatwaves and how to cool down themselves, their homes and their neighbourhoods by joining organisations that are greening their city.



A PLACE TO SIT DOWN AND REST



GALLERY



FREE SPACE

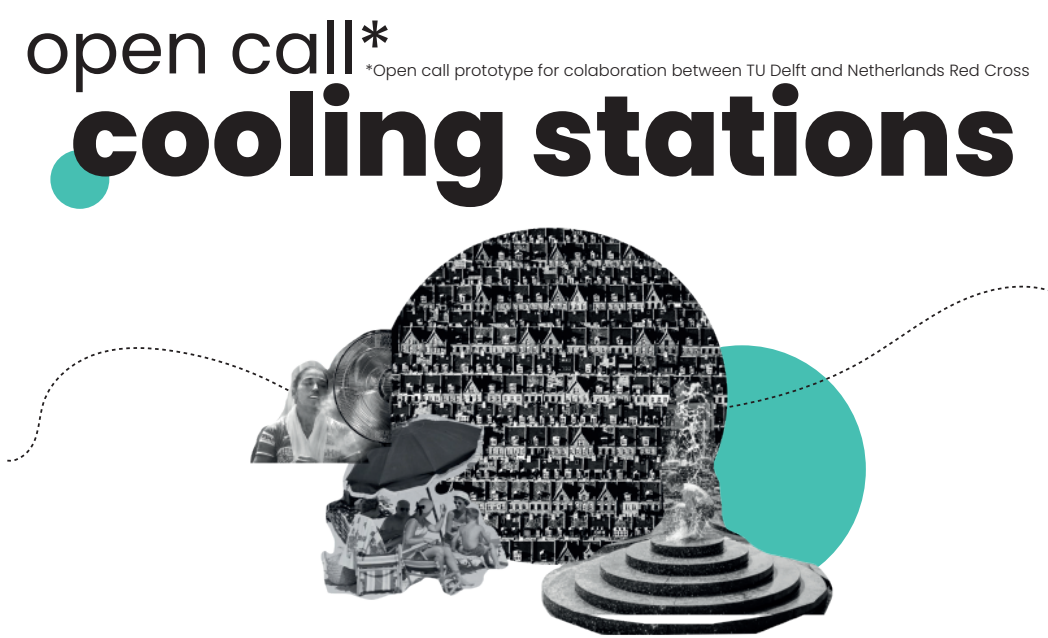


6.3C ARCHITECTURE COMPETITION

To follow the design principle “Context adaptation” an architecture competition is proposed. An open call for designs is sent out to receive different proposals from people around the world. This way the Red Cross can find the ideas that best work and put them into action.

For this project an architecture competition prototype was developed. Sixteen proposals were submitted. See the appendix at the end of this report for the full submissions.

This prototype explored the interest in the architecture community within the humanitarian sector and the diversity of proposals. It is important to mention that the participants belonged to a similar context and shared the same education institution. The submissions were diverse and participants showed a genuine interest in collaborating with the Red Cross under the subject of urban heatwaves.



**Intro** Urban Heatwaves are extreme heat forms, a period when temperature is unusually high and dangerous to human health and well-being. This phenomenon takes away thousands of lives and one of the biggest dangers is that it is an invisible killer. Heatwaves impact health and livelihoods but also service provision, nature, infrastructure and economy. Cities face a unique vulnerability due to the Urban Heat Island effect (UHI). Factors that make cities hotter are the amount of asphalt, building materials, air flows and the lack of vegetation, to mention a few. Most cities do not have the infrastructure to face this incrementing climate condition, placing their citizens at risk.

The Red Cross is a non-profit organisation who's vision is to prevent and alleviate human suffering. This is an international open call for ideas on “cooling stations”, structures to be placed in the city in order to provide shelter for the vulnerable people during a heatwave.

**What** Cooling stations are structures to be placed in the city in order to provide a refreshing space for citizens during a hot summer day. **The competition deliverable is an A4 Portrait** with a sketch, axonometric, collage or any other representation of the idea and a brief text explaining your concept.

**Why** The elderly, children, pregnant women, people working outside and people with pre-existing medical conditions are the most vulnerable, the built environment belongs to the people and this is a way to make sure we are accessible to all groups.

**Where** The current context is The Netherlands, but the big plan is to find solutions for different cities around the world.

**When** July 26

**How** The programme of the stations needs to take into account the following:

- The space should be inviting for people to walk in
- Shade is an important element
- Space for people to stay, rest and hydrate
- Budget is not limiting at this stage, but important to note the Red Cross is a charity
- Surfaces : Dark materials absorb heat, making surfaces hotter than light coloured materials. Vegetation helps bring down temperatures due to their transpiration process.
- After summer: Can the station be designed to serve a multi-purpose? Or is it a pop-up structure?

OPEN CALL POSTER FOR PROTOTYPE

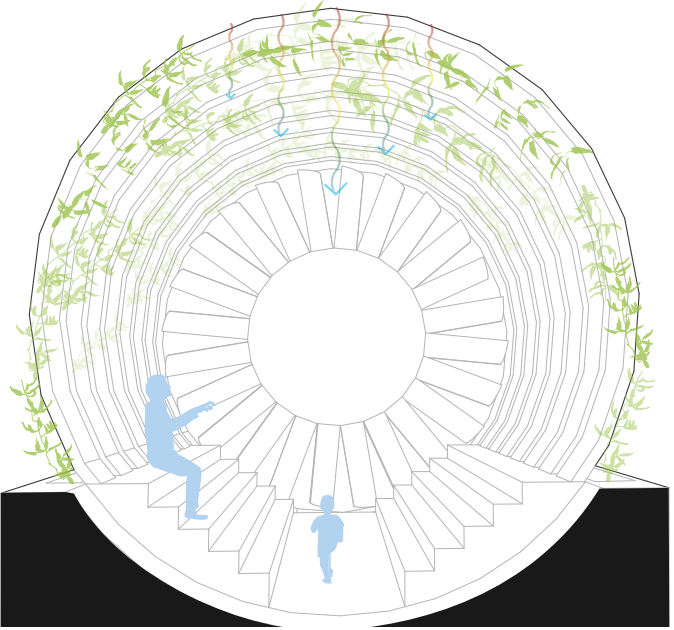
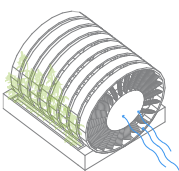
COMPETITION SUBMISSIONS

PROPOSAL BY ALEJANDRA KAPLUN

Urban windmill

Inspired by the famous windmills in the Netherlands, the urban windmill uses a fan-like system that allows air to flow. Plants can grow in the pots located on each side, the vegetation will help reduce the temperature while adding humidity to the air.

With its spacious seating area, the urban windmill becomes the perfect place to rest from the hot summer.



PROPOSAL BY LAURA MONTAÑO

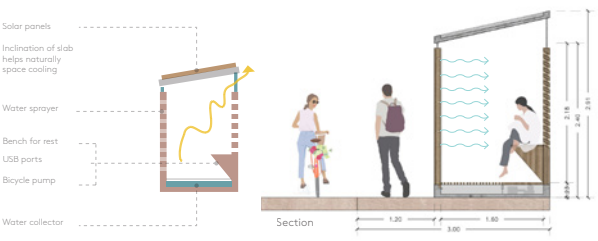
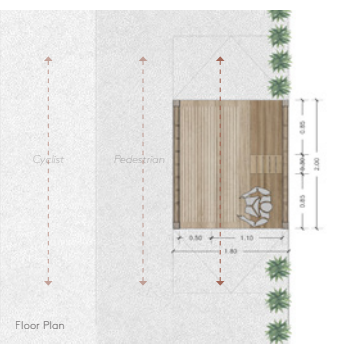
CHARGER

A module placed in the streets, at specific points with greater pedestrian and cyclist influx, to rest, hydrate, charge your devices and bicycle maintenance; is charged by two solar panels that in turn feed an internal motor that sprays water, the system pumps and reuses the internal water.

The inclinate slab directs the panels towards the ideal sun position and to recover rainwater. It is fully open on two of its sides for easy access, security and free air running. The other two structural elements have channels to distribute the water, with permeable layers to allow light to enter, as well as LED luminaires that generate a light box in the evenings and nights.

Inside the module are USB ports to charge portable items as well as a pump to inflate bicycle tires.

When there is no need to spray water for cooling, it becomes a place for charge your devices, bicycle maintenance, to rest and charge yourself with energy.



LET IT SLIDE!

To cool down, all you need is shade a bit of running water to freshen up the air. But bringing thermal comfort to the public arena allows for the opportunity to address larger issues of collectiveness and resource distribution. Making the shading canopies moving structures, creates the need to collectively decide how to use them, and where to set them. The public realm then becomes an arena to experiment, negotiate, and decide on how to allocate resources, in these case shade. This flexibility allows for multiple configurations, let in them overlap or nestle to create a more covered area, or distributing them to cover more ground.

**A SLIDING CANOPIES**  
Sturdy and weather-resistant moving structures, that create shade and help to bring the temperature down. Like nesting tables, this structure could be stacked together to occupy less surface making room for other dynamics to take place.

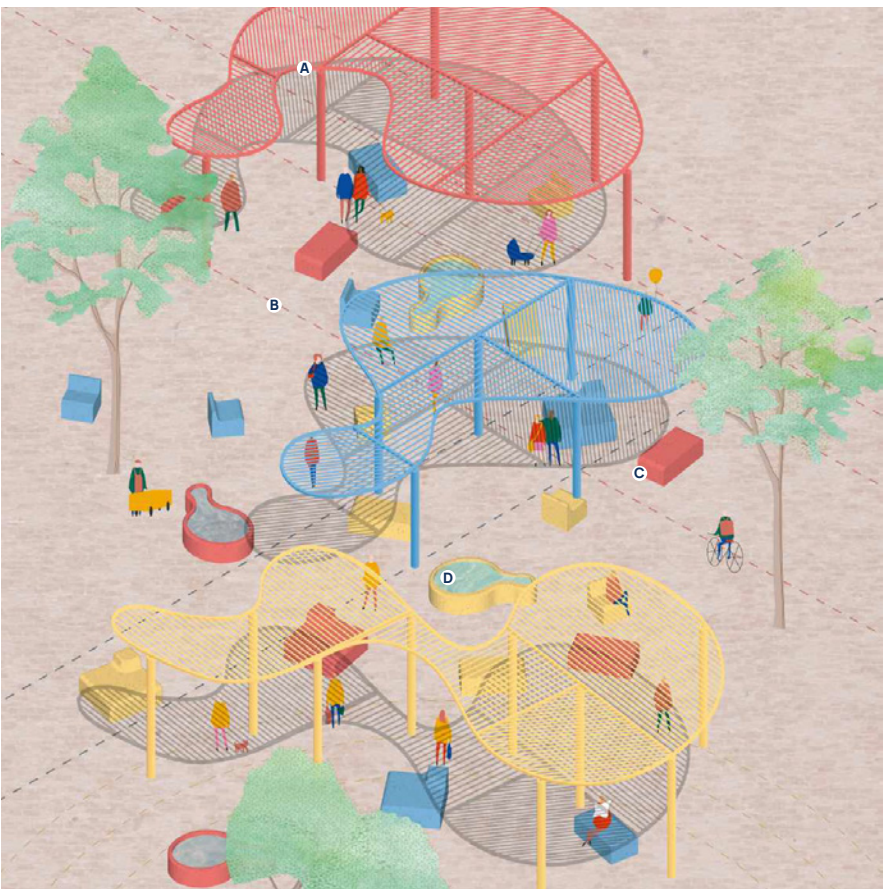
**B CANOPIES TRACKS**  
Tracks in the pavement make sliding the canopies easy and accessible, inviting the public to use them, move them around and make them their own.

**C URBAN FURNITURE**  
Inviting shapes and bright colors. Unprescribed objects that are simultaneously seats, tables, playgrounds, and daybeds.

**D WATER FOUNTAINS**  
Evaporative cooling can make an impactful difference to cool-down space, that combine with shade from the canopies, or surrounding buildings and trees create a microclimate.

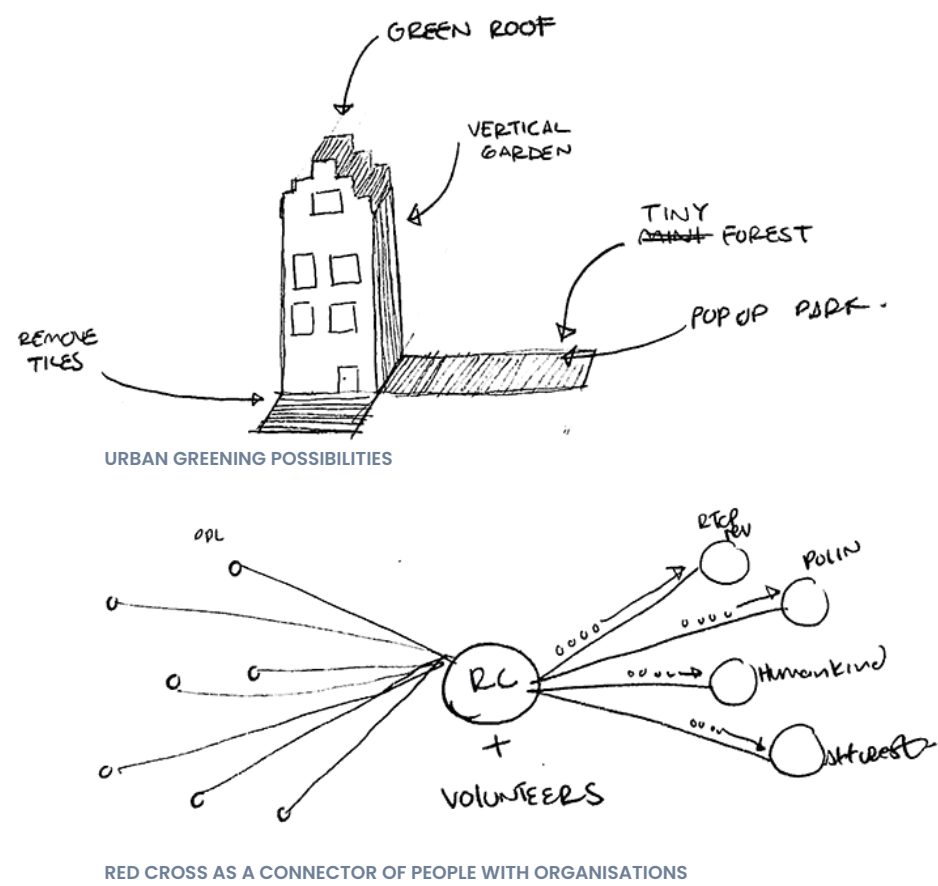
The public space should be pleasant and comfortable to be. This proposal aims not only to achieve that but to foster a sense of collectiveness and empathy; attitudes that are very relevant when addressing the larger issues that have to lead up to unprecedented climatic conditions.

PROPOSAL BY ARMANDO QUINTANA





6.4 SOLVE – GREENING THE CITY



Greening the city can be achieved collectively. The role of the Red Cross at this stage takes a step back and act as a connector and facilitator. By connecting people from neighbourhoods with the organisations that are working towards a more climate resilient city. The Red Cross can facilitate the greening by canalising interested people with organisations and offering volunteers to these organisations. A new target of volunteers can be requited, a group of people that care for their city, environment and planet. Volunteers can join these movements in their cities and together with the experts, mobilise communities to work together.

This part is crucial for the project to transcend. Strong communities have higher survival rates when disasters arise.

A phenomena like a heatwave can have avoidable deaths by having people that know each other and check on the loners, elderly and the most vulnerable. Through this greening activities not only neighbours can achieve less hot surfaces and lower temperatures during a heatwave or a hot summer period, but they can also strengthen their community by meeting their neighbours and collaborating together by building something.



CITY CENTER OF DELFT



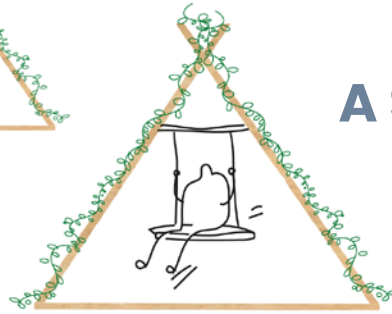
VISUALIZATION DELFT WITH GREENERY



## A FORT!



## A SWING!



## A VERTICAL GARDEN!



## A RESTAURANT!

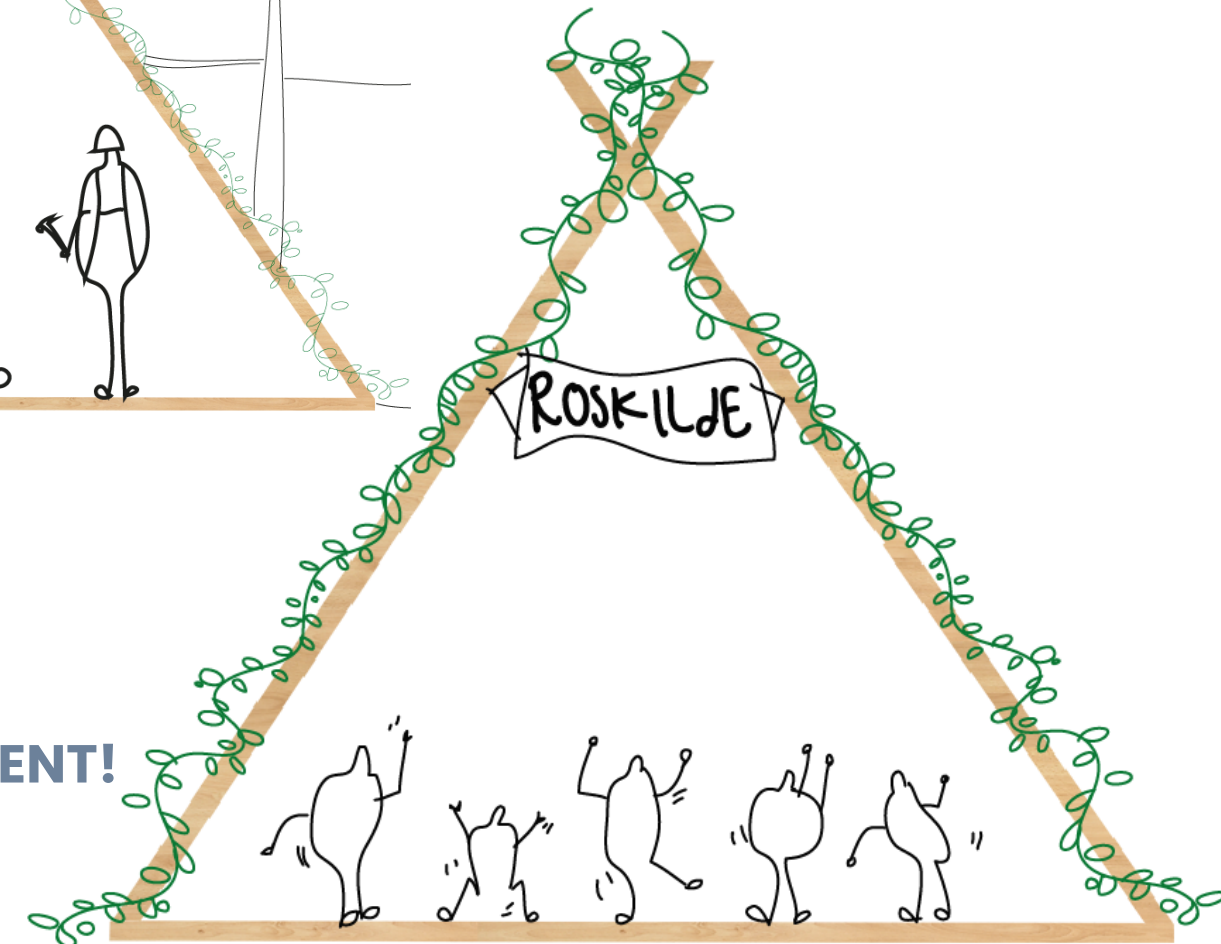


## AN OASIS FOR CONSTRUCTION WORKERS!



By offering people different alternatives to green their city we can expect more people to join the movement. In this page you see an example of the adaptability of the cooling station design for the Netherlands. This design can be used as different means according to the needs and preferences of the user, to hopefully inspire people to bring a little bit of greenery into their streets.

## A MUSIC FESTIVAL TENT!

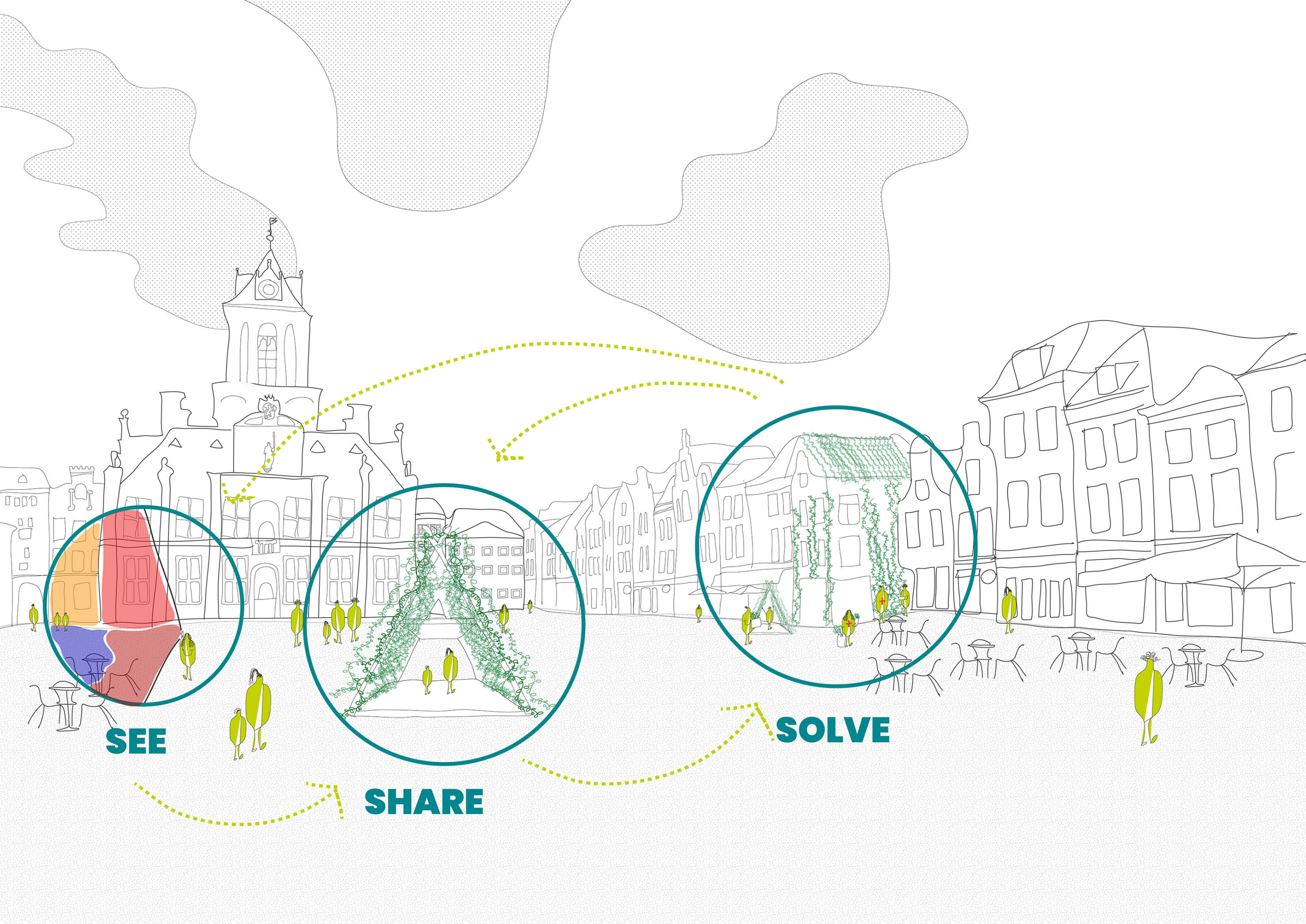




6.5 ONE YEAR IMPLEMENTATION PLAN

	WINTER	SPRING	SUMMER	AUTUMN
ACTIONS	<ul style="list-style-type: none"><li>◦ Identify greening practices and reach out to them</li><li>◦ Contact local gardeners</li><li>◦ Open call to volunteers with an interest in Global Warming or city matters.</li></ul>	<ul style="list-style-type: none"><li>◦ Map city neighbourhoods</li><li>◦ Build cooling stations structure and plant seeds</li></ul>	<ul style="list-style-type: none"><li>◦ Set up and monitor cooling stations</li><li>◦ Update hot and cool routes</li></ul>	<ul style="list-style-type: none"><li>◦ Recycle stations</li><li>◦ Share data with municipalities and neighbourhoods</li><li>◦ Canalise volunteers to greening practises</li></ul>
PREPARE	<ul style="list-style-type: none"><li>◦ Pre-construction plan for cooling stations</li><li>◦ Get technology needed for mapping</li><li>◦ Train volunteers</li></ul>	<ul style="list-style-type: none"><li>◦ Volunteers that will take care of cooling stations</li><li>◦ Platform prototypes for data sharing</li></ul>	<ul style="list-style-type: none"><li>◦ Set up the after-life of the cooling stations</li></ul>	<ul style="list-style-type: none"><li>◦ Plan for measuring the after effect. Thermal imaging scan</li></ul>
TECHNOLOGY	<ul style="list-style-type: none"><li>◦ CNC cutter machines</li><li>◦ 3d mapping software</li></ul>	<ul style="list-style-type: none"><li>◦ Thermal cameras</li><li>◦ Drone</li><li>◦ Photogrammetry</li></ul>	<ul style="list-style-type: none"><li>◦ Proximity tracking location</li></ul>	<ul style="list-style-type: none"><li>◦ Shared platform</li></ul>
STAKEHOLDERS	<ul style="list-style-type: none"><li>Greening practises</li><li>Urban studio (tactical urbanism)</li><li>Climate centre</li><li>Volunteers</li></ul>	<ul style="list-style-type: none"><li>Volunteers</li></ul>	<ul style="list-style-type: none"><li>Citizens</li><li>Vulnerable groups</li><li>Volunteers</li></ul>	<ul style="list-style-type: none"><li>Restaurants and bars</li><li>Green practises</li><li>Urban studio</li><li>Municipalities</li></ul>
PARTNERSHIPS	<ul style="list-style-type: none"><li>Greening practices</li><li>Urban studio (tactical urbanism)</li><li>Climate centre</li></ul>	<ul style="list-style-type: none"><li>Gardeners</li><li>Local plant shops</li><li>Climate universities</li></ul>	<ul style="list-style-type: none"><li>Restaurants and bars</li><li>Green practises</li><li>Urban studio</li><li>Municipalities</li></ul>	
RED CROSS ROLE	<ul style="list-style-type: none"><li>Establish partnerships with local enterprises</li></ul>	<ul style="list-style-type: none"><li>Map danger zones and existing city infrastructure to cool down citizens</li></ul>	<ul style="list-style-type: none"><li>Provide shelter to vulnerable people in the city</li><li>Share awareness and solutions for urban heatwaves</li></ul>	<ul style="list-style-type: none"><li>Facilitate volunteers to greening practises</li></ul>





**SEE**

**SHARE**

**SOLVE**



# CHAPTER SEVEN

## **DISCUSSION & EVALUATION**



# 7. EVALUATION AND DISCUSSION

The proposed strategy explores the combination of different disciplines and is an invite for collaboration. Urban heatwaves are a public health issue that needs to be addressed through different levels and different stakeholders. This project advises the Red Cross to get involved in the built environment, to start seeing the city as a living being instead of a stage in which life takes place. Cities are alive, and it is the time to make sure we design for cities that live.

Health organisations like the Global Heat Health Information Network and the World Health Organisation currently offer advice for people to stay safe during a heatwave. This advice does not always reach its targets and in addition it only comes around the hot period of the year, making it easy to forget. Under the same subject, these organisations also offer advice for governments and municipalities regarding urban planning or policy changes. These advices are long term and there is no ownership from governments to take action.

There seems to be a gap between informing people about the risks of extreme heat and advising government for long term infrastructure or policy changes. The Red Cross is in a strategic position when it comes to the subject of urban heatwaves. They can find themselves in the middle. As the trusted organisation they are, they possess the ability to mobilise the masses and at the same time influence policy making and advise municipalities and governments.

As the first step of the See, Share, Solve strategy suggests, mapping the areas of the city by changing the use of existing technology for other applications is needed. Thermal imaging is currently used mostly in construction by technicians to indicate heat leaks in thermal insulation, taking the same technology but using it in the city to identify hot areas and cool areas is a good way to start.

For the second part, it is not a new thing for the Red Cross to offer shelter for the vulnerable, in this case the cooling stations. However, giving the stations an education focus it is possible to help people prevent a health hazard due to extreme heat. In addition, offering people advice on how to cool down their environment could motivate them to join the initiatives. Fighting climate change seems like an impossible task to be carried out by a single person, however, by making tasks smaller through the urban greening and making the connection between greening organisations, citizens and volunteers, things can get mobilised and resources would not be missing.

This connects directly to the third part of the strategy, Solve. There are many organisations, municipalities, universities and start-ups that share the same vision of bringing vegetation to our urban environments. They all do it for different reasons, quality of air, the bees, biodiversity, green spaces for mental health and so on. Vegetation has multiple benefits and that is why it is possible to collaborate with such parties. Currently they are siloed and this could break the silos and generate a space for ideas, prototypes and experiments in the city. Reaching out to a new sector of volunteers that care for the environment and are willing to contribute to make cities more liveable is another opportunity for the organisation to collaborate with different age groups and disciplines.

The architecture competition is an opportunity for the Red Cross to collaborate with architects and designers. There is big interest in the creative industry to work with the humanitarian sector, and this could expand to emergency shelter competitions, hospital units, pop-up refugee camps, re-building city areas after a natural disaster, etc.

The Red Cross can benefit from entering the urban planning and design of our cities. They are an organisation that promotes resilient communities and work on improving the lives of vulnerable people. Many can be achieved through the environment that surrounds us.



CITY GREENING. IMAGE BY KEES VREEBURG



# CHAPTER EIGHT

## **RECOMMEN- DATIONS & CONCLUSION**



# 8. RECOMMENDATIONS & CONCLUSION

## 8.1 RECOMMENDATIONS

### Architects and Urban Planners

- Material selection is a crucial decision, select mindfully considering extreme weather conditions
- Insist on greenery, not as an extra bonus but as part of the project
- Think of affordable greening options
- Consider indoor climate as well as the perimeter outside of the building, your design affects both inside and outside temperature

### Municipalities

- Facilitate citizen initiatives for greening projects, it is an investment since it solves multiple problems for cities
- Look over different city plans and compare the objectives
- Consider a “green but” policy, where green is the rule and not the exception
- Pay attention to the lack of information connecting health risk and vulnerabilities into planning strategies
- Consider having departments go through training for heat planning

### Developers

- Greening should not be seen as an extra expense, but rather as an asset of the building for users wellbeing
- Consider your building is part of the city
- Do an analysis of the area of your terrain and anticipate extreme weather conditions

### Citizens

- Consider “the immediate outside” as yours, add vegetation to the entrance of your house
- Join activities promoted in your neighbourhood to strengthen the social cohesion
- Volunteer for greening projects in your city
- Share advise on projects you have done before or have knowledge on like gardening

### Tech developers

- Smart watches could measure body temperature
- Phone cameras can include thermal imaging
- Consider technology for monitoring high temperatures in cities



A GREEN FACADE IN AMSTERDAM



## 8.2 CONCLUSIONS

Cities are alive. The built environment is an opportunity for solution exploration, the Red Cross can benefit from entering this space and together with its assets, improve the environments in which we live in, our cities. It is time to recognise the cities importance in people's quality of life. Urban health is a right and we do not only need healthy cities but happy cities as well. Green cities in which neighbours know each other, neighbourhoods in which people knock on each others door during a heatwave to ensure people are alright. This is an opportunity for a big and well trusted organisation to mobilise people into action taking. It is time for the Red Cross to collaborate with multiple parties to achieve a common goal, people's wellbeing.

What I hope with this project is that it opens the humanitarian sector doors to other disciplines. I expect that we prioritise disaster prevention over damage control, and that through collaboration we can find shared visions for the wellbeing of the people. A big part of the world's population lives in cities and these numbers point into an increasing direction. It is a good time to look at the places where we live and try to improve them. The Red Cross has the potential to mobilise change both from the bottom up and the top down approach, I hope that with this project a first step towards the Red Cross improving our cities can be taken.



# REFERENCES



# REFERENCES

68% of the world population projected to live in urban areas by 2050, says UN | UN DESA | United Nations Department of Economic and Social Affairs. (2020). Retrieved from <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html>

Colenbrander, S., Lazer, L., Haddaoui, C., Godfrey, N., Lobo, A., Clarkson, H., ... & Altenburg, T. (2019). Climate emergency, urban opportunity. how national governments can secure economic prosperity and avert climate catastrophe by transforming cities.

Coumou, D., & Robinson, A. (2013). Historic and future increase in the global land area affected by monthly heat extremes. *Environmental Research Letters*, 8(3), 034018.

Coumou, D., Robinson, A., & Rahmstorf, S. (2013). Global increase in record-breaking monthly-mean temperatures. *Climatic Change*, 118(3-4), 771-782.

Cross Ventilation, the Chimney Effect and Other Concepts of Natural Ventilation. (2018). Retrieved from [https://www.archdaily.com/887460/cross-ventilation-the-chimney-effect-and-other-concepts-of-natural-ventilation#\\_=\\_](https://www.archdaily.com/887460/cross-ventilation-the-chimney-effect-and-other-concepts-of-natural-ventilation#_=_)

Curran, P., Siderius, C., & Singh, T. (2019). Policy brief Cities, climate change and chronic heat exposure.

Ellard, C. (2015). Places of the heart: The psychogeography of everyday life. Bellevue literary press.

Flouris, A. D., Dinas, P. C., Ioannou, L. G., Nybo, L., Havenith, G., Kenny, G. P., & Kjellstrom, T. (2018). Workers’ health and productivity under occupational heat strain: a systematic review and meta-analysis. *The Lancet Planetary Health*, 2(12), e521-e531.

Fountain, H. (2020). Billions Could Live in Extreme Heat Zones Within Decades, Study Finds. Retrieved from <https://www.nytimes.com/2020/05/04/climate/heat-temperatures-climate-change.html>

Gehl. Available at: <<https://gehlpeople.com/blog/public-space-plays-vitalrole-in-pandemic/>>  
Ghhin.org. 2020. Heat Health. [online] Available at: <<http://www.ghhin.org/heat-health-explained>>

Hansen, J. E., Ruedy, R., Sato, M., & Lo, K. (2006). NASA GISS surface temperature (GISTEMP) analysis. Trends: A Compendium of Data on Global Change.

Heat and Health. (2018). Retrieved 24 July 2020, from <https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health>

Hoogduyn, R. (2014). Urban Acupuncture” Revitalizing urban areas by small scale interventions”.  
Houghton, K., Foth, M., & Miller, E. (2015). Urban acupuncture: Hybrid social and technological practices for hyperlocal placemaking. *Journal of Urban Technology*, 22(3), 3-19.

IRFC Heatwave Guide For Cities (2019) [Report] Available at: <<https://www.climatecentre.org/downloads/files/IFRCGeneva/RCCC%20Heatwave%20Guide%202019%20A4%20RR%20ONLINE%20copy.pdf>>

IRFC Red Cross 2020 Strategy. Saving lives changing minds <https://www.ifrc.org/Global/Publications/general/strategy-2020.pdf>

IRFC Red Cross 2030 Strategy. Platform for change <https://future-rcrc.com/wp-content/uploads/2019/10/E-6-Strategy-2030.pdf>

Mathey, J., Rößler, S., Lehmann, I., & Bräuer, A. (2011). Urban green spaces: potentials and constraints for urban adaptation to climate change. In *Resilient Cities* (pp. 479-485). Springer, Dordrecht.

McGregor, G. R., Bessmoulin, P., Ebi, K., & Menne, B. (2015). Heatwaves and health: guidance on warning-system development. WMOP.  
McGregor, Glenn (2017) ‘Meteorological risk : extreme temperatures.’, in *Science for disaster risk management 2017 : knowing better and losing less*. Luxembourg: Publications Oce of the European Union, pp. 257-270.

NASA Climate Kids. 2020. What Is An Urban Heat Island?. [online] Available at: <<https://climatekids.nasa.gov/heat-islands/>>

Netherlands Red Cross International strategy 2020-2030 Strategy 2030 NLRC-IH, 2019

Nogrady, B., 2020. Urban Heat Islands: Cooling Things Down With Trees, Green Roads And Fewer Cars. [online] the Guardian. Available at: <<https://www.theguardian.com/sustainable-business/2017/feb/21/urban-heat-islands-cooling-things-down-with-trees-green-roads-and-fewer-cars>>

O’Connor, E., 2020. Public Space Plays Vital Role In Pandemic – Gehl. [online]

Pfeifer, L. (2013). The planner’s guide to tactical urbanism. Montereal, Canada Page.

Robine, J. M., Cheung, S. L. K., Le Roy, S., Van Oyen, H., Griffiths, C., Michel, J. P., & Herrmann, F. R. (2008). Death toll exceeded 70,000 in Europe during the summer of 2003. *Comptes rendus biologies*, 331(2), 171-178.

Sadik-Khan, J., & Solomonow, S. (2017). *Streetfight: Handbook for an urban revolution*. Penguin.



Santamouris, M., & Kolokotsa, D. (2013). Passive cooling dissipation techniques for buildings and other structures: The state of the art. *Energy and Buildings*, 57, 74–94.

Singh, R., Arrighi, E., Strachan, K., Spires, M., & Kadihasanoglu, A. (2019). et al. Heatwave Guide for Cities. Red Cross Red Crescent Climate Centre. [climatecentre.org/downloads/files/IFRCGeneva/RCCC% 20Heatwave% 20Guide, 202019](https://climatecentre.org/downloads/files/IFRCGeneva/RCCC%20Heatwave%20Guide,202019).

Stache, E., Jonkers, H., & Ottel , M. (2019). Integration of Ecosystem Services in the Structure of the City is Essential for Urban Sustainability. In *Ecological Wisdom Inspired Restoration Engineering* (pp. 131–150). Springer, Singapore.

Tan, J., Zheng, Y., Tang, X., Guo, C., Li, L., Song, G., ... & Chen, H. (2010). The urban heat island and its impact on heat waves and human health in Shanghai. *International journal of biometeorology*, 54(1), 75–84.

Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin.

Unicef.org. 2020. Lessons From The COVID-19 Pandemic For Tackling The Climate Crisis. [online] Available at: <<https://www.unicef.org/stories/lessons-covid-19-pandemic-tackling-climate-crisis>>

Voiland, A. (2010). NASA – Satellites Pinpoint Drivers of Urban Heat Islands in the Northeast. Retrieved from <https://www.nasa.gov/topics/earth/features/heat-island-sprawl.html>

Who we are – IFRC. (2020). Retrieved from <https://www.ifrc.org/en/who-we-are/>  
Who.int Urban Health. [online] Available at: <<https://www.who.int/health-topics/urban-health>>  
WMO 2011 Weather Extremes in a Changing Climate: Hindsight on Foresight (Geneva: World Meteorological Organization)

World of Change: Global Temperatures. (2020). Retrieved from <https://earthobservatory.nasa.gov/world-of-change/global-temperatures>

## IMAGES

Maps NASA  
<https://earthobservatory.nasa.gov/world-of-change/global-temperatures>

Red Cross people  
<https://www.rodekruis.nl/over-ons/>

Maps National Geographic  
<https://www.nationalgeographic.com/magazine/2020/04/these-cities-will-feel-climate-changes-effects-the-most-feature/>

Urban Canopy  
[www.urbancanopy.io/](http://www.urbancanopy.io/)

Basel River  
<https://www.badische-zeitung.de/3000-menschen-beteiligten-sich-am-am-basler-rhein-schwimmen--74405815.html>

Mist Japan  
<https://matcha-jp.com/en/855>

Paris plage  
<https://www.timeout.com/paris/en/sport-fitness/paris-plages>

Farm house precht  
<https://www.precht.at/the-farmhouse/>

Vertical forest  
<https://www.stefanoboeriarchitetti.net/en/project/vertical-forest/>

Big Factory  
<https://big.dk/#projects-arc>

Boat volunteers Red Cross  
<https://media.ifrc.org/ifrc/what-we-do/volunteers/global-review-on-volunteering/>

Pandemic bicycle Kid  
<https://www.independent.co.uk/news/world/europe/coronavirus-spain-children-lockdown-lift-ed-barcelona-cases-a9485181.html>

Humankind logo  
<https://www.humankind.city/>

The pollinators logo  
<https://www.thepollinators.org/>

Encuentro Guadalupe  
<https://www.archdaily.com/199347/endemico-resguardo-silvestre-graciastudio>

Farnsworth  
<https://www.dwell.com/article/farnsworth-house-flooding-ludwig-mies-van-der-rohe-a1d85bbd>

Ambasz  
<https://www.ambasz.com/fukuoka-prefectural-international>

Bilbao  
[https://www.plataformaarquitectura.cl/cl/775166/propuesta-de-tatiana-bilbao-en-la-bienal-de-arquitectura-de-chicago-responde-al-problema-de-vivienda-social-en-mexico?ad\\_medium=gallery](https://www.plataformaarquitectura.cl/cl/775166/propuesta-de-tatiana-bilbao-en-la-bienal-de-arquitectura-de-chicago-responde-al-problema-de-vivienda-social-en-mexico?ad_medium=gallery)

Lego house  
[https://www.archdaily.com/866818/bigs-lego-house-tops-out-gets-september-opening-date?ad\\_medium=gallery](https://www.archdaily.com/866818/bigs-lego-house-tops-out-gets-september-opening-date?ad_medium=gallery)

Termas  
[https://www.plataformaarquitectura.cl/cl/759356/termas-geometricas-german-del-sol?ad\\_medium=gallery](https://www.plataformaarquitectura.cl/cl/759356/termas-geometricas-german-del-sol?ad_medium=gallery)



# APENDIX



ARCHITECTURE COMPETITION ENTRIES

CHARGER

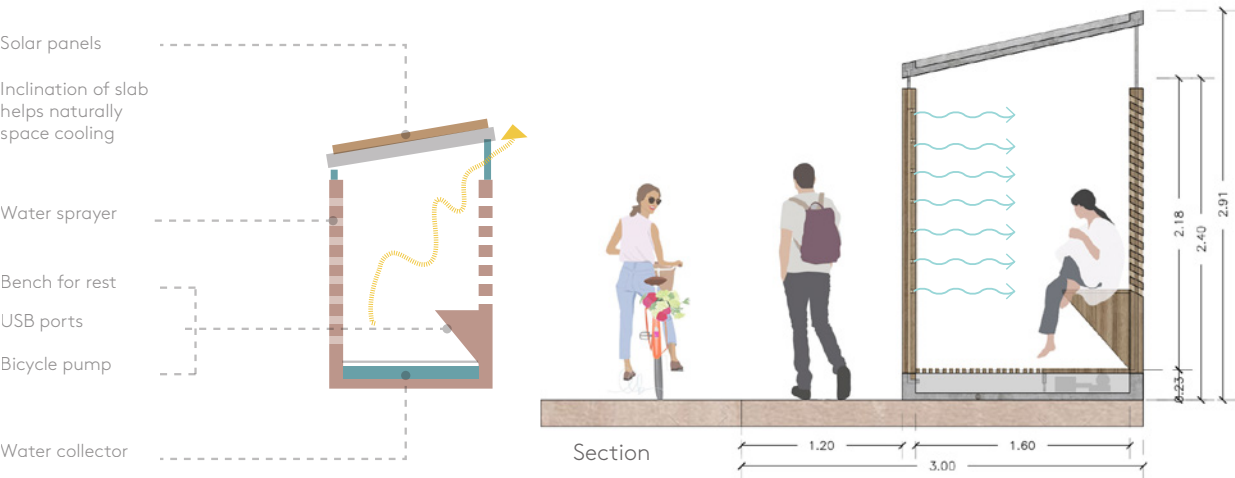
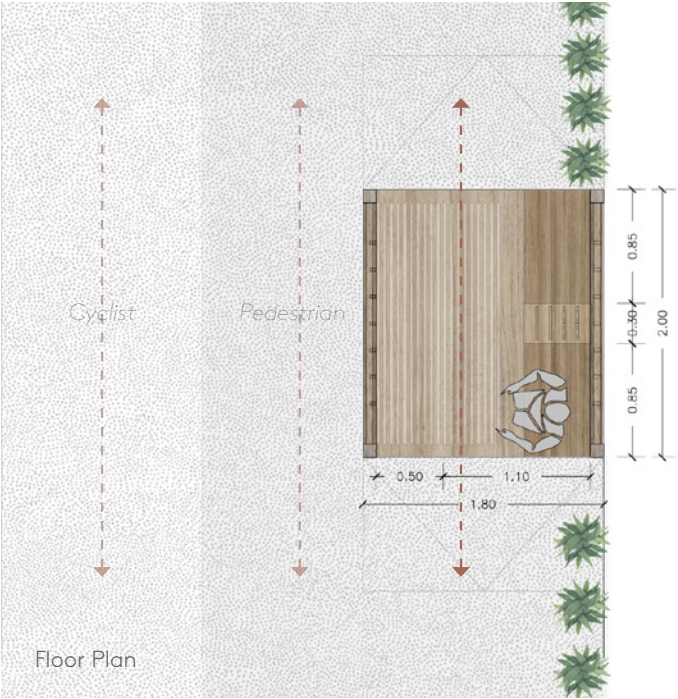
A module placed in the streets, at specific points with greater pedestrian and cyclist influx, to rest, hydrate, charge your devices and bicycle maintenance; is charged by two solar panels that in turn feed an internal motor that sprays water, the system pumps and reuses the internal water.

The inclinate slab directs the panels towards the ideal sun position and to recover rainwater. It is fully open on two of its sides for easy access, security and free air running.

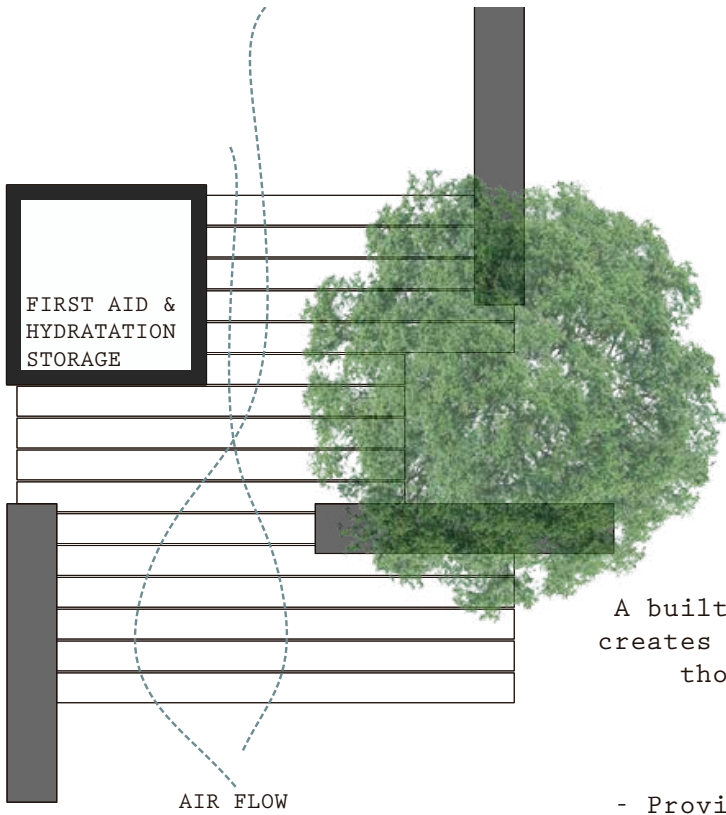
The other two structural elements have channels to distribute the water, with permeable layers to allow light to enter, as well as LED luminaires that generate a light box in the evenings and nights.

Inside the module are USB ports to charge portable items as well as a pump to inflate bicycle tires.

When there is no need to spray water for cooling, it becomes a place for charge your devices, bicycle maintenance, to rest and charge yourself with energy.



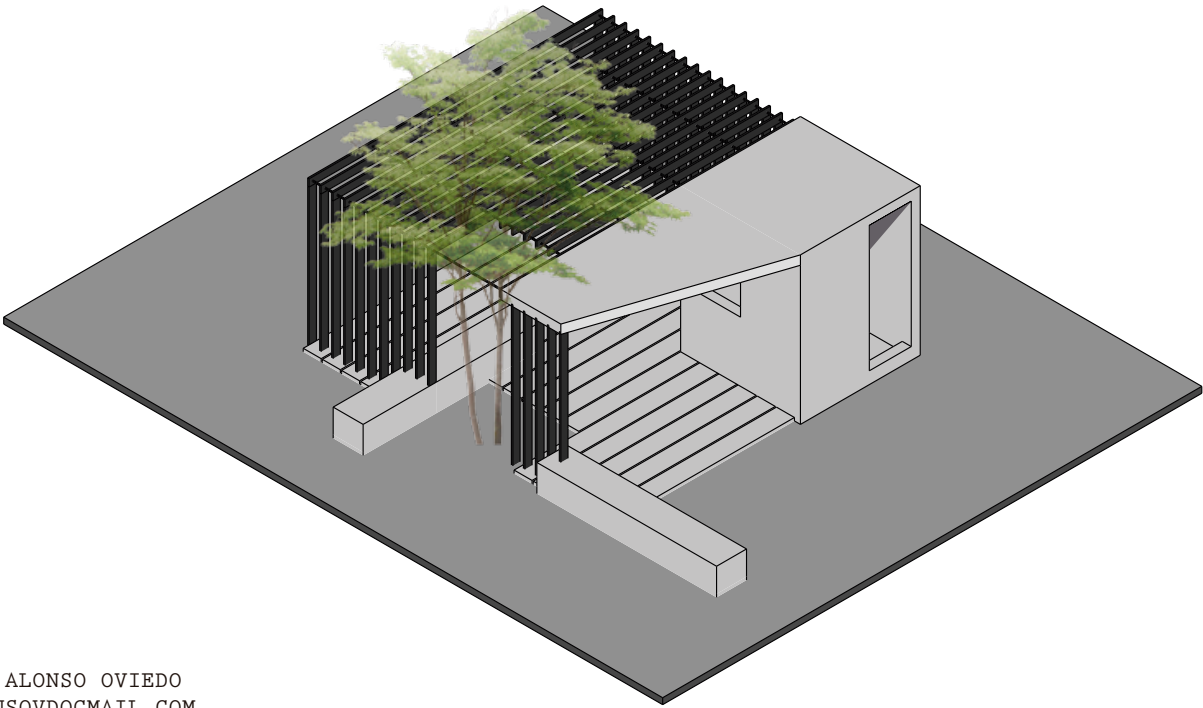
LAURA MONTAÑO



COOLING STATION

A built-in-site module proposal that creates a fresh micro-environment for those in need of cooling down in the middle of a heat wave.

- Providing shade and airflow with a permeable steel structure.
- Vegetation as a natural element that will drop temperature a bit by bringing freshness
- First Aid Attention for those in urgent situations. (storage space included)
- Comfort Sitting to rest



ARQ. ALONSO OVIEDO  
TALONSOVDOGMAIL.COM

ALONSO OVIEDO



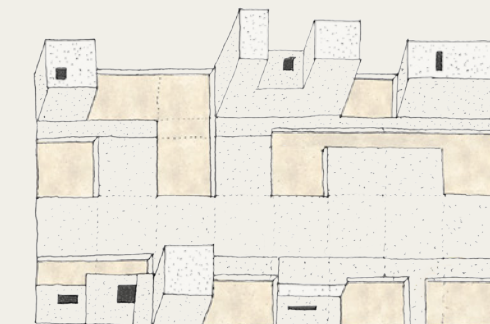
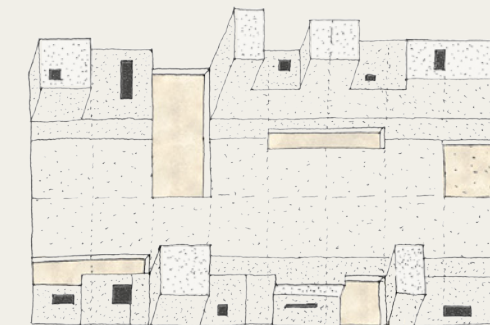
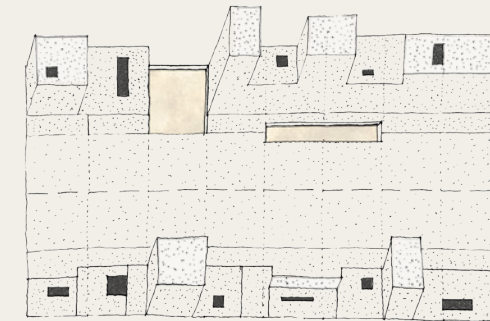
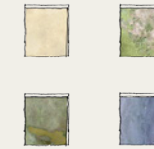
## The Coolingloo

Inspired in the 'winter cafe igloo's' this proposal is a structure that can provide a space to refresh around several parts of the city. With its geodesic structure, this cooling station can be easily installed and transported. It allows the people to cool down from head to toes. It delivers shadow, but also allows the wind to circulate. Its hermetic floor allows water to be contained in a sort of pond which refreshes user from their feet. Its spacious design can enable it to have several plants and chairs or bunks to sit or lay down and rest.



## PATCH UP

01/01



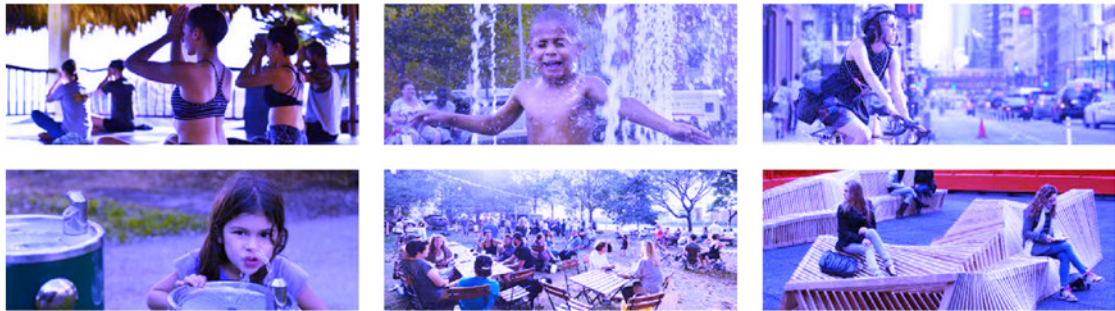
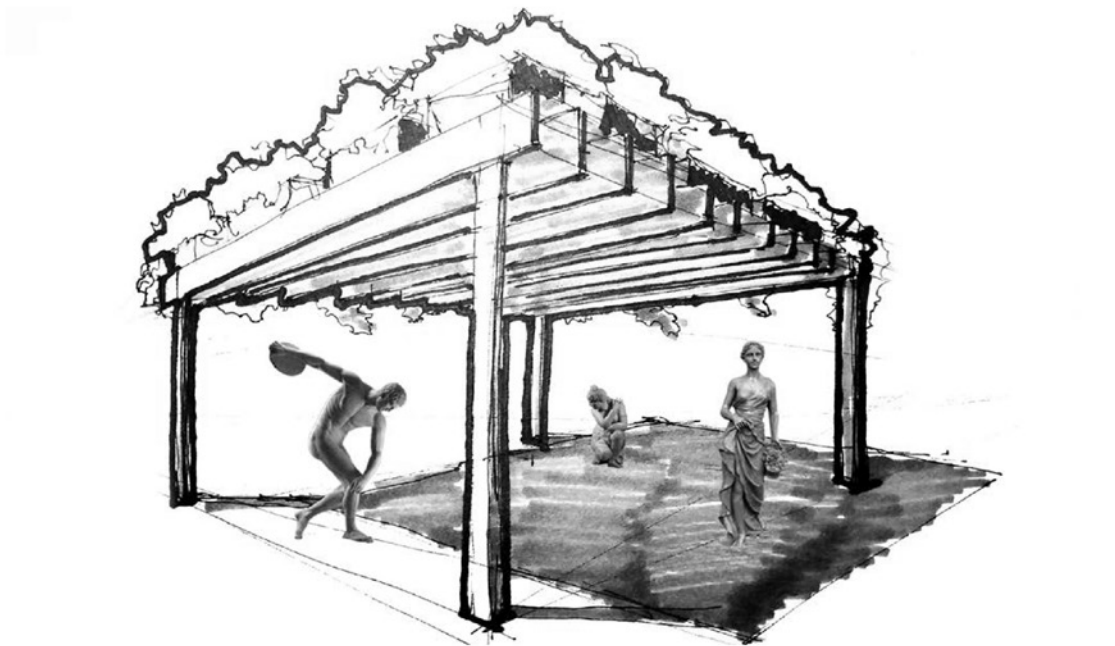
In order to prevent high temperatures in cities, to decrease the amount of concrete on streets and to reduce unconscious consumption of resources, PATCH UP proposes empty land and vegetation to heal our cities. Instead of adding, it is a call to subtracting.



COOLING CANOPY



What is happening above ...



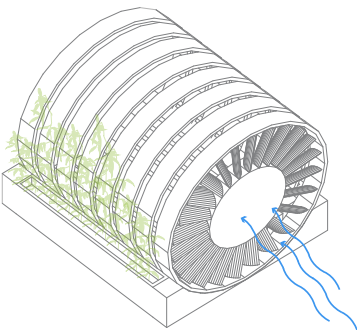
What could happen inside ...



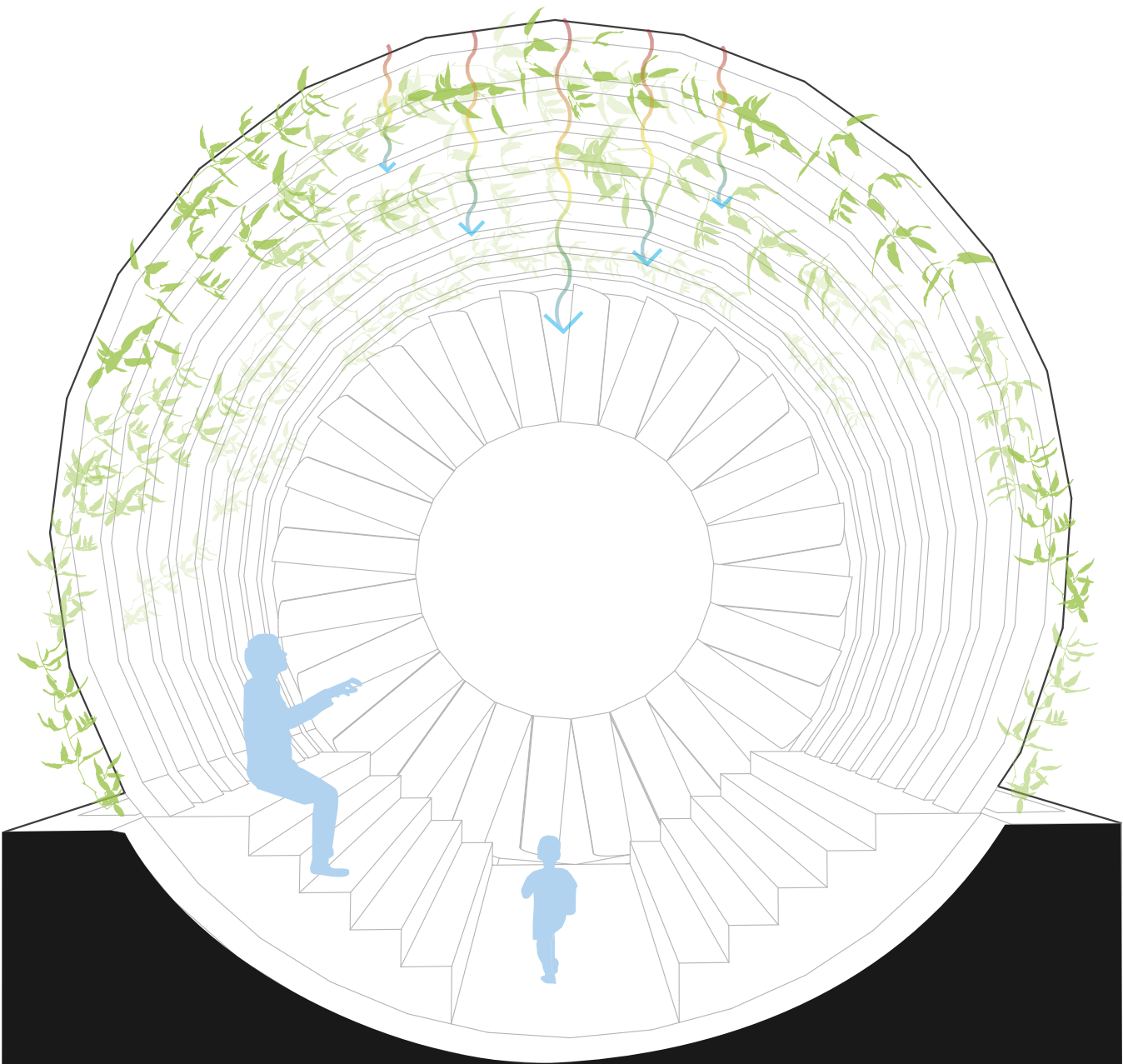
Rogelio de la Garza Z

Urban windmill

Inspired by the famous windmills in the Netherlands, the urban windmill uses a fan-like system that allows air to flow. Plants can grow in the pots located on each side, the vegetation will help reduce the temperature while adding humidity to the air.



With its spacious seating area, the urban windmill becomes the perfect place to rest from the hot summer.





# LET IT SLIDE!

To cool down, all you need is shade a bit of running water to freshen up the air. But bringing thermal comfort to the public arena allows for the opportunity to address larger issues of collectiveness and resource distribution. Making the shading canopies moving structures, creates the need to collectively decide how to use them, and where to set them. The public realm then becomes an arena to experiment, negotiate, and decide on how to allocate resources, in these case shade. This flexibility allows for multiple configurations, let in them overlap or nestle to create a more covered area, or distributing them to cover more ground.

## A SLIDING CANOPIES

Sturdy and weather-resistant moving structures, that create shade and help to bring the temperature down. Like nesting tables, this structure could be stacked together to occupy less surface making room for other dynamics to take place.

## B CANOPIES TRACKS

Tracks in the pavement make sliding the canopies easy and accessible, inviting the public to use them, move them around and make them their own.

## C URBAN FURNITURE

Inviting shapes and bright colors. Unprescribed objects that are simultaneously seats, tables, playgrounds, and daybeds.

## D WATER FOUNTAINS

Evaporative cooling can make an impactful difference to cool-down space, that combine with shade from the canopies, or surrounding buildings and trees create a microclimate.

The public space should be pleasant and comfortable to be. This proposal aims not only to achieve that but to foster a sense of collectiveness and empathy; attitudes that are very relevant when addressing the larger issues that have to lead up to unprecedented climatic conditions.



Cooling pavilions must act not only as infrastructure for the city but as our new monuments, places that guide us through the city and also serve as communication devices to connect with the environment. Cooling pavilions should be art-houses, playgrounds, monuments, plazas, theaters, markets and / or distribution centers, they ought to change through time. They should be a reminder of global warming and a way to understand climate change in a planetary scale.



# OASIS

BY MARIO RAMIREZ OROZCO

mario.ramirez.o@gmail.com

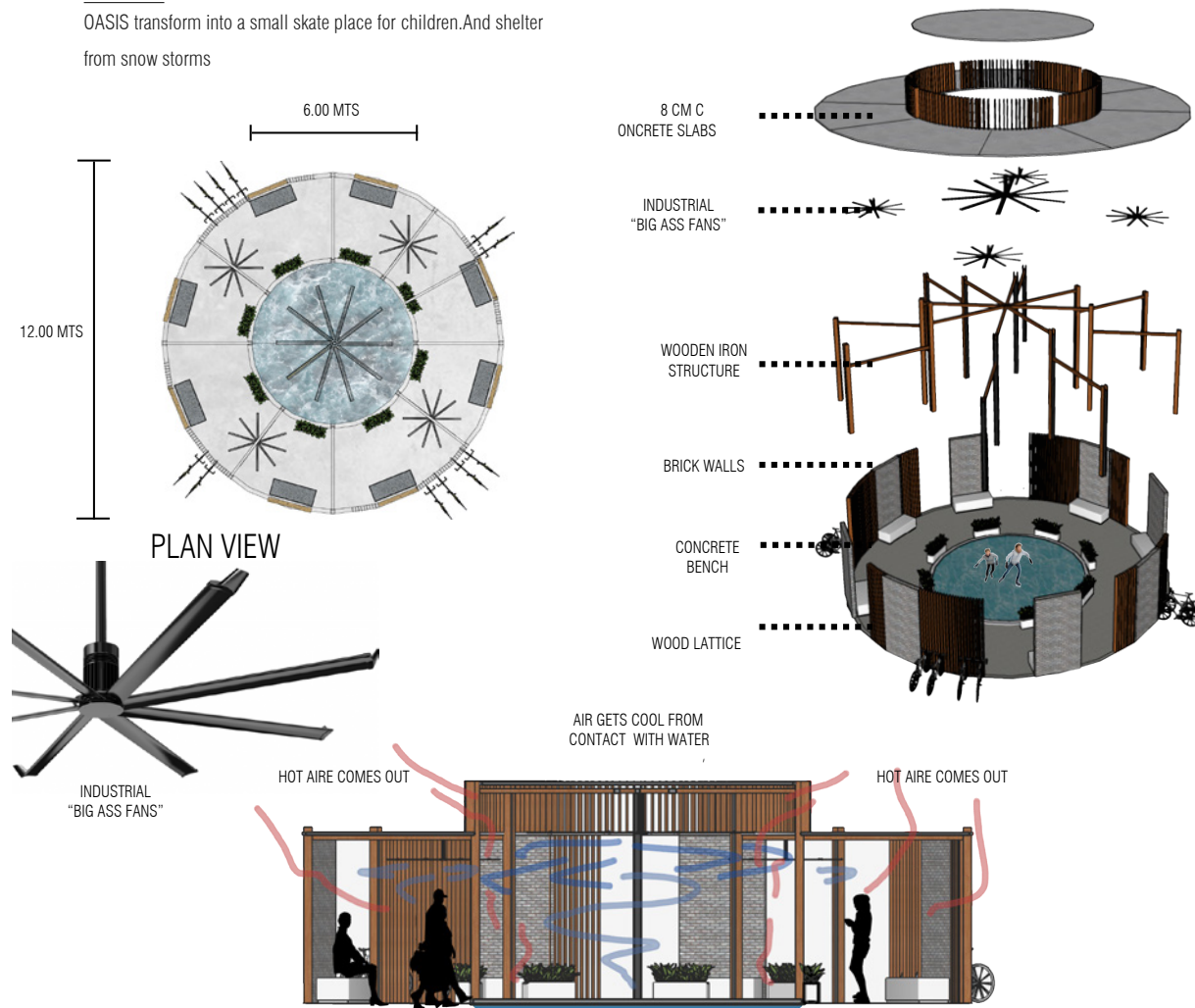
OASIS generate cool fresh air through passive systems. Air passes through water and plants. It filters and generates a fresh sensation.

Passive systems are methods and devices that can be integrated into the building to perform the function of heat transfer and storage with little or no assistance from electrical or other non-renewable



## WINTER

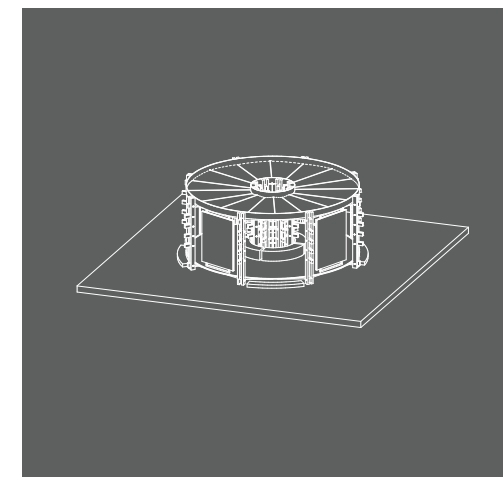
OASIS transform into a small skate place for children. And shelter from snow storms



MARIO RAMIREZ

# HEAT SHELTER

ROBERTO CEVADA GONZÁLEZ



The shelter roof serves as a garden that helps reduce to temperatures and promotes urban vegetation.

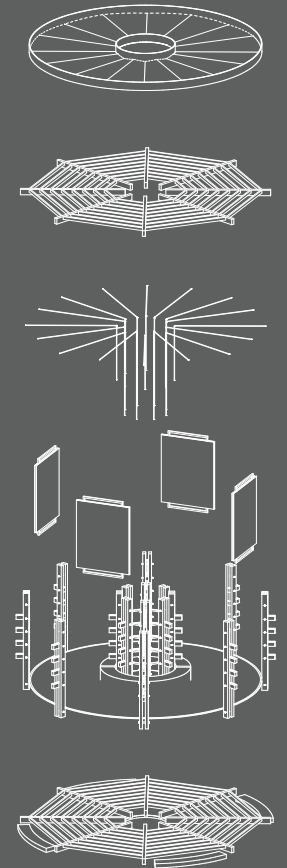
A wooden structure supports the roof providing the shelter with natural materials that go along with the organic concept.

A series of pipes pump water through the central columns to water the roof plants that then drip through the pipes irrigating the perimetral pots.

Four bulkheads show interesting info-graphics to the user about over heated spaces in the city and the dangers of it.

Wooden columns joined by steel cubes that work as plant pots are the responsible for the vertical structure of the pavillion.

A wooden structure elevates itself from the ground in order to evade the heat emanated from it and keep lower temperatures.



ROBERTO CEVADA



## DESIGN PRINCIPLES

Through literature review, interviews and the thermal study carried out for this research, six design principles have been developed for the cooling stations. These principles will ensure thermal comfort inside of the cooling stations and will act as a guideline for further designs related to the extreme heat climate emergency.

# 1

### Let it flow

Allow two opposite sides of the structure to be open in order for air to flow from one side to the other of the space. Crossed ventilation allows for constant air changes in order to reduce internal temperatures.

Large openings provide greater ventilation that causes thermal equilibrium. Warm air is lighter than cold air

Sun breakers are mechanisms for natural ventilation, they can also regulate light and sun.



### The floor is lava

Flat surfaces are exposed to direct sunlight more than vertical or inclined planes. This is the case of floors and roofs. In addition, flooring in cities is mostly stone, asphalt or concrete. These materials reach temperatures of above 60°C (Stache et al, 2020)

# 2



# 4

### Allow it to multiply

The size and program of the stations might change according to its location across the city. It is important that these structures have the ability to expand or reduce their size accordingly. Modules allow for flexibility.



### Belongs to everyone

The city belongs to all. The cooling stations should be inclusive and welcoming, by being in the public space it automatically allows for appropriation. The design should be inviting and open for people to join.

# 5



# 6

### Multifunction is sexy

Utilising these spaces for more than cooling down is another principle. Think of second uses when it is not very hot, like rain protection or a place to eat and meet with people.



# 3

### Green is cool

Urban greening is an effective method for the reduction of heat in the built environment (Voiland, 2010). Vegetation in urban environments lowers down the air temperature locally up to 8.4°C at 10 cm above and 2.5°C at 70 cm (Stache et al, 2020).



### Context adaptation

The design must respond to its context. Local materials, local environment, weather, and people are things to consider when designing for a specific context.

# 7



# DESIGN PRINCIPLES IN ACTION

Here are some architecture pieces that apply the design principles around the world.

**1** **Let it flow**  
HOTEL ENCUESTRO GUADALUPE – GRACIA STUDIO



**The floor is lava**  
FARNSWORTH HOUSE – MIES VAN DER ROHE

**2**

**3** **Green is cool**  
ACROS FUKOKA – . EMILIO AMBASZ



**4** **Allow it to multiply**  
VIVIENDA SOCIAL – TATIANA BILBAO



**6** **Multifunction is sexy**  
FUJI KINDERGARDEN – TEZUKA



**Belongs to everyone**  
LEGO HOUSE – BJARKE INGELS GROUP

**5**



**Context adaptation**  
TERMAS GEOMETRICAS – GERMAN DEL SOL

**7**



