A Toolkit for Co-Designing Streetscapes for A Cool Pedestrian Network in Melbourne, Australia

MSc Thesis Integrated Product Design | Alina Kaiser | September 2023

TU Delft

Project	**MSc Graduation Project** A Toolkit for Co-Designing Streetscapes for A Cool Pedestrian Network in Melbourne, Australia
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Preface

Two years ago, I began my Integrated Product Design master's degree at TU Delft, hoping to discover my product designer identity. Instead of helping me narrow down the path I'd like to take, the degree opened my eyes to a much broader and more abstract world of design, far beyond just products. I discovered my interest in the cross-section of product design and urban planning and my interest in designing for climate-resilient cities. After a year in Delft, I embarked on an exchange semester at RMIT in Melbourne, Australia, where a heatwave-focused service design project for the City of Melbourne inspired my final master's project on public space design for heatwaves.

Working on a toolkit pushed me beyond my comfort zone as a 'conventional' product designer so I was very lucky to have a great supervisory team that guided me throughout this journey both from Delft and right in Melbourne. Carissa, Laurens and Ollie, I would like to thank you all for sharing your valuable knowledge with me and for providing all the insightful feedback that helped me take this project in the right direction.

I would also like to thank Candace from the City of Melbourne, whose knowledge was very valuable for shaping this project. Thanks a lot for supporting this project, both by sharing your ideas and feedback but also by helping me organise feedback and toolkit testing sessions within the council. This also leads to a big thanks to everyone (council members, residents of Drewery Lane and my friends) who participated in my trial workshops. I really appreciate the time that you all took to participate and help me test my toolkit design.

Finally, a heartfelt thanks to my family and friends in Melbourne and Germany who supported me throughout this project. I appreciate your open ears that listened when I was trying to organise the chaos in my head and make sense of all my thoughts and ideas.

September 19th, 2023

Executive Summary

Global temperatures are rising, and climate change is leading to an increase in extreme weather events such as heatwaves, droughts, floods, storms and fires (WMO, 2022). The increase in unusually hot days and heatwaves is also noticeable in Melbourne, Australia. By 2050, Melbourne is projected to have an annual average of 16 hot days above 35°C (DELWP, 2019). Extreme heat and heat waves have significant impacts on people's health, the economy, the environment and the city's infrastructure assets.

To address this issue, this graduation project focused on the development of a toolkit that engages different stakeholders in the design of heat-adapted streetscapes for a cool pedestrian network in Melbourne. Research into the shortcomings of existing often text-heavy cooling toolkits motivated the aim of making the new toolkit tangible and interactive. Literature research identified suitable cooling interventions for Melbourne's climate, while insights from placemaking research inspired the inclusion of placemaking, wayfinding, and walkability aspects into the toolkit to address the overall pedestrian experience beyond just cooling. Based on the research findings, the toolkit was developed and refined through interactive feedback sessions with the council. The final design was tested through co-design workshops in which the city council and citizens trialled the toolkit by developing a streetscape concept for Drewery Lane in Melbourne.

The developed toolkit suggests a new approach to developing heat-adapted public spaces. While existing cooling toolkits are mainly text-heavy documents targeted at governments, planners and policymakers, this new toolkit aims to engage both experts (such as the council and design practitioners) and non-experts (such as citizens) to collaboratively develop concepts for cool streetscapes in Melbourne. Through its gamified approach, the toolkit provides an interactive and engaging manner of exchanging knowledge by 1) learning about citizens' current and future desired experiences within the streetscape, 2) engaging the council's policy and the design practitioners' planning knowledge and 3) by providing relevant yet easy-to-understand and accessible information about different cooling interventions. The toolkit also addresses the overall pedestrian experience beyond just cooling by prompting the consideration of placemaking, wayfinding and walkability aspects.

Main recommendations for the future are to 1) further test and refine the toolkit through co-design workshops with all stakeholders, 2) investigate how resulting streetscape concepts can be evaluated in terms of their cooling capacity and 3) consider the development of a community-led version of the toolkit.

1 Context

The Connection Between Global Climate Change and Heatwaves in Melbourne

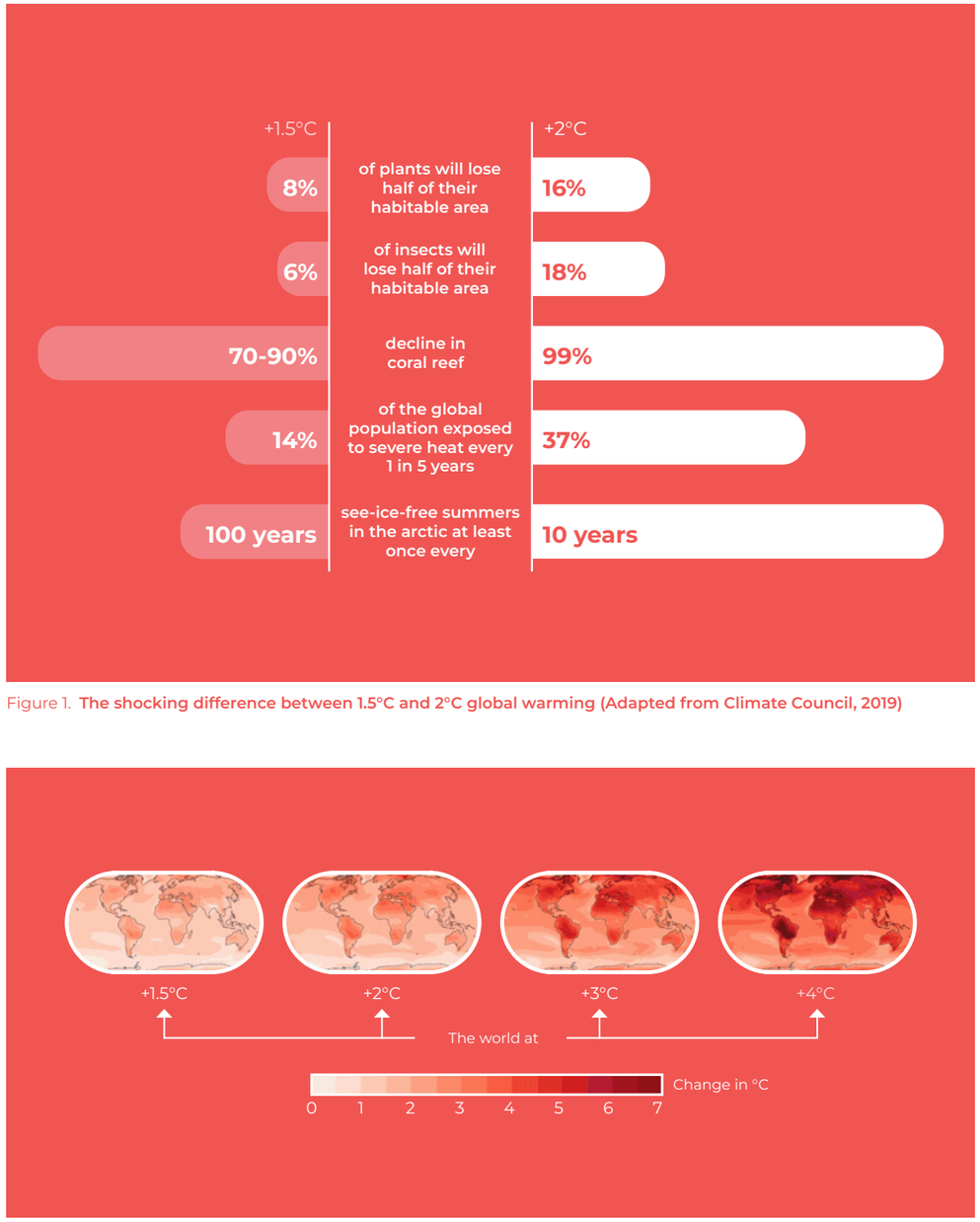


Figure 1. **The shocking difference between 1.5°C and 2°C global warming (Adapted from Climate Council, 2019)**

Figure 2. **Projected annual maximum daily temperature change at global warming levels of 1.5°C, 2°C, 3°C and 4°C relative to 1850–1900 (Adapted from IPCC, 2023)**

1.1 Climate Change, Global Warming and Extreme Heat

Human-Caused Climate Change

Global temperatures are rising - we are currently experiencing a global warming of 1.1°C above pre-industrial levels which leads to an increased amount of extreme weather events such as heatwaves, droughts, floods, storms, and fires (WMO, 2022).

The observed temperature change is driven by greenhouse gas emissions resulting from human activities and therefore also referred to as 'Human-Caused Climate Change' by the IPCC as many of the observed physical changes can be attributed to human influence (Figure 3). While a temperature difference of 1.1° may not sound very alarming, the opposite is the truth: Already today global warming has a significant impact on human systems in relation to water availability and food production, health and wellbeing, cities, settlements and infrastructure and on biodiversity and ecosystems (IPCC 2023).

The Big Difference One Half Degree Can Make

And global warming will not just stop at the current 1.1°C increase. In fact, global temperatures have risen faster than ever during the last 50 years - and according to the most recent IPCC report, there is a 50% probability that global temperatures will already reach 1.5°C above pre-industrial levels by 2030-2035 (IPCC 2023).

Keeping global warming well below 2°C but preferably to 1.5°C above pre-industrial levels is the main goal of the Paris Agreement that 196 parties have committed to in 2015 (United Nations Climate Change, n.d.). Already an increase of 1.5°C will have tremendous impact on humans, wildlife, land, and oceans, but 2°C or more can worsen the impact by a multiple (Figure 1). Figure 2 supports that statement by showing how every degree of warming leads to more pronounced temperature extremes around the entire world.

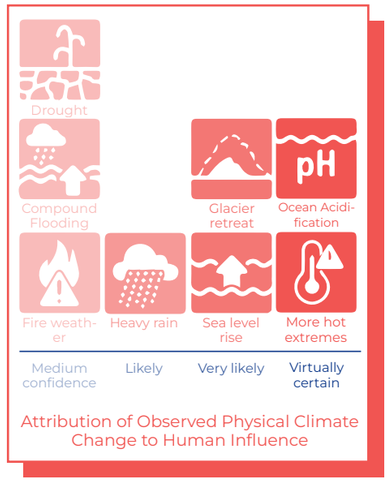


Figure 3. **Attribution of human influence to observed physical climate change (Adapted from IPCC, 2023)**

»A heatwave occurs when the maximum and the minimum temperatures are unusually hot over a three-day period at a location. This is considered in relation to the local climate and past weather at the location«
BoM (n.d.)

Heat - A Direct Consequence of Climate Change

As Figure 2 shows, global warming has a massive impact on maximum temperatures worldwide and leads to a general increase of hot days and heatwaves. According to Steffen et al. (2014) the increased periods of heat and heatwaves are one of the most direct consequences of climate change.

Urban Heat Island Effect

The impact of climate change is intensified in urban areas due to the abundance of heat-storing concrete streets and buildings and the lack of green infrastructure that cause cities to be much hotter than surrounding rural areas - a phenomenon known as the urban heat island effect (UHI). Human activities (e.g. use of polluting transportation modes and electricity consumption) can intensify the UHI effect (NSW Government, n.d.) and the UHI effect is even more pronounced at night, because heat in the city is released slower than in the surrounding rural areas (Lee et al., 2013).

Dangers Related to Heat

Extreme heat and heatwaves have a significant impact on people's health, the economy, the environment and city's infrastructure assets.
In regards to health, extreme heat can lead to physical health issues and hospitalisations, increased violence within communities and even mental health issues due to inaccessibility of cool places and jobs being shut down (Myrivili, 2022). Research has also shown that mortality increases on hot days with temperatures above 28°C (Kjellstrom & Weaver, 2009) and during heatwaves - those are claimed to be more hazardous for humans than any other natural disasters (Nairn and Fawcett, 2014). Steffen et al. (2014) shows how the likelihood of heat exhaustion, hospitalisation and eventually death increases if our core body temperature rises above 38°C for several hours (Figure 4). Loughnan et al. (2010) identify that age and socio-economic disadvantages correlate with a higher risk of hospital admissions during hot weather.

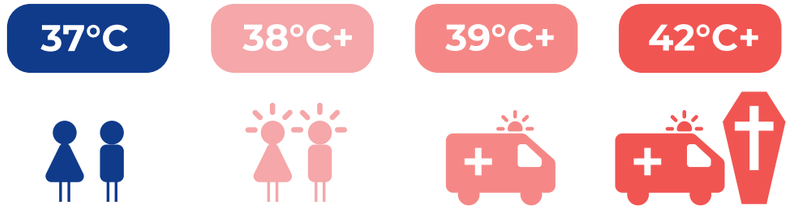


Figure 4. **Core Body Temperature and Health Impacts (Adapted from Steffen et al., 2014)**

1.2 Heat and Heatwaves - Australia's Silent Killer

»Heatwaves kill more Australians than any other natural disasters. They have received far less public attention than cyclone, flood or bushfire – they are private, silent deaths which only hit the media when morgues reach capacity or infrastructure fails.« (PWC, 2011).

Climate Change and Heat in Australia

Urging news with devastating photos of Australian bushfires (Figure 5) are not a scarcity and show that just like any other country in this world, also Australia is impacted by climate change and the increasing temperatures. The change in Australian climate leads to an increase of precipitation, flooding, drought, tropical cyclones, tornadoes, heatwaves and bushfires (Steffen et al., 2014) all of which have tremendous impacts on human and eco systems. Being much less visible than bushfires, yet more dangerous, heatwaves are described as Australia's silent killer that kills more people than any other natural disaster.

Figure 5. **Kangaroo in front of a burning home in Lake Conjola in NSW, Australia (Adapted from Abbott, 2020)**

Climate Change and Heat in Melbourne

Zooming more closely in to Australia, we can see that also Melbourne, Australia's second largest city located in the state of Victoria, has to deal with the impacts of climate change. The amount of unusually hot days and heatwaves in Victoria has increased since 1960 (Figure 6). Between 1986 and 2005, Melbourne already experienced an average of 8 days per year with temperatures above 35°C and this number is projected to double by the 2050s (DELWP, 2019).

Heatwaves in 2009 and 2014

Two extreme heatwaves that hit Melbourne particularly hard happened in 2009 and 2014. The January 2009 heatwave with maximum temperatures of 45.1°C led to 374 excess deaths and the January 2014 heatwave with maximum temperatures of 45°C led to 167 excess deaths in Victoria (Department of Health, 2021).

How El Niño and la Niña Impact the Heat

El Niño and la Niña events are climate drivers – they are part of the natural oscillations of the Earth's climate. La Niña typically causes more rainfall all over Australia and leads to cooler temperatures in the North and warmer temperatures in the South while el Niño typically leads to much drier and hotter weather allover Australia with increased fire danger (BOM, 2014). Despite the last three years being generally more cold and wet due to La Niña, Melbourne hit a record with 17 days above 30 degrees in January 2022 - the hottest of those days reaching 37.1°C (BOM, n.d.). And with El Niño likely to emerge in Autumn 2023, Melbourne may soon experience more extreme heat events again (King, 2023).

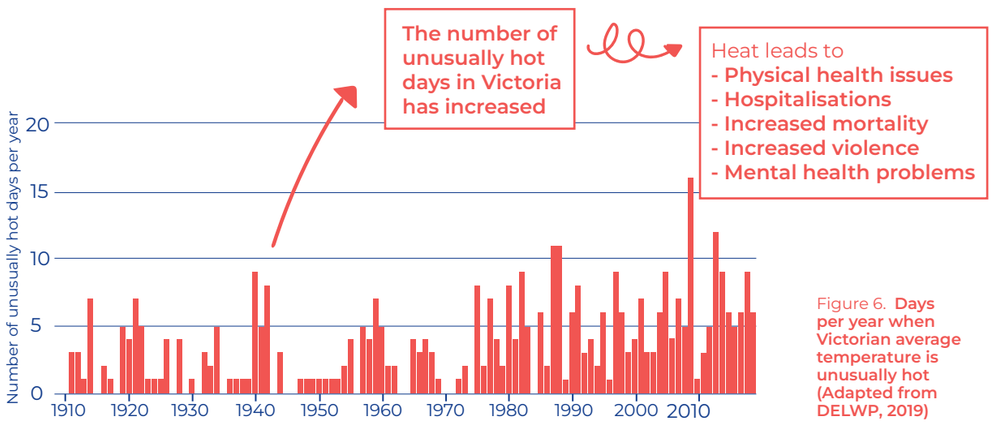


Figure 6. **Days per year when Victorian average temperature is unusually hot (Adapted from DELWP, 2019)**

1.3 Urban Climate Resilience - Responding to Climate Change

Urban Climate Resilience as a Response to Climate Change

When looking at the impact that climate change and global warming have on both a global but also a local level, the question that comes up is: What now, how should we react to this overwhelming challenge? The answer is a combination of climate mitigation (the reduction of green house gas emissions) and climate adaptation (adapting to living with the changing climate). Climate adaptation efforts on an urban level form part of the overall effort of building urban climate resilience – on both an infrastructural and social level – to allow for an urban area and its community to either withstand or quickly recover from climate related stresses and shocks (Cortesão & Copeland, 2021).

» Urban Climate Resilience **is defined as the capacity of an urban area to maintain or quickly return to desired functions in the face of climate-related chronic stresses (e.g., urban heat islands) and/or acute shocks (e.g., heatwaves or intense rainfall), to adapt to changing and uncertain climatic conditions, or to rapidly transform/improve the urban climate system, while ensuring the safety, health, and well-being of its community. Hence, urban climate resilience comprises both an infrastructural (i.e., urban areas as physical assets; spatial design and engineering; the material dimension of urban areas) and a social (i.e., urban areas as socio-cultural assets; inclusivity and ethics; the immaterial dimensions of urban areas) dimension.«** (Cortesão & Copeland, 2021)

A Heat-Focussed Climate Resilience Approach

Figure 7 shows how a heat-focussed climate resilience approach can look like based on a framework and corresponding design strategies from The Western Sydney Regional Organisation of Councils' (WSROC). Their resilience framework builds up on a combination of awareness, mitigation, adaptation and response readiness and shows which urban interventions can be considered to both mitigate and adapt to heat in cities.

The City of Melbourne's Heat Response

The City of Melbourne acknowledged the severity of heat-related issues by assigning their first ever Chief Heat Officers in 2022. They want to improve the city's climate resilience to better react and adapt to heat-related chronic stresses (urban heat island effect) and acute shocks (heatwaves). To get Melbourne and its citizens heat-ready the city already has several initiatives in place: a heat-health-alert activation plan, a heatwave and homelessness program, neighbourhood maps showing cooling infrastructure, greening projects to cool the city and the 'Cool Routes' app showing the most shaded route through the city (City of Melbourne, n.d.). **Despite the existing initiatives, the City of Melbourne acknowledges that they have to improve their efforts in building urban climate resilience and therefore want to implement more cool public spaces in the city that focus on heat relief for the community and climate adaptation.**

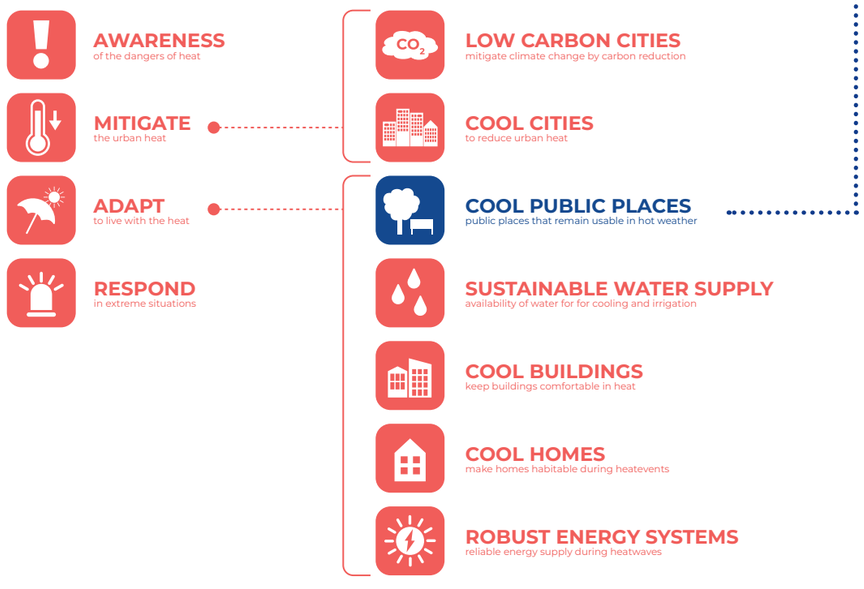


Figure 7. **Heat-focused climate resilience framework and corresponding design strategies - based on the Western Sydney Regional Organisation of Councils' Resilience approach (Adapted from WSROC, 2021)**

2 The Assignment

A Toolkit for Designing
Cool Public Places

2.1 Assignment and Research Questions

As discussed in the previous chapter, hot summer days pose an increased health risk for Melbourne's citizens. While the City of Melbourne already has some initiatives in place, they want to better prepare the city and its citizens for the heat by incorporating more cool public spaces that remain usable during hot days and that provide heat-relief for people in the city.

Assignment

The original aim of this project was to explore how public spaces can contribute towards a heat-focused climate adaptation in Melbourne. However, throughout the project, it became apparent that the main focus of exploration is how different stakeholders (e.g. the city council, design practitioners and citizens) can be engaged in the process of designing these public spaces for heat-adaptation and how they can be supported in sharing their knowledge during this process. The assignment therefore focusses on developing a toolkit that provides guidance in designing cool public spaces by containing suitable cooling interventions and design guidelines but that also enables the engagement of different stakeholders in the process and supports them in sharing their knowledge.

Develop a toolkit that enables the engagement of different stakeholders in the process of designing heat-adapted public spaces in Melbourne. The toolkit should contain suitable cooling and placemaking interventions and support knowledge sharing between the stakeholders.

Research Questions and Expected Project Outcome

The main research question to be explored during this project is:

How can toolkitting enable the engagement of different stakeholders in the planning of heat-adapted public spaces and support them in sharing and gaining knowledge throughout the process?

Subquestions that help the exploration and answer the overarching research question are:

1) How do citizens experience the City of Melbourne on a hot day and what heat-adaptation efforts has the council already made? What needs and wishes do the citizens and council have for public places that protect citizens from the heat?

2) What information do existing cooling toolkits contain and what are their strengths and weaknesses?

3) Which passive and non-energy consuming cooling interventions are suitable for cooling public spaces in general and more specifically in Melbourne's climate?

4) Besides cooling, what other aspects are relevant for placemaking and when designing public spaces?

The research insights are used to identify a more specific design challenge within the defined assignment and to gather relevant knowledge to identify the interventions that should be part of the toolkit. The research insights will also inform what form the toolkit should take to enable the desired stakeholder engagement and knowledge sharing. The developed toolkit should mainly be desirable and feasible but it also needs to be viable. The toolkit is to be designed for Melbourne and its specific climatic conditions with a focus on the heat-issue. However, to make public spaces that are designed with the toolkit suitable for multifunctional, all-year round use and desirable for the city to implement, other extreme weather situations and placemaking aspects should also be considered. Since the project focuses on climate resilience, cooling interventions suggested within the toolkit should ideally be passive and non-energy consuming.

2.2 Project Approach

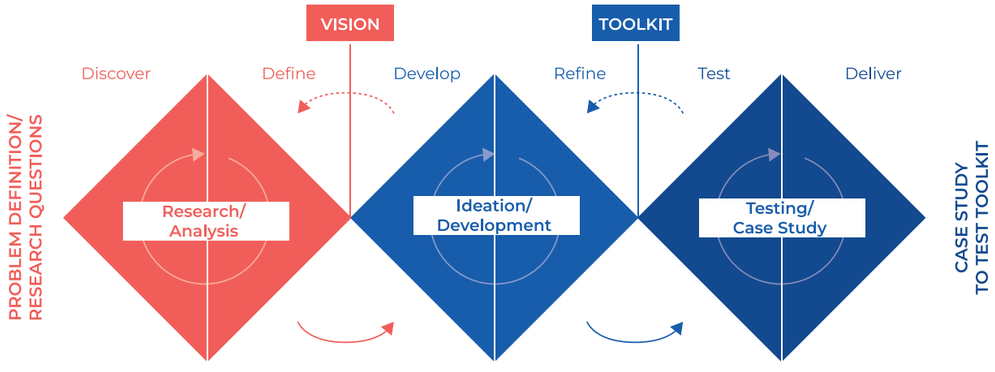
This project is approached using an adapted version of the double diamond design approach (Design Council, n.d.), that acknowledges that at least 3 converging and diverging phases will be needed (Figure 8). As a design process is hardly ever very linear, iterations within and between the phases are natural.

Research/Analysis Phase
During this phase the research questions are approached by first exploring the context of Melbourne on a hot day through observations and by conducting interviews with citizens and Melbourne's city council. Desktop and literature research help to gain knowledge about exisiting cooling toolkits, the general heat issue and suitable cooling interventions that improve thermal comfort. The research insights help to develop a refined project vision and design criteria for the toolkit development.

Ideation/Development
During the ideation and development phase the vision and research insights are used to generate ideas for the toolkit. This encompasses ideas about what shape the toolkit will take (e.g. physical or digital) and what elements the toolkit should contain. Those ideas are presented to stakeholders before being redefined into a final design of the toolkit.

Testing/Case Study
The final toolkit design gets tested during the testing/case study phase, during which the toolkit is trialled with stakeholders that have to develop a design concept for a chosen public space. This will give insights into whether the toolkit can successfully engage stakeholders to co-design heat-adapted public spaces and provide insights for the further development of the toolkit in the future.

Figure 8. **Triple diamond design approach (Adapted from Design Council, n.d.)**



2.3 Methodology

Toolkitting To Develop Planning Support Methods
As explained in the assignment description, the aim of this project is to enable the engagement of different stakeholders in the process of designing heat-adapted public spaces in Melbourne.
A toolkit presents itself as a suitable design intervention for this undertaking, as toolkitting can be seen as a “form of knowledge infrastructuring to support spatial planning” and provides an iterative process to develop planning support methods and instruments (Champlin et. al, 2023).

»Toolkitting concerns the continuous adaptation and iterative development of planning support methods and instruments as an integral, open-ended activity that co-evolves with the planning process it supports.«
(Champlin et. al, 2023)

Methods Used In the Toolkit Design Process
As the toolkit focuses on stakeholder engagement and knowledge sharing, a **participatory design approach** is taken for the toolkit design process. Participatory design is viewed as a democratic design process that aims to involve users in the design process of products or services that they will be using (Hartson & Pyla, 2019). Following this participatory design approach, a strong emphasis lies on learning from and involving stakeholders in the design process throughout the whole toolkit design process. **Observations and interviews** are used in the research phase to gather relevant insights from stakeholders such as pedestrians and the council. According to Slingerland et al. (2020) interviews help to not only gather data but also to build relationships with stakeholders. **Desktop and literature research** are used to identify the necessary interventions that are to be included in the toolkit. To translate these interventions into a tangible and interactive toolkit in the ideation and development phase, a **gamification approach** is used which relates to the use of game design elements in non-game contexts (Deterding et al., 2011). Champlin et. al (2022) demonstrate how game co-design can be used as an engaging and accessible manner to elicit stakeholder knowledge. **Co-design** is described as "active collaboration between stakeholders in designing solutions to a prespecified problem" (Vargas et al., 2022) and repeatedly applied throughout the project to engage stakeholders in the design process - first in feedback sessions where toolkit elements are presented and refined in collaboration with the council and later by testing the co-design workshop series included in the toolkit through actual co-design workshops in the testing and case study phase. **Observations** during and **feedback sessions** after the co-design workshops are used to evaluate the proposed toolkit design. Observations add the benefit of helping to collect data that participants are unable to communicate verbally during the co-design workshops and feedback sessions (Champlin et. al, 2023).

3 Research and Analysis - Melbourne Now

This part of the research and analysis phase focussed on the now – trying to understand what Melbourne is currently like, how the city is experienced on a hot day and what the council is already doing to deal with the heat. This helped with identifying a design opportunity for this project and the toolkit.

3.1 Introduction to Melbourne

3.1.1 The City of Melbourne and Its History

Metropolitan Melbourne, also known as Greater Melbourne, is the geographical area that defines Melbourne as a city within the State of Victoria, Australia. Metropolitan Melbourne currently has a population of more than 5.2 million people and is divided into 31 local government areas.

One of these 31 local councils is the City of Melbourne (Figure 9), located in the centre of Metropolitan Melbourne and divided into ten different neighbourhoods. Since the project is carried out for the City of Melbourne, the work carried out is focussing on the City of Melbourne council area. More specifically, the research and work presented within this report is focussing on Melbourne's CBD, the Central Business District, also known as the "heart of Melbourne and the cultural, social and economic capital of Victoria" (Participate Melbourne, n.d.).

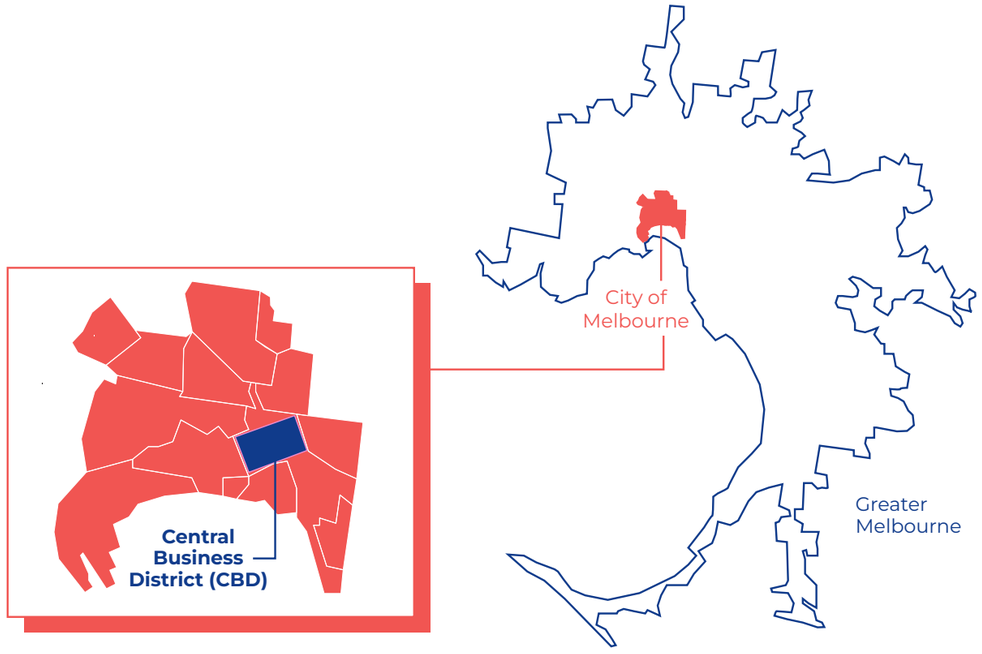


Figure 9. **Relation between Greater Melbourne, the City of Melbourne and the CBD**

History of Melbourne's CBD

When talking about the history of Australian cities it is always important to acknowledge their aboriginal origin and significance. Melbourne – the traditional aboriginal name is Naarm – is situated on the traditional lands of the Kulin Nation. The Kulin Nation consists of five clans (Wurundjeri, Boonwurrung, Wathaurrung, Taungurung and Dja DjaWrung) that have inhibited the land for more than 40,000 years prior to colonization (Melbourne, n.d.).

The CBD is located on the traditional lands of the Wurundjeri Woi Wurrung. After the European settlement, Melbourne was founded in 1835 as the capital of Victoria under the reign of King William IV. In 1837 Assistant Surveyor General Robert Hoddle was instructed by Governor Burke to lay out the town of Melbourne. That's when Hoddle designed the grid of Melbourne (Figure 10) – which until today is still referred to as the "Hoddle Grid" and forms a major part of the CBD (DocoMonde, 2022).

Project 'Postcode 3000' - Reviving the Dead City

In 1978 the CBD was described as "an empty useless city centre" by newspaper 'The Age'. Resident numbers declined as many people moved out of the dead city and the 'Postcode 3000' project had the aim to revive public life in Melbourne. This is also when urban design revolutionist Jan Gehl came into play. His 'Public Space Public Life' survey in 1994 studied issues and opportunities for the City of Melbourne and helped to turn Melbourne in a more people focussed city. A second 'Public Space Public Life' survey in 2004 showed the success of the improvements: The resident number has grown by 803% within 10 years, new public squares have been introduced, existing lanes and arcades have been revitalized and public life has generally improved (Gehl Architects & City of Melbourne, 2004). Since those improvements, Melbourne has been named 'The World's Most Liveable City' multiple times.

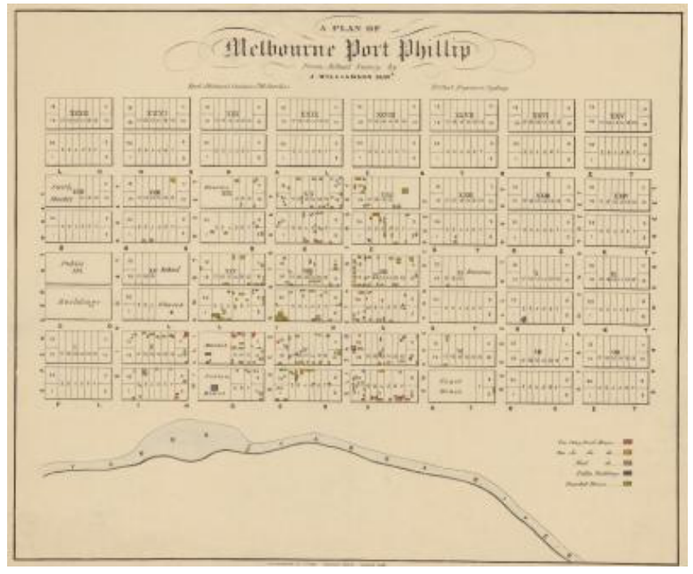


Figure 10. **Map of central Melbourne showing location of brick houses, mud buildings, public buildings and boarded houses (From Williamson, 1839)**

3.1.2 Focus On the CBD and Its Users

CBD Nowadays

The CBD still forms the heart of Melbourne, where Melbourne's famous laneways, arcades and café culture can be found (Figure 13). The city center offers a broad variety of events and opportunities for shopping, dining and nightlife. A lot of Melbourne's iconic landmarks can be found here as well: the State Library of Victoria, Queen Victoria Market and Federation Square, one of the few public squares within the CBD.

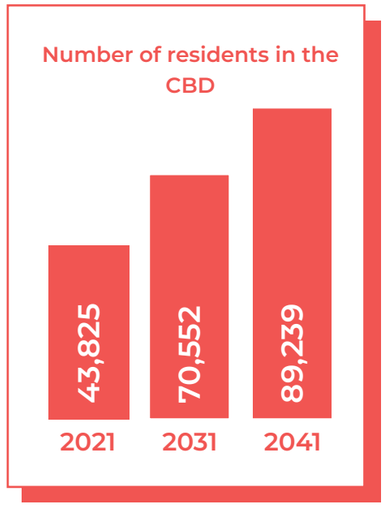


Figure 11. **Expected number of residents in the CBD in 2021, 2031 and 2041 (Data from City of Melbourne, 2022)**

Why Focus on the CBD?

Since the 'Postcode 3000' project, the City of Melbourne continued growing and attracting people. The CBD has the highest population number within the City of Melbourne with 43,825 people living there in 2021, and these numbers are expected to double by 2041 (Figure 11). The CBD is built very densely with many high-rise buildings, leading to a very high population density – in fact the CBD had the highest population density in all of Victoria with 33,500 people per square km in 2022 (Australian Bureau of Statistics, 2023). Much higher than the resident number however is the amount of workers and visitors that populate the CBD every day. In 2019, 98,000 workers came to the CBD on weekdays, as well as 274,700 international and domestic visitors (Figure 12). Despite this data being measured before Covid-19, total visitor numbers in 2022 were already back to 83% of the pre-pandemic result (Business Victoria, 2023).

Who Is Using the CBD?

The density and growth of residents, workers and daily visitors show that the CBD is a space where many people spend time, move around and travel through daily, creating a lot of demand for heat-adapted public spaces on a hot day. Due to its density, high-rise buildings, traffic and abundance of asphalt streets, the CBD is more prone to the Urban Heat Island effect, making it even more important to offer cool public spaces – or more public spaces in general, as the Hoddle Grid has originally been designed without any public spaces in order to prevent *"the formation of any public democracy that could lead to civil unrest"* (DocoMonde, 2022).

The City of Melbourne states in their "Future Streets Framework 2030 and Beyond" (2023) that having a productive central city is important for Victoria's economic prosperity and that *"supporting residents, workers, business owners and visitors through walking, cycling and public transport*

Figure 13. **Impressions from the CBD (Photographs by author) left: Skyline view from Queen victoria market, middle: Drewery Lane, right: Parliament Gardens)**

is crucial to the city's ongoing economic success". However, when it comes to the provision of cool public spaces, the economy shouldn't be the only thing to consider. Many people in need of access to protection from the heat are those who most likely cannot contribute much to the economy – e.g. people with bad living conditions and who don't have or are unable to afford air-conditioning or people experiencing homelessness. Just like elderly people, they tend to be more vulnerable and being able to escape their living conditions during a heatwave is important. Another group to consider are workers who must come into or commute through the city despite the heat. While many people can work from home on a hot day, certain jobs require one to still come into the city. A good indication for these jobs is the 'Essential Workers and Essential Providers List' (DHHS, n.d.) that was released during the Covid-19 pandemic. Essential health and emergency workers, roadside assistance workers and public transport workers are just a few examples of the many workers who had to continue working throughout the lockdown and would also be required to come to work during a heatwave. Making it safe and comfortable for them to reach their work on a hot day, particularly if they commute to work by public transport, is important.

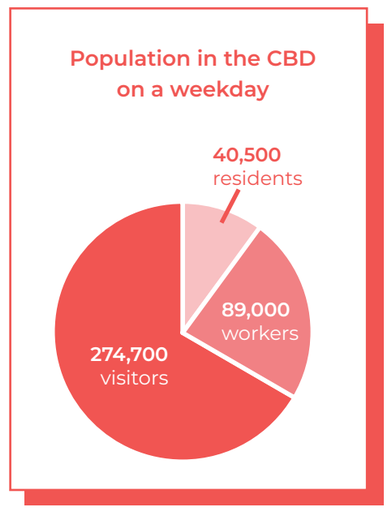


Figure 12. **Adult (20+ years) daily population estimates 2019 (re-weighted mobile data) (Data from City of Melbourne, 2019)**

Design Public Spaces for All

In conclusion, heat-adapted public spaces in the CBD should be designed to attract people with good socio-economic conditions into the city to still enjoy the city's offerings and to support the economy on a hot day but should also be designed to offer places to stay for people who have no choice but to come into the city (e.g. due to their work) or that need access to cool public spaces as their living conditions don't provide any heat protection for them.

3.2 Melbourne On A Hot Day

3.2.1 Observations

To get a first understanding of how a hot day impacts the City of Melbourne and the public life, the city was visited on two hot days (February 17th, 2023 with 38°C and February 24th, 2023 with 32°C) to observe the behaviour of people and usage of existing public places.

Usually Buzzing Places are Almost Entirely Empty – But Fill Up as Soon as Heat Diminishes

On a regular day, public places like Federation Square, the QV Square or the grass area in front of the Victoria State Library are a popular choice for people to dwell. On a sweltering day, those places provide no protection from the burning sun, with hardly a soul deciding to spend time over there (Figure 14). But it shows how popular these public squares are: As soon as the heat diminishes, people are returning to eat, chat and relax (Figure 15).

Public places provide very little to no shade - and therefore remain empty on a hot day. But people start returning as soon as there's more shade and less heat.

Seeking Shade Wherever Possible

When walking through the city, it becomes apparent that people seek shade wherever possible. However, shade is not readily available everywhere and particularly traffic lights, that force people to stop on their journey through the city, often don't provide any shade which leads to people having to wait in full sun exposure or a couple of meters away from the crossing. This also shows at tram stops, that don't provide enough shade or, depending on the sun direction, cast the shadow onto the street, where people are unable to wait for their tram (Figure 16)

Contrast Between Sunny and Shaded Streets

Melbourne has very wide streets both in the North-South as well as the East-West direction. A combination of the surrounding building height and the sun direction leads to some streets being fully exposed to the sun, while others are very shady.

Unused Benches

Even though the City of Melbourne provides many benches throughout the city it becomes apparent that many of them stay unused on a hot day – some are fully exposed to the sun while others are made from metal that heats up very quickly in the sun, making it uncomfortable to sit on.

Necessary Work still Needs to Continue

When walking through the streets of Melbourne on a hot day, two groups of people can be identified: Those who voluntarily come to the city to spend their leisure time or to run errands and those who have to be there: workers. Those are for example construction workers, public maintenance workers or food delivery workers. They need to continue their work despite the heat and don't have an option to work from home.

Figure 14. **Public squares - fully exposed to heat and empty. Victoria State Library (top), Federation Square (bottom) and QV Square (right)**

Figure 15. **Victoria State Library (left) and QV Square (right) buzzing again once heat diminishes**

Figure 16. **People seeking shade wherever possible when having to wait. Street crossings at Queen Vic Market (left), tram stop on Royal Parade (right)**

3.2.2 Pedestrian Interviews

To understand how pedestrians experience the city on a hot day, street interviews were carried out in Melbourne on a hot day in March 2023 with maximum temperatures of 32.5°C. Melbourne can experience much higher temperatures than on that day, particularly during El Niño years, so interviewees were also asked if they experienced hot Melbourne summers in the past, to make them refresh their memories. A total of 30 pedestrians was interviewed and asked about their knowledge of heat risks, the impact of hot days on their daily life and how they perceive the city's preparedness on such a day. The interview questions can be found in Appendix B.

Risks Exist – But What Are They?

All pedestrians were aware that there are risks related to the heat, but not everyone was equally aware of what those risks are. Personal health risks like dehydration, heat stroke and sunburn were associated with heat most often but only one person mentioned death as a possible heat risk. Several people did not consider their own personal health at risk, but rather mentioned risks like bush fire hazards and damage to nature and wildlife.

»It was like, I think forty something degrees whilst I was getting out of the tram and then I just fainted. So It was clearly very, very hot. I think especially for elderly people the risks are really high walking outside!«

»I am more lethargic on hot days. I feel like I don't get as much done and I stay at home to stay cool.«

Staying Home and Laying Low When It's Hot

It clearly showed that the hot days have a big toll on people's daily lives and their behaviour, as almost everyone mentioned wanting to just stay home all day and reducing their activity when it gets very hot outside. Some people mentioned turning on their air conditioning or going to air-conditioned places. Several people mentioned that the heat makes them feel lethargic, tired, and drained which makes it hard to still get things done. It also showed that the heat causes a behaviour change as people mentioned that they swap plans around, leave the house only late in the afternoon when the heat is lower or check the UV rating before leaving the house.

Switching Mode of Transport

When having to leave the house on a hot day, to run errands or get to work, many people indicated that the heat impacts their choice of transportation. Many people indicated taking the car on a hot day, some of them because it's their regular mode of transport due to their location but many indicated that they only choose the car on a hot day and that it wouldn't be their choice on a regular day. Reasons for using the car were the opportunity of using the air conditioning and worries about having to walk in the heat or having to be in a very squished tram or bus. A few

people indicated that they would usually just walk or bike but would switch to public transport on a hot day and several people said that public transport is always their choice of transportation, despite the weather, but that they may adjust travel time on a hot day.

»I often drive if it's really hot just because I think when taking public transport, I don't wanna be squished on a tram and walking or worried about getting sunburnt or getting too exhausted.«

Does the Availability of Air-Conditioned Malls Mean Melbourne is Prepared for the Heat – or the Exact Opposite?

The interviews showed that Melbourne is not perceived as a city that is very well prepared for the heat as people rated Melbourne's preparedness somewhere between 4 and 8.5 out of 10 points, with 5 points being given the most often (Table 1). Interestingly most people that think the city is already somewhat or well prepared and have given a rating of 6.5 or higher did mention the availability of air-conditioned public places, such as shopping malls as well as the availability of (drinking) fountains – even though they also mentioned that there still should be more of latter.

»We try to meet at our house. But if it's not possible, then we have to take a cab. Because for the tram, you know you have to walk some distance and then 5 minutes can take a toll on you.«

»One of my friends adviced me that if you feel really hot then go to a shopping mall.«

»Outside, I think it's hotter and from, you know, from the times that I've been in there, there's no shade readily available.«

»If it's too hot or there's nothing you can do but I think that there's not enough places for people to go to escape the heat.«

People that however think that the city is not yet well prepared and gave a rating of 6 or lower, elaborated it with mentioning those same exact air-conditioned public spaces and how they don't like that those are the only public places one can go to when it's hot. They mentioned that there is not enough purposefully designed shelters and shade readily available in outdoor areas. Greenery in the city also influenced how people rated Melbourne's preparedness – while some gave a high rating because of the availability of green outdoor areas, others gave a low rating because they think there is not yet enough green areas in the city. Another issue that was mentioned was the lack of air-conditioned public transport on a hot day.

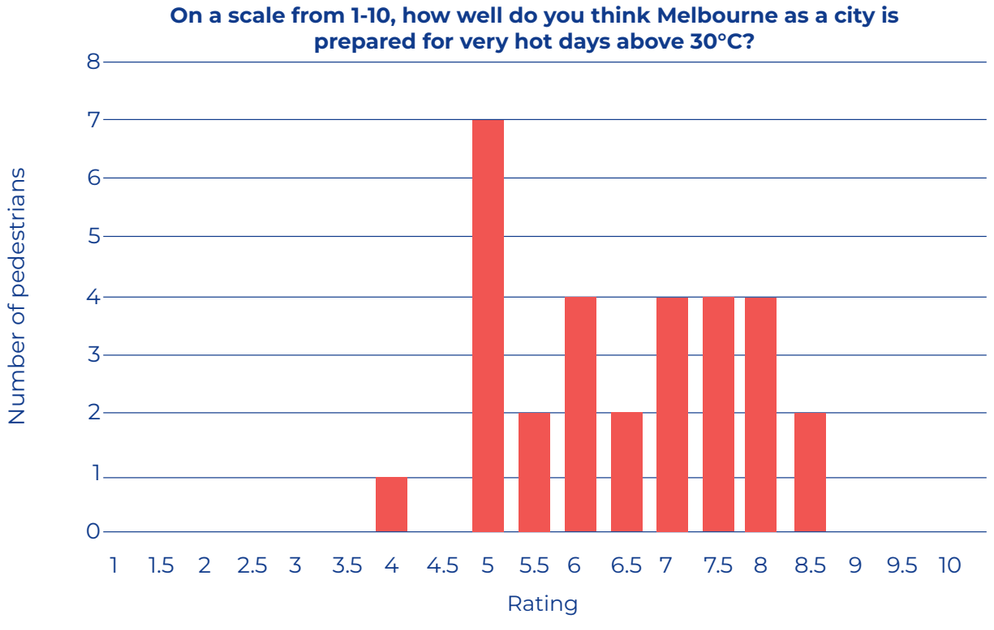


Table 1. **Rating: How well do you think the City Of Melbourne is Prepared for the Heat on A Scale From 1 to 10?**

What's Missing? Cool Outdoor Places, Water Elements and Comfortable Public Transport

When being asked what's still missing to make the city more comfortable on a hot day, a common answer was that participants would like to have more public spaces where people can spend time without having to go into air-conditioned malls. It was also mentioned how this is especially important for the elderly or people that don't have or cannot afford air-conditioning at home. Many people agreed that there is enough indoor space to go to but that they wish there was more outdoor spaces like parks to hang out but also more shaded areas when walking through the city and the possibility to take breaks in comfortable and shaded outdoor areas. Another theme that reappeared was the availability of water – people mentioning wanting to have more drinking fountains but would also like to see more water play and misting around the city to keep cool. Besides that, the need of better public transport was mentioned – this includes both having more air-conditioned trams but also better shaded waiting areas at the tram stops.

»Just cause yeah, a lot of people can't afford to use air conditioning or don't have air conditioning in their homes. And people don't wanna go to shopping centres.«

»Like, during summer I'm just kind of walking around. It gets really, really sunny, but there's not many trees or else you have to actually go inside.«

»So, yeah, you do tend to go to somewhere like a food court, to sit and wait rather than there being like a little park or something like that. So there should be just more outdoor seating area sort of.«

Heat-Safe City Survey Confirms the Insights

The City of Melbourne is currently running a project called "Heat Safe City" in which they consult the community to learn about their heat experiences in the city. The insights from that survey (Appendix D) with 135 Melburnian participants confirm the insights from the pedestrian interviews, that the community would like to generally see more greenery and shade areas in the city and would like to have more publicly accessible cool places, like cooling corridors or cooling centres.

Insights from Pedestrian Interviews

- **Melbourne is not perceived as being heat-ready**
- **At the moment cool places in the city are limited to air-conditioned indoor places like malls or libraries**
- **There is a need for more outdoor places where people can walk, hang out and rest on a hot day, citizens want to see more greenery, cool green corridors and shade in the city**

3.3 The Council's Efforts On The Heat-Issue

3.3.1 Interview with the Council

Next to the local citizens, workers and visitors as main users of the to-be-designed public places, the City of Melbourne as municipality and decision maker is another important stakeholder for the project. An interview with Candace Jordan, Climate Change Adaptation Lead at the City of Melbourne, offered interesting insights into the council's perspective on the heat issue and their already existing efforts to mitigate and adapt to the heat, but it also helped to identify current weaknesses and resulting opportunities for the future (see Appendix C for interview consent form).

City Of Melbourne Climate Change and City Resilience Team
Strategic Branch

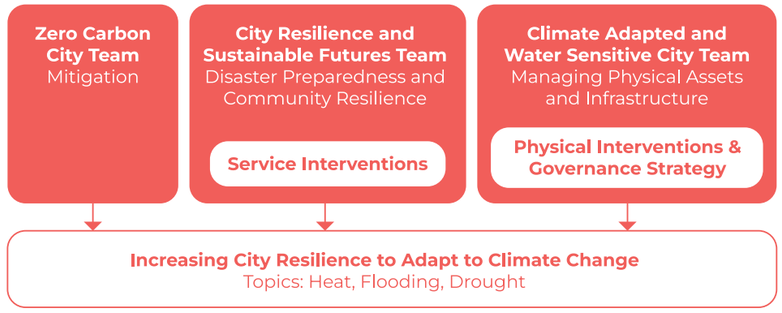


Figure 17. **City of Melbourne Climate Change and City Resilience Team**

Climate Change and City Resilience Branch

The Climate Change and City Resilience (CCCR) Team is a Strategic Branch within Melbourne's city council and is divided into the Zero Carbon City Team, the City Resilience and Sustainable Futures Team and the Climate Adapted and Water Sensitivity City Team, who are working together on increasing City Resilience to Adapt to Climate Change. Their main topics are Heat, Flooding and Drought (Figure 17). Candace Jordan works within the Climate Adapted and Water Sensitivity City Team where she focuses on adapting the city to extreme heat.

Heat – an Underrated Issue

Despite heat being the most deadly of all natural catastrophes heat seems to often be overlooked next to other issues. Candace states that even within the City of Melbourne heat and heatwaves just started getting the attention they deserve within the last few years. That the heat issue is finally being recognized showed when the City of Melbourne

joined Arsht Rocks City Champions for Heat Action initiative in 2022 and assigned Tiffany Crawford and Krista Milne as Chief Heat Officers. One of the missions of the CCCR team is to build more heat awareness – both within the community but also within the council.

Ongoing Efforts to Increase City Resilience and Heat-Adaptation

Figure 18 shows an overview of ongoing efforts that the City of Melbourne has been making to address city resilience and heat adaptation over the past few years. Fields that are marked orange show initiatives that are directly targeted at tackling heat-issues, while the other fields show initiatives that don't have heat-adaptation as their main priority but are still relevant to reducing the heat in the city.

Melbourne-Specific Toolkit Has Been Desired by Council for Long Time

The interview showed that a Melbourne-specific toolkit for designing cool spaces is something that the Climate Change and City Resilience Branch has been wanting to create for a long time already as existing toolkits are either not targeted at Melbourne's climate or not very actionable and a *"mix and match"* toolkit could help to retrofit existing places.

Opportunity to Use Non-Greening Solutions – But They Need to Be Evidence-Based

A toolkit for designing cool public places is an opportunity to introduce more non-green cooling interventions to Melbourne and a chance to introduce

»When I look at this, I think like we do the greening stuff pretty well, it's the non green stuff that we don't do well. [...] We haven't done as much work to build the literacy around alternative cooling methods that are non-green, so it's almost like that's an untapped space.«

tactical cooling where different cooling strategies can be mixed and matched, depending on the specific needs of a location. However, Candace also mentions that there needs to be an evidence base when introducing new cooling techniques – there needs to be proof that those interventions work for Melbourne's climate. *"It's like it has to be greening or nothing maybe. But giving people options that say actually we can meet this through other methods, that's where we don't really have that evidence base."*

Whom to Design For – Necessary to Recognize That There is Not a "One Size Fits All" Solution

"How are we designing spaces for a particular function, particular users, and knowing that there's different kinds of spaces that we can provide, like whether it's indoor, public space or outdoor public space? It might be some groups where it's not about providing a public space, but it's about making sure that they've got something at home. […] To knowing that, yeah, they might not want to go out to a public park or a library or the community centre, so recognizing that it's not like a one size fits all that it's, I suppose, like we talk about a toolkit […] where we like have a suite of options." Candace acknowledged that there is no such thing as just one target group or one solution for cool public spaces. It's rather about being able to have different options available in a toolkit, that can be applied to different needs, locations and users.

Efficient Use of Resources - Cooling Interventions Don't Need to Be Everywhere and All Year Round

When designing new cool public spaces, it's important for the City of Melbourne to use resources efficiently and depending on the needs of a place. Some cooling interventions could only be rolled out during summer when they are needed. And temporary cooling interventions are also a very interesting approach to complement greening projects as there needs to be additional cooling or shading while new trees are still growing and cannot provide shade yet. Efficiency also relates to location strategies – which places really need cooling? Where do people spend time, and what do they do in those places? *"We don't need to cool everywhere, we just need to target certain places, like prioritize places that need it because of who lives there, how they use the space, what space they use."*

»But I think it's the more temporary that when we can't plant trees, what do we put in place? And yeah, also what are the temporary sort of things we can do while we're waiting for trees to grow?«

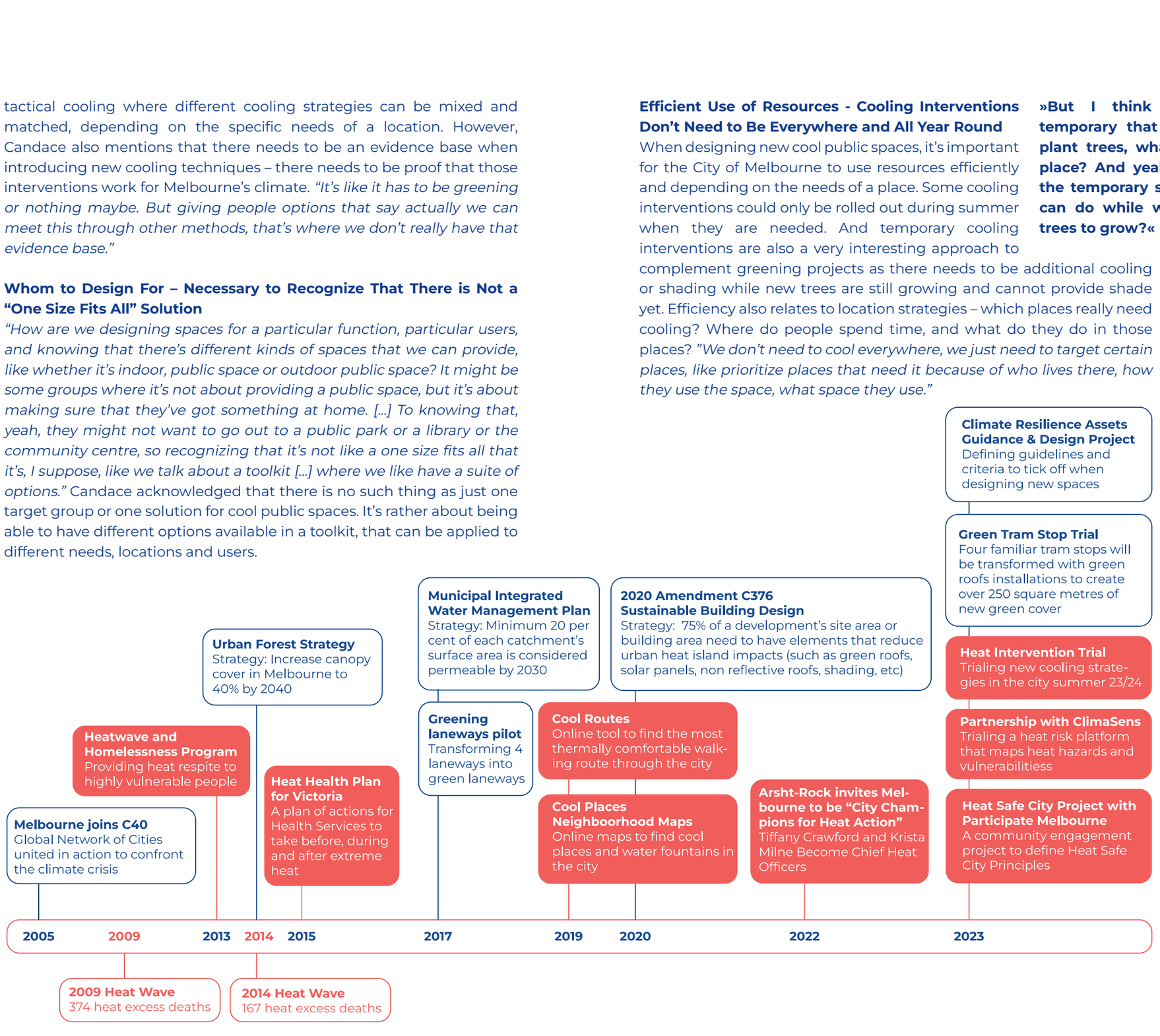


Figure 18.
Timeline with interventions that the City of Melbourne has introduced to address climate change and heat

Cooling Places Where People Dwell and Wait

One opportunity to introduce new shade and cooling interventions are places where people have to wait. This can be tram and bus stops, but also traffic lights. Those places are often not well shaded. "*Places like tram stops, bus stops are like some of my high target areas because there are places that people dwell while you're waiting for, like while you wait for your bus [...] But yeah, it's about making sure that like the shade is actually going to be where the people are.*"

»So this is our cool routes tool and so this is about finding, you know from A to B how to get there and the coolest way. It's about recognising that we could actually create cool corridors through the grid.«

Physical Cool Routes and Tactile Wayfinding

Another opportunity for introducing new cool public spaces in the city would be to turn the existing 'Cool Routes' web application into physical cool corridors in the city and making sure that people can find those cool routes via tactile wayfinding. When designing these cool routes it's important to look into how streets are currently used to identify their functions.

Activation – Melbourne as a Safe City that Attracts People on a Hot Day and Keeps the Economy Alive

The council does have an activation strategy, so they want to provide safe and cool places in the city that attract residents, workers and visitors to still come into the city on a hot day. This also has to do with the economic impact of hot days and heatwaves – if people stop coming into the city on a hot day that will have a negative impact on local businesses and the overall economy. "*We do see it as an activation, encouraging people to come into the city and show them 'You don't have to stay home. You can still come in. It will be comfortable. It will be cool.' [...] The 2014 heat wave showed that over that four day period businesses lost an estimate, it was around $37 million in revenue [...] Yeah, there's that economic impact. So trying to counteract that by making it desirable to come into the city on a hot day, that is part of the story as well.*"

»We don't want people to be turned off by coming to the city because it's hot, right? So we want to make sure that we are attracting people to this by having cool places and whatnot. Having those places of refuge for residents, workers and visitors.«

Insights from Council Interview

- **Current strategies are very much focused on greening solutions, the toolkit is a great way for the City of Melbourne to start implementing more non-green solutions that complement the greening efforts**
- **Cooling doesn't need to be everywhere and all times, but where people dwell and spend time and during the hot summer periods**
- **There is an opportunity to turn the 'Cool Routes' web application into a physical cool routes network in the city with tactile wayfinding**
- **The city follows an activation strategy and wants to attract people to still use the city on a hot day to keep the city alive and support the economy**

3.4 Movement Through The City On A Hot Day

Walkability and movement through the city appeared as an interesting theme in both the interviews with the pedestrians as well as in the interview with the council and was therefore further explored.

89% of Trips Within the CBD Hoddle Grid Are Made on Foot

According to the 2030 Melbourne Transport Strategy (City of Melbourne, 2019), around 900,000 people (both residents, workers and visitors) moved into and within the City of Melbourne municipality every day in 2016 and this number is expected to rise to 1,400,000 people by 2036. Within the municipality, 66% of daily trips are made on foot, and within the CBD hoddle grid a surprising 89% of trips that start and finish in the CBD are made on foot (Figure 19). Despite the high amount of pedestrian traffic, only 26% of street space is allocated to footpaths within the hoddle grid and also within the municipality (City of Melbourne, 2019). This uneven allocation of street space and use was also shown in De Gruyter et al.'s (2021) research that analysed the street space and use ratio across 57 sites in Melbourne. An analysis of Elizabeth Street in the CBD showed that more than 70% of people pass that street as pedestrians, while only slightly more than 35% of space is actually allocated to footpaths on Elizabeth Street (Figure 21).

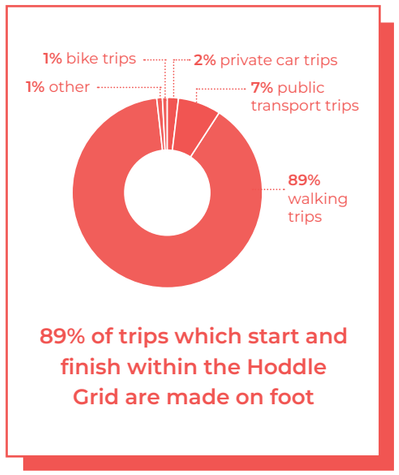


Figure 19.
Daily trips within the Hoddle Grid in 2016 (Data from City of Melbourne, 2019)

Melbourne Transport Strategy – Increase Walkability and Resolve Overcrowding and Safety Issues for Pedestrians

The 2030 Melbourne Transport Strategy identified overcrowding, the resulting pedestrian delay, the lack of designated pedestrian space and a high number of fatalities and injuries as some of the biggest issues with currently existing pedestrian networks in the city. Their vision for 2030 is to half the number of people being killed or injured on the streets, half the proportion of central-city through traffic and increase public transport, walking and cycling mode share to 70 per cent of all trips in the municipality by improving the pedestrian network and assigning more space to pedestrians as it is their vision that *"Walking on our streets and laneways will be safe and comfortable with expansive unobstructed footpaths, seating and substantial tree canopy coverage"* (City of Melbourne, 2019).

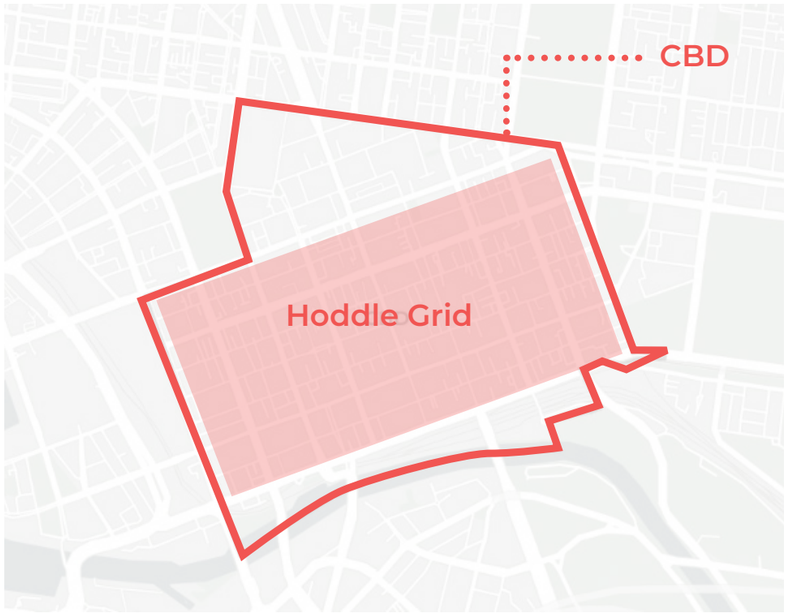


Figure 20.
Location of Hoddle Grid within the CBD

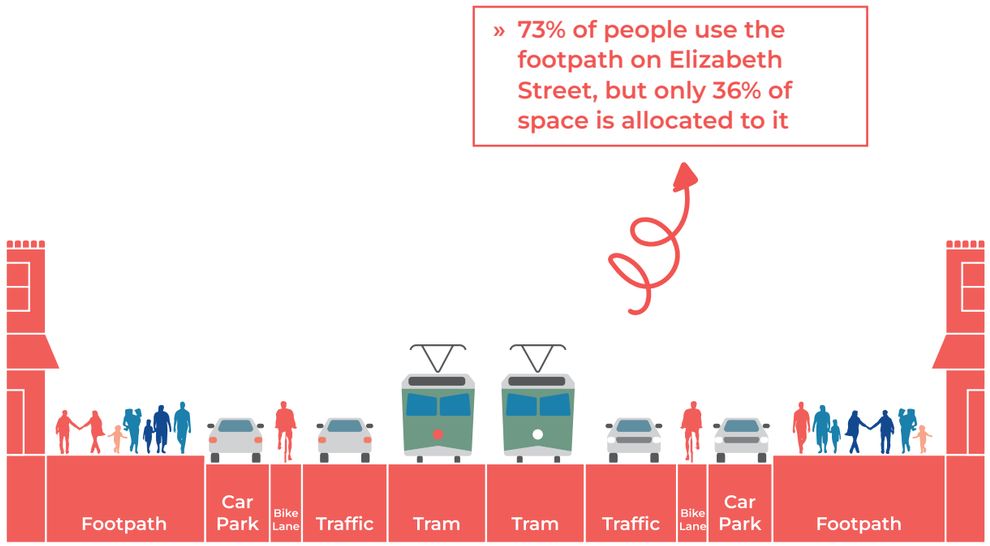


Figure 21. **Street cross-section and analysis of space allocation at St Francis Church, Elizabeth Street, Melbourne (Modified from De Gruyter et al., 2021)**

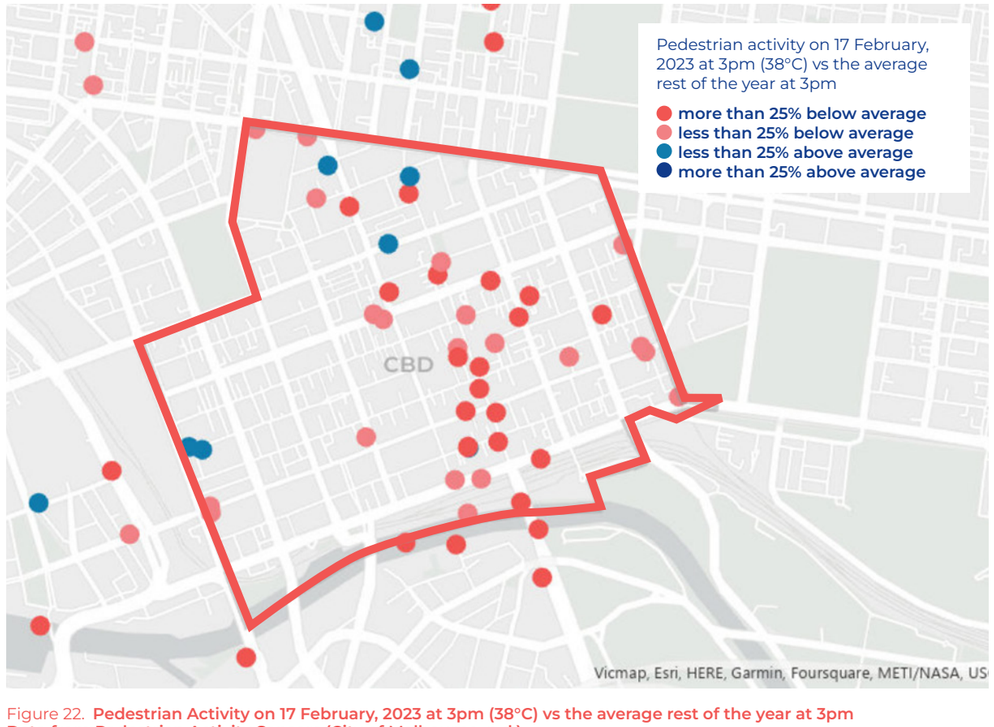


Figure 22. **Pedestrian Activity on 17 February, 2023 at 3pm (38°C) vs the average rest of the year at 3pm Data from Pedestrian Activity Sensors (City of Melbourne, n.d.)**

Figure 23. **Screenshot from Cool Routes App (City of Melbourne Cool Routes, n.d.)**

Below Average Pedestrian Activity in the CBD on a Hot Day

What already showed in the observations, interviews and survey is that people tend to go out less on a hot day and try to avoid being in hot crowded places. This also shows when analysing data from pedestrian activity sensors that are placed across popular pedestrian streets in the city: The pedestrian activity on a hot day (in this case, on 17 February 2023 with a maximum temperature of 38°C) is lower than the average pedestrian activity in those locations during the rest of the year (Figure 22). Particularly streets like Swanston Street that are typically very busy, have much less pedestrian traffic on such a hot day.

An Unused Tool: the Cool Routes App

The 'Cool Routes' app (Figure 23) is a web application that was developed for the City of Melbourne in 2019 with the aim to show people not necessarily the fastest but the coolest pedestrian route within the CBD and the municipality. *"Cool Routes was developed using spatial analysis and heat data from the City of Melbourne and adjusts routes based on the time of day you select to travel, analysing shadowing, tree canopy, surface materials and sun location to determine the most shaded and thermally comfortable path."* (City of Melbourne, n.d.) While being an interesting tool, it is only available as a stand-alone web application that is not integrated within existing navigation apps, such as Google Maps, and not available as an offline map or wayfinding tool within the city. The pedestrian interviews were also used to identify whether people have ever heard about this tool, and it showed that out of 30 people, only one person had previously heard of the application, but has not even used it. While some people were curious about the app, they also indicated that they would be unlikely to use it just to find a route through the city.

Insights from Movement Through the City Analysis

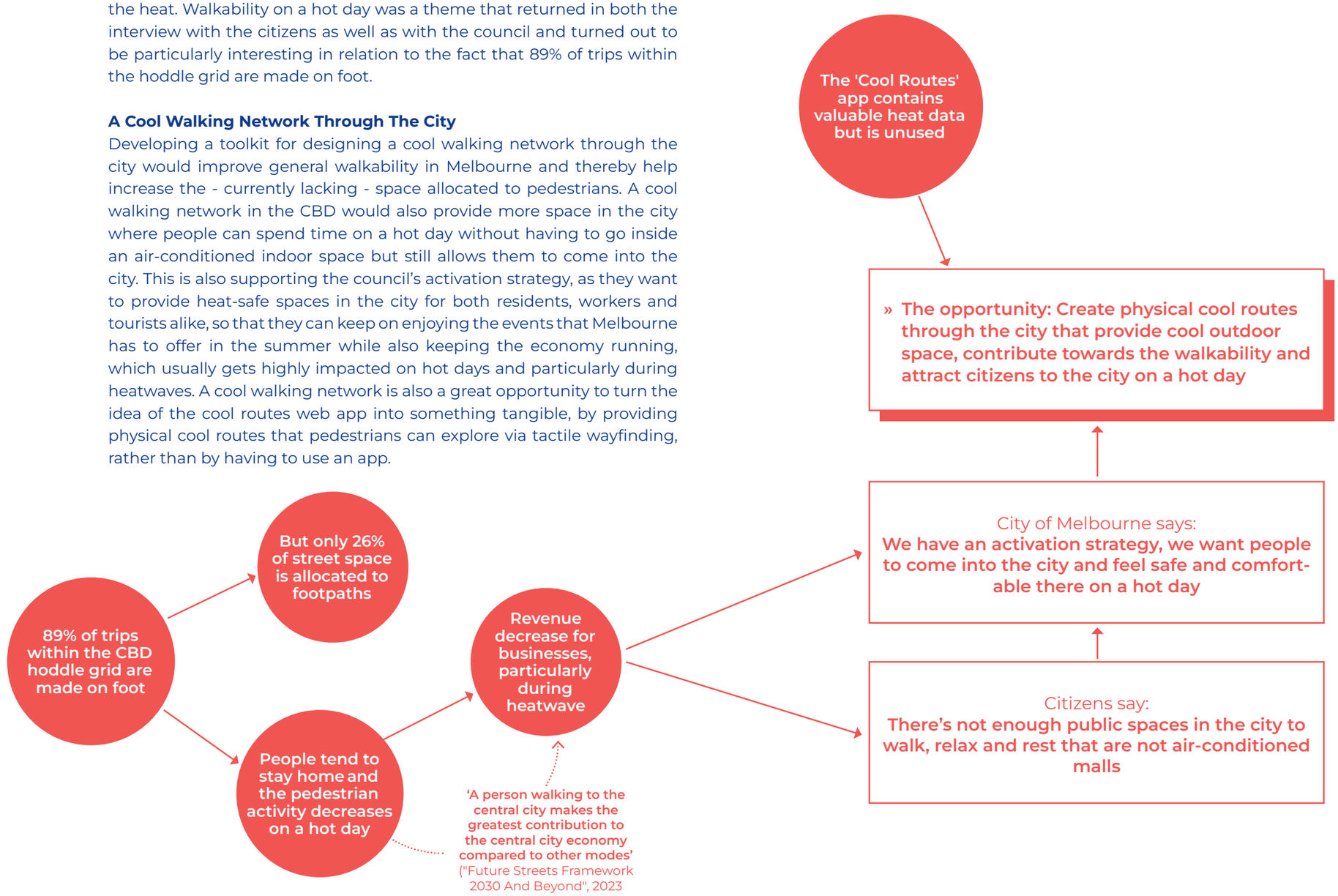
- **The CBD is very heavily used by pedestrians, but at the moment there is not enough space allocated to the high pedestrian traffic**
- **Pedestrian traffic through the CBD reduces on a hot day**
- **The Cool Routes app contains valuable data about hot spots and how to walk through the city on a hot day, but is only available digitally and currently not used by people**

3.5 Design Opportunity

The work conducted in this first research and analysis phase helped with getting a better understanding of how citizens experience heat in the city and what the council is already doing to both mitigate and adapt to the heat. Walkability on a hot day was a theme that returned in both the interview with the citizens as well as with the council and turned out to be particularly interesting in relation to the fact that 89% of trips within the hoddle grid are made on foot.

A Cool Walking Network Through The City

Developing a toolkit for designing a cool walking network through the city would improve general walkability in Melbourne and thereby help increase the - currently lacking - space allocated to pedestrians. A cool walking network in the CBD would also provide more space in the city where people can spend time on a hot day without having to go inside an air-conditioned indoor space but still allows them to come into the city. This is also supporting the council's activation strategy, as they want to provide heat-safe spaces in the city for both residents, workers and tourists alike, so that they can keep on enjoying the events that Melbourne has to offer in the summer while also keeping the economy running, which usually gets highly impacted on hot days and particularly during heatwaves. A cool walking network is also a great opportunity to turn the idea of the cool routes web app into something tangible, by providing physical cool routes that pedestrians can explore via tactile wayfinding, rather than by having to use an app.



4 Research and Analysis - What’s Next?

While the first research and analysis phase focused on analysing the current situation in Melbourne on a hot day, the second phase presented in this chapter focussed on the future situation and on gathering knowledge for developing the toolkit. This includes an analysis of existing toolkits and a deep dive into the three main strategic components for the toolkit: cooling, placemaking and walkability.

4.1 Cooling Toolkits Precedents

4.1.1 Toolkit Precedents

To understand what the toolkit for the Cool Pedestrian Network for the City of Melbourne should look like, eight different toolkits (Figure 24) from organisations like the UN Environment Program, C40 Cities and Low Carbon Living CRC as well as from cities impacted by the heat like Athens, Sydney, Singapore and New York, were analysed to understand how their toolkits are built and which strategies they suggest to adapt to the heat. A full overview of the analysis can be found in Appendix E.

Existing Toolkits: A Lot of Information on a Lot of Pages
What all toolkits have in common, is a good and understandable introduction to the issue of climate change and heat and why it is important to act and implement cooling strategies. Some toolkits suggest as little as 4 cooling strategies, while other toolkits provide an overview of 85 strategies for cooling the city. Having 85 strategies to choose from means a great variety, but at the same time makes it harder to choose and get a real understanding for all the options without being overwhelmed. This seems to be a general issue as many of the cooling toolkits are very text heavy, the longest one of them containing 208 pages of information. This makes a lot of the toolkits very unactionable as the amount of information is very overwhelming while the strategies are also often still described on a very abstract level rather than suggesting specific actions or assets to be implemented. It also needs to be mentioned that most toolkits are written by academic researchers in a high level language are mainly targeted at councils and governments and not at laypersons like citizens and community groups.

Elements to Adapt From Existing Toolkits
Some elements that were found in the analysed toolkits and that can be implemented in the new toolkit for the City of Melbourne are:

- An easy-to-understand introduction to the issue of urban heat, supported by visuals or graphics
- Using simple icons and/or illustrations for the cooling strategies
- Explaining benefits and concerns per strategy
- Providing resources – either case studies from other cities or scientific research that support the strategy choice
- An overview of the cooling capacity per strategy
- Organising strategies by intervention type, effectiveness, implementation cost, scale and temporality
- Combine cooling strategies with placemaking strategies to attract people to the place

4.1.2 The Council's Opinion on the Toolkit

The previously discussed interview with Candace Jordan from the City of Melbourne (page 28) revealed that a cooling toolkit is something that the Climate Change and City Resilience team has been wanting for a long time already and also gave insights into what they would like this toolkit to contain in order to be useable for the council.

Mix and Match
During the interview it became evident that it would be very useful if the toolkit allows to mix and match different cooling strategies depending on the topology of the chosen location as well as depending how that space is being used and by who. Therefore, the toolkit should also contain rules and guidelines that help with knowing which strategies to combine for which location and purpose.

Evidence-Based
As already mentioned in "3.3 The Council's Efforts On The Heat-Issue", the council acknowledges that their current cooling strategies are mainly focused on the use of vegetation and that they are not yet very good in the *"untapped space"* of implementing non-green cooling solutions. The toolkit is therefore a great opportunity to introduce new strategies that complement green cooling strategies, but Candace also highlighted that it's important to have some evidence that the cooling strategies work, e.g.

»It's almost like a matrix, isn't it? Like you have different technologies and different options that match, say, the East West streets, the low density, or your open space that has a plaza space [...] I guess there's some topologies and rules there that could be followed that you kind of mix and match just so that works for that particular space based on use and I suppose location and orientation and all that sort of site specific issues.«

Figure 24. **Existing cooling toolkits (See Appendix E)**

in other cities, and that they also want to trial new interventions to have evidence if it's suitable for Melbourne. *"We don't have a lot of water play in a lot of public spaces, something we're actually interested in trialing to gather some evidence on to then be able to say it's effective or it is ineffective and then we can hopefully roll that out in more public space."*

»So if it's fit for purpose for Melbourne[...] those options need to make sure that it is right for our climate and our types of spaces.«

Fit for Melbourne's Climate

A very important aspect for the new toolkit is that the suggested cooling strategies are fit for Melbourne's climatic and spatial requirements. Candace mentioned that most other cooling toolkits are often not that suitable for her team, as the suggested strategies are often too abstract and because it's not obvious in which climatic requirements they would be effective.

Accessible to Different Stakeholders

"So I think it's yeah, it's those practitioner levels. Like I can understand it and maybe make recommendations if I go along, if I'm in on a working group for an open space to something like that. But the technical side, yeah, we really want them, they're the users, they're the ones who pick it up" When discussing about the potential users of the toolkit, it became apparent that accessibility is very important so that different stakeholders involved in the city planning can be involved and make use of the toolkit. After first mentioning that the main user group for the toolkit would be the in-house and external practitioners (project managers, concept designers and consultants) who require a high level of technical information, the interview soon revealed that there is a much larger group of people that should be able to use and comprehend the toolkit and that this could mean that the technical information is added at a later point or on a different layer within the toolkit, only provided to those for whom the information is relevant. Candace would like the toolkit to be accessible and easy to understand for her own team, so that they can also use the toolkit to give recommendations on existing design concepts but that it also makes it easier for them to communicate more easily about projects. Ideally, she would like the toolkit to be so accessible that it can also easily be shared with other councils, academics or researchers or even some community or health organisations to use for their community projects.

»Not everyone's super technical, so maybe it's kind of like that's the technical side sits underneath, but you have that [...] higher level that I think most people could probably engage with and many types of designers or open space planners doing master plan.«

»I think, if it's accessible for us, I'd like to think that it's accessible for external audiences too. I don't know, there's some nuances there probably but I mean, actually, if it's the sort of thing that we can spread to other cities as well, other councils, academics, researchers, potentially people who are delivering community projects, community service organisations and health organisations, community groups.«

Insights about Cooling Toolkits

- **Current toolkits are mainly text-heavy documents, so the new toolkit should be more tangible than that**
- **The toolkit should offer the possibility to mix and match different interventions**
- **Interventions in the toolkit should be supported by research evidence and fit for Melbourne's climate**
- **Ideally the toolkit is accessible to practicioners, the council but also other parties like external organisations and community groups**

4.2 Heat, Thermal Comfort & Cooling Strategies

4.2.1 Causes for Heat in the City

Before starting to research about suitable cooling interventions, it was important to understand what causes and contributes to the heat in a city like Melbourne.

Urban Heat Island Effect
Urban areas often experience much higher temperatures than their surrounding rural areas – this phenomenon is also known as the Urban Heat Island (UHI) effect which is even more extreme at night as heat is released slower in the city than in rural areas.

Urban Materials Absorb Heat
There are several causes for the UHI (Figure 25) - urbanisation and the related increase in non-vegetated surface areas being one of the biggest. Materials used in cities such as asphalt concrete often have a high heat storage capacity and a low albedo coefficient (meaning a low reflectance of sunlight) and therefore absorb most of the radiating sunlight and only very slowly release the heat back into the air (Mohajerani et al., 2017). For example, Pomerantz et al. (2003) found that fresh asphalt concrete has an albedo of 5%, meaning it absorbs 95% of sunlight. According to Mohajerani et al. (2017), around 60% of urban surfaces are covered in "hard, man-made, heat-absorbent surfaces", which also means that there are fewer green surfaces in cities that can act as rainfall ground storage and cool the city via evaporation.

Anthropogenic Heat Caused by Human Activity
Buildings and streets absorb a lot of solar radiation and heat during the day and slowly release it back into the air during the night. This heat absorption also causes a higher demand for cooling, but the use of high-energy demanding air-conditioners itself is worsening the UHI and increasing the heat in the city. The heat generated by air-conditioners is also referred to as "anthropogenic heat" which refers to heat production related to human activity. Other sources of anthropogenic heat can for example be the use of polluting transport modes such as cars or the high energy usage in the industry such as in factories (Lee et al., 2013).

The Difference in Rural Areas
Compared to urban areas, rural areas usually have a much higher degree of vegetation which reflects the solar radiation rather than absorbing it. In addition, rural areas often have much higher rainfall ground storage, meaning that stored rainwater evaporates into the air and cools the surroundings. Similarly, evaporation also happens around larger bodies of water such as lakes, and trees use trans-evaporation to release stored water back into the air.

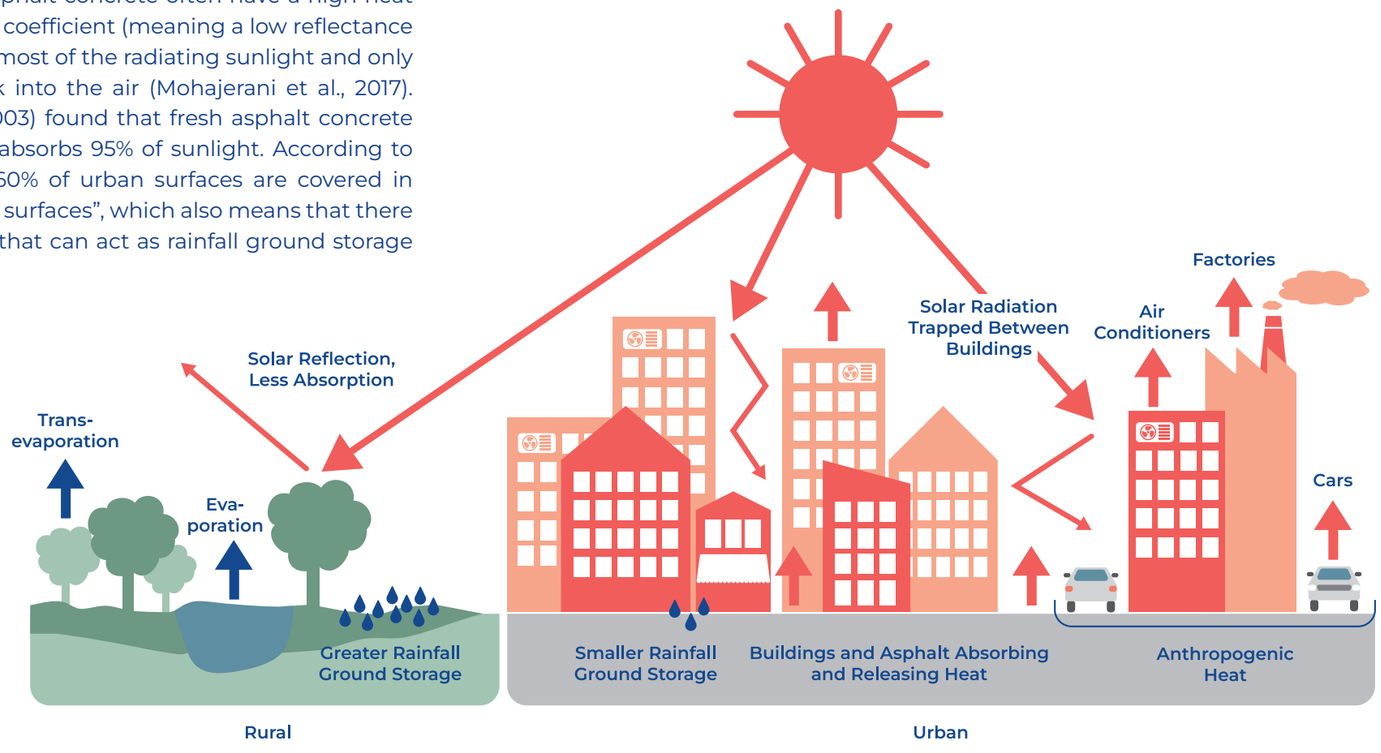


Figure 25. **Causes for the urban heat island effect**

4.2.2 Outdoor Thermal Comfort

Relation Between Use of Outdoor Spaces and Microclimatic Conditions
How much an outdoor public space is being used is greatly related to the prevalent microclimatic conditions as a study by Nikolopoulou and Lykoudis (2007) found that with increasing temperatures public spaces are less visited and during summer people prefer to spend time in shaded areas, while during winter sunlit places are preferred. It is therefore very important to provide public spaces that offer thermal comfort to make the space attractive for people.

Environment-Based and Human-Based Factors: Outdoor Thermal Comfort Depends on More than Just Air Temperature
It would be easy to say that how comfortable we feel outside on a hot day is simply related to the air temperature in a specific location, however outdoor thermal comfort (OTC) is impacted by many different parameters that are categorised into environment-based and human-based factors (Aghamolaei et al., 2022). Environment-based factors can be divided into the climatic and meteorological conditions of a place (this includes meteorological parameters like air temperature, solar radiation, etc. and the location's land characteristics) and the physical characteristics of a place (this includes the location's morphology and geometry, the existence of cooling infrastructure and material properties). Human-based factors can be divided into individual parameters (this includes a person's age, health and clothing but also past experiences and resulting expectations) and social parameters (this includes social, economic and cultural aspects). Appendix F explains each factor in more detail.

Measuring Outdoor Thermal Comfort
As mentioned in the previous paragraph, OTC cannot simply be represented by providing the outdoor air temperature. Therefore many different models and indices have been developed that help to indicate how an outdoor thermal situation is experienced by humans. According to Lai et al. (2020), some of the most used models are the PET (physiologically equivalent temperature), PMV (predicted mean vote), UTCI (universal thermal climate index) and SET (standard effective temperature). Research presented in this report mainly refers to PET and UTCI.

The Universal Thermal Climate Index (UTCI) and the Physiologically Equivalent Temperature (PET)
UTCI and PET are two commonly used indices to assess the thermal bioclimate based on the human energy balance. The PET has been introduced more than 20 years ago by Mayer and Höppe (1987) whereas the UTCI has been introduced more recently with the aim to be "thermo-physiologically significant across the entire range of heat exchange; applicable for whole-body calculations but also for local skin cooling" and "valid in all climates, seasons, and scales from the micro to macro" (McGregor, 2012). Both indices are based on the human energy balance and consider the meteorological conditions (short and long wave radiation, air temperature, air humidity, and wind speed) and thermo-physiological conditions (clothing and activity) on a human. Both indices aim to provide an understanding of how a certain outdoor thermal condition is experienced by humans by relating it to the equivalent air temperature in an indoor situation. In an example by Höppe (1999), a sunny outdoor situation with 30°C air temperature and 60°C mean radiant temperature, would compare to a physiologically equivalent temperature of 43°C - meaning the given sunny outdoor situation feels to humans like being in a room with 43°C air temperature. The main difference between both indices is that PET calculations use standard clothing while the UTCI calculations adjust the clothing to the specific thermal situation (Matzarakis et al., 2015). However, Matzarakis et al. (2015) found that UTCI and PET are generally comparable and may be used indifferently for evaluating hot conditions, even though UTCI is more suitable for warm and humid conditions.

> **»PET is defined as the physiological equivalent temperature at any given place (outdoors or indoors) and is equivalent to the air temperature at which, in a typical indoor setting, the heat balance of the human body [...] is maintained with core and skin temperatures equal to those under the conditions being assessed.«** (Höppe, 1999)

> **» The universal thermal climate index (UTCI) is defined as the air temperature (T_a) of the reference condition causing the same model response as actual conditions.«**
> (Błażejczyk et al., 2013)

4.2.3 Cooling Strategies to Improve Thermal Comfort

Relation Between Urban Planning, Biometeorology and Urban Climate
Lai et al. (2019) demonstrate how the urban climate, urban planning and biometeorology and thereby thermal comfort are linked to each other when designing high quality urban spaces (Figure 26). To demonstrate how urban planning can impact thermal comfort and open space quality they compare different cooling strategies and their impact on the perceived thermal comfort in urban outdoor spaces. They use the physiologically equivalent temperature (PET) to compare the strategies. The strategies are divided into four different categories: Urban Geometry, Vegetation (Green Infrastructure), Reflective Surfaces (Grey Infrastructure) and Water Bodies (Blue Infrastructure).

Urban Geometry
Urban geometry strategies can be divided into 1) sky view factor (SVF) which describes the amount of unobstructed sky seen from a point, 2) the height-to-width (H/W) ratio between the height of buildings and the width of the street as indicator for the openness of an urban canyon and 3) the orientation of buildings and streets.
Compact spaces and deep canyons with a low SVF or a high H/W ratio experience lower solar exposure and therefore lower radiant temperatures and lower air temperatures compared to open spaces. However, they usually also experience more long-wave radiation compared to open spaces, which results in higher radiant temperatures and air temperatures at night in comparison (Lai et al., 2019). In general, East-West oriented streets are much more exposed to solar radiation than North-South oriented streets (Ali-Toudert & Mayer, 2006), however Johansson (2006) found that the street orientation becomes negligible in street canyons with a H/W ratio higher than 6.
The wind speed in compact spaces and street canyons with a low SVF or high H/W is lower than in open spaces, which is unfavourable for thermal comfort in hot climates. However, studies found that shade has a higher impact on the PET than wind speed, so it's more effective to decrease solar radiation and air temperature rather than increasing wind speed to improve outdoor thermal comfort (Lai et al., 2019).

Vegetation (Green Infrastructure)
Trees slow wind speeds, reduce air temperature and reflect a lot of short-wave solar radiation as the leafs of a tree only transmit 10% of visible radiation and 30% of infrared radiation (Brown & Gillespie, 1995). Trees can reduce the mean radiant temperature by about 7-8°C, however as trees also lower the SVF they trap long-wave radiation which can result in higher radiant temperatures at night (Lai et al., 2019). An advantage of trees in comparison to other vegetation is that they can not only reduce air temperatures by evapotranspiration - a process in which stored water is converted to water vapour through transpiration - but also by providing shade. Wang et. al (2015) found that the air temperature under a tree's shadow is 0.6-0.9°C lower on average and up to 3.3°C lower on a hot day. Even though trees reduce wind speeds by up to 50%, they can have a big impact on outdoor thermal comfort as they reduce radiation and air temperature and therefore also reduce the PET (Lai et al., 2019).
While trees can reflect the short-wave radiation, vegetation on the ground or on walls and roofs can be used to reduce long-wave radiation. Through evapotranspiration, vegetation reduces the surface temperature and thereby reduces long-wave radiation (Lai et al., 2019). Studies found that the surface temperature of grass can be around 20°C cooler than other materials like concrete (Rosso et al., 2016). This effect has not only been measured on the ground but also when vegetation was used in green walls or green roofs. Studies found that surface temperature can be reduced by up to 20°C when using green roofs (Ouldboukhitine et al., 2014) or walls (Mazzali et al., 2013). Tan et al (2014) found that green walls can reduce radiant temperatures by up to 12.8°C. When applied on a city scale, green roofs can reduce air temperatures by 0.3-3°C (Santamouris, 2014). However green roofs will only have an impact on the temperatures at the pedestrian level if the green roof is not placed higher than 10m (Lai et al., 2019).

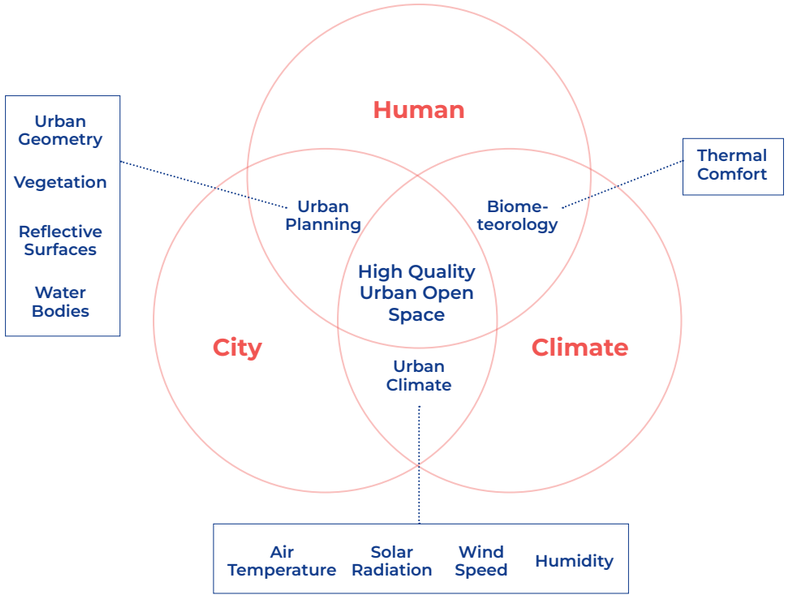


Figure 26. **Relation between urban planning, biometeorology and urban climate (Modified from Lai et al., 2019)**

In conclusion, trees reduce air temperatures by providing shade and reduce short-wave radiation, while vegetated surfaces can reduce long-wave radiation and lower surface temperatures (Lai et al., 2019).

Reflective Surfaces (Grey Infrastructure)

As Figure 25 showed, urban materials absorb a lot of heat, thereby greatly contributing to the urban heat island effect. To counteract this heat absorption, reflective materials are used to reflect and radiate the heat away rather than absorb it. Highly reflective materials have a high albedo – that value describes what percentage of sunlight gets reflected. Many studies show that high albedo results in a lowering of the surface temperature and that the higher the albedo, the higher the surface temperature difference. For example, Taha et al. (1992) found that surfaces with a white coating and thereby a high albedo (0.72) can be up to 45°C cooler than surfaces with a black coating and a low albedo (0.08). A downside of reflective materials is however that while they do decrease long-wave radiation, they do increase short-wave radiation due to the reflection, thereby actually increasing the mean radiant temperature. So, while the surface temperature of a high albedo material decreases, the mean radiant temperature around it increases. However, materials with high albedo do reduce the average air temperature by 0.3°C per 0.1 increase in albedo (Santamouris, 2014).

So, despite reflective surfaces having the ability to reduce the temperature of materials and buildings, they often have a negative impact on outdoor thermal comfort as they increase the radiant temperature. The PET has a positive relationship to the albedo, meaning that increasing the albedo also increases the PET and thereby lowers the outdoor thermal comfort – some studies showed increasing the albedo by 0.4 raises the PET by 5-7°C (Lai et al., 2019).

Water Bodies (Blue infrastructure)

The heat capacity of water is around 4 times higher than that of materials typically used in the built environment like e.g. concrete, asphalt and gravel. This means that the same volume of water heats up much slower than e.g. the same volume of surrounding asphalt. Studies by Chatzidimitriou and Yannas (2015) showed that the surface temperature of water stayed around 20-25°C cooler than that of surrounding asphalt in summer. The lower surface temperature of water leads to less long-wave radiation, and thereby a lower mean radiant temperature - the mean radiant temperature above water is between 4-6°C lower than above asphalt (Chatzidimitriou and Yannas, 2015).

When it evaporates, water removes ambient heat. Furthermore, the convective heat transfer between the ambient air and the water surface results in 1-2°C lower air temperatures (Lai et al., 2019).

While water has a lower surface temperature and can reduce air temperatures. But unlike urban geometry and vegetation, water bodies cannot block solar radiation, therefore they have a much lower impact on reducing the PET and improving the outdoor thermal comfort in comparison to vegetation or urban geometry (Lai et al., 2019).

Comparing Strategies

Lai et. al (2019) compare the results from different studies that focus on evaluating the impact of the different cooling strategies. Figure 27 shows an overview of the maximum air temperature reduction and PET reduction measured in those studies. The reductions compare to measurements in reference places without vegetation, reflective surfaces or water bodies. Results from studies that were conducted in Melbourne-like Cfb climates are highlighted in solid red. The median air temperature reductions for the different strategies are similar, with 2.1°C for changing geometry, 2.0°C for adding vegetation, 1.9°C for using reflective surfaces and 1.8°C for implementing water bodies. When it comes to the PET reduction and thereby the improvement of outdoor thermal comfort, clear differences can be seen. Urban geometry is most effective in reducing the PET by an average of 18°C, followed by different vegetation approaches that can also improve the thermal environment and reduce PET by 13°C on average. While reflective surfaces have a lower surface temperature and can reduce air temperature, the increase in reflected solar radiation has a negative impact on PET which increased by 2.7°C on average. Water bodies decrease air temperature and act as urban heat sinks, but as they cannot block solar radiation, their impact on the PET reduction is lower with an average decrease of 4.6°C. While water bodies are not as effective in improving thermal comfort like the urban geometry and vegetation strategies, they still can contribute towards greater thermal comfort, particularly when combined with other strategies (Lai et al., 2019).

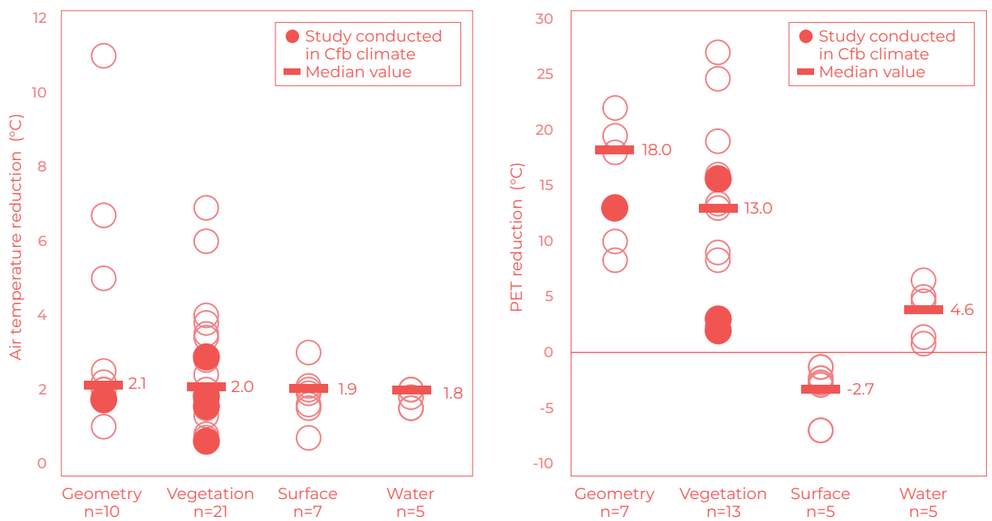


Figure 27. **Summary of maximum reductions in (a) air temperature and (b) PET for different strategies (Note: Not all studies measured both the impact on air temperature reduction and PET reduction which leads to the different n-values. (Modified from Lai et al., 2019)**

Lai et al. (2019) have introduced and compared several known cooling strategies that reduce solar radiation and improve outdoor thermal comfort. The list has been extended by other cooling strategies (Figure 28) that are commonly used. Those added strategies are:

Misting, Fountains and Pavement Watering
Despite not being a passive technology, misting and pavement watering are suitable cooling strategies for dry and hot climates. Another option is to incorporate water fountains for cooling water play. Due to the low rainfall in hot & dry climates, it's important to use a water sensitive urban design approach that focuses on reusing stormwater (Osmond & Sharifi, 2017).

Shading and Shelter
Besides trees, artificial temporary or permanent shading and shelter provision is a logical approach to reduce solar radiation and improve thermal comfort during summer. Shading does not necessarily reduce air temperature but does decrease the radiant temperature (Osmond & Sharifi, 2017). Temporary shading structures are particularly interesting as they can be used while trees are still growing and can be removed during winter when solar radiation and natural sunlight are desired.

High Emissivity Materials
Lai et al. (2019) showed that reflective high albedo materials lower surface temperatures but decrease pedestrian comfort. Another relevant material characteristic for urban cooling is emissivity. A material's emissivity describes how much heat is radiated from a material at a given temperature and the minimum temperature at which the material's surface will be in balance with its surrounding environment. High-emissivity materials release heat more easily and can therefore help with reducing the UHI (Osmond & Sharifi, 2017).

Permeable Pavement & Grass Cover
Permeable materials are porous or pervious. They allow stormwater to drain, facilitate rainfall ground storage and enable the evaporation of the latter for cooling purposes. Standard urban materials such as asphalt or concrete are typically not permeable, instead foam based concrete or concrete with permeable natural resins can be used (Osmond & Sharifi, 2017). Grass cover is an alternative for a natural permeable ground material.

Psychological Cooling
Fischer & Perkins Eastman (2018) suggest psychological cooling as another strategy by referring to studies that show that our own physical temperature can be affected by how we perceive the temperature of other individuals around us (Cooper et al., 2014). Based on this they suggest using images or art that make use of cool colors or incorporate

Figure 28. **Overview of cooling strategies that can be implemented into the toolkit**

4.2.4 Cooling Strategies Fit For Melbourne

Temperate Climate Makes Evaporative Cooling Effective

According to the Köppen Geiger Climate Classification, Melbourne is classified as a 'Cfb' climate (Figure 29). The C stands for temperate, the f explains that there is no dry season and the b stands for warm summers (Peel et al., 2007). Unlike other Australian cities with very humid summers, Melbourne's summers are hot but relatively dry which makes it very suitable for water related, evaporative cooling strategies, but the low rainfall during summer also requires water sensitive approach that focuses on reusing rainwater. Despite the summers being dry, Melbourne experiences high rainfall throughout the year with 650mm of annual rainfall. This makes permeable pavement a suitable strategy to address storm water management and use evaporative cooling in summer (Osmond & Sharifi, 2017).

»Melbourne has a hot and relatively dry summer climate. It experiences its highest monthly mean maximum temperature of 26.0°C and average 9 hours of daily sunshine during summer. Rainfall is lowest in summer – average rainfall decreases to as low as 46.8mm during january – and wind speed averages 14.4km/h at 3pm in Melbourne.« (Osmond & Sharifi, 2017)

Shading Structures and Emissive Materials to Radiate Heat Away

As Melbourne experiences high solar radiation and UV levels during summer, shading through vegetation, buildings or (temporary) shading structures is another effective strategy. To radiate the urban heat away, high emissivity materials are recommended. High albedo materials have a lower effectiveness and as shown by Lai et al. (2019), can have a negative impact on pedestrian thermal comfort. In Melbourne that strategy should therefore only be applied in low pedestrian and car traffic areas and on building rooftops (Osmond & Sharifi, 2017).

Insights about Cooling Strategies for Melbourne

- **Water-related evaporative cooling strategies are suitable for Melbourne's hot and dry summers**
- **Permeable pavement is an essential cooling strategy**
- **Shading structures (artificial and through vegetation) and emissive materials help to reduce UV levels and radiate heat away**
- **In the inner city high albedo materials should only be used on big open squares**

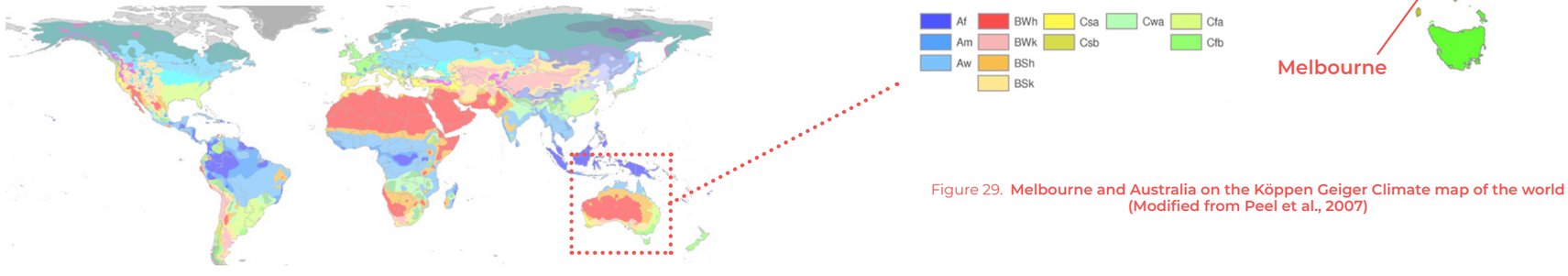


Figure 29. **Melbourne and Australia on the Köppen Geiger Climate map of the world (Modified from Peel et al., 2007)**

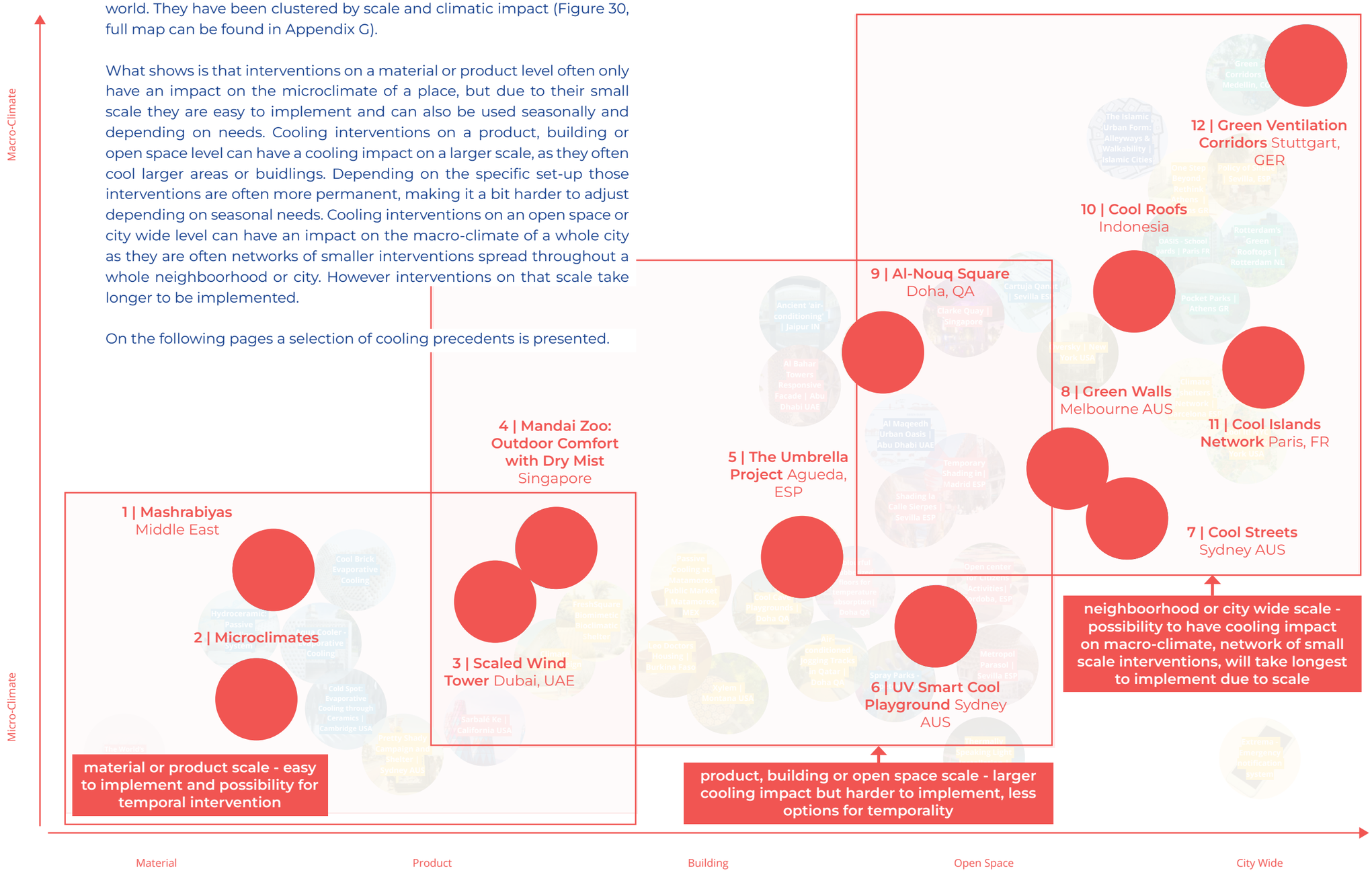
4.2.5 Cooling Strategies Precedents

Different precedents were collected for inspiration and show how different cooling strategies are applied in different cities and countries across the world. They have been clustered by scale and climatic impact (Figure 30, full map can be found in Appendix G).

What shows is that interventions on a material or product level often only have an impact on the microclimate of a place, but due to their small scale they are easy to implement and can also be used seasonally and depending on needs. Cooling interventions on a product, building or open space level can have a cooling impact on a larger scale, as they often cool larger areas or buidlings. Depending on the specific set-up those interventions are often more permanent, making it a bit harder to adjust depending on seasonal needs. Cooling interventions on an open space or city wide level can have an impact on the macro-climate of a whole city as they are often networks of smaller interventions spread throughout a whole neighboorhood or city. However interventions on that scale take longer to be implemented.

On the following pages a selection of cooling precedents is presented.

Figure 30. **Mapping of cooling precedents depending on intervention scale and climatic impact**



1 | Mashrabiyas | Middle East
Mashrabiyas are vernacular wooden structures that have been used for centuries as a shading and cooling device in the Middle East. The oriental ornament structure allows a constant flow of air to cool interiors. Often clay pots filled with water are placed behind a mashrabiya to have extra cooling though evaporation.
(Encinafernandez, 2016)

Figure 31. **Mashrabiya (From Hadi, 2016)**

2 | Microclimates
Microclimates by Postlerferguson is a conceptual approach that uses the concept of mashrabiyas in combination with 3D printed binded sand. Water can evaporate from the porous sand material and cool down the structure which in return cools the air flowing through the mashrabiya-inspired 3D structure.
(Fairs, 2013)

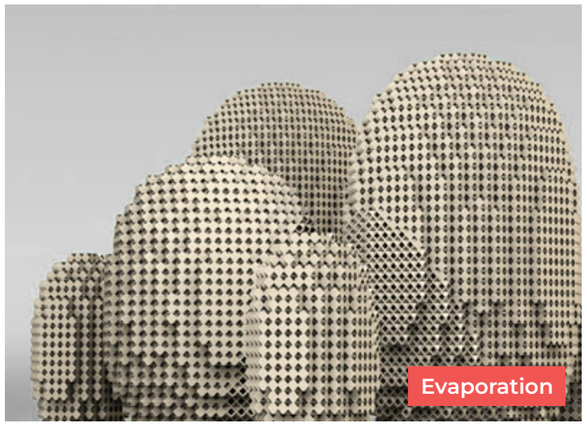


Figure 32. **Microclimate sculptures (From PostlerFerguson, n.d.)**

3 | Wind Tower | Dubai, UAE
Wind towers have been used for centuries to passively cool buildings in the Middle East as they funnel breezes of air into buildings. MAS Architecture Studio's scaled down version for the Dubai Design Week 2019 uses that same technology with a windtower constructed from cardboard that offers shade and cooling for pedestrians.
(Robarts, 2019)

Figure 33. **Barjeel installation (From Ghinitoiu, n.d.)**

4 | Mandai Zoo: Outdoor Comfort with Dry Mist | Singapore
The dry misting system by transsolar is an energy-efficient water saving misting system that improves outdoor thermal comfort. Conventional misting systems sprinkle water droplets that can be uncomfortable therefore transsolar developed their system so that the droplets fully evaporate in the air and people will only feel a cold breeze when walking past.
(Transsolar, n.d.)

Figure 34. **Misting fans (From Transsolar, n.d.)**

5 | The Umbrella Project | Agueda, ESP
The Umbrella Project is a colourful art installation that is installed in many places. Not only does it add color to a city and attracts people, but it also creates shaded areas that protect people from the sun. The temporality of the installation is a bonus - it can be installed during summer but taken down during winter when direct sun light is more desired.
(Impactplan - Art Productions, n.d.)

Figure 35. **Woman under umbrella sky (From Impactplan - Art Productions, n.d.)**

6 | UV Smart Cool Playground | Sydney, AU
The playground project is based on extensive research and makes use of thermal resistant shade sails and new advanced polyolefin plastomer surface with lower heat conductivity than formerly used mulch surfaces. Play equipment surfaces previously reached up to 80°C in summer, this has been reduced to 35-40°C and UV exposure was reduced from 100% to 0-2%. *(Cumberland City Council, n.d.)*

Figure 36. **UV smart playground (From Tsoutas, 2020)**

7 | Cool Streets | Sydney, AU

"Cool Streets is an initiative to empower communities to cool the planet, one street at a time." Cool Streets combines scientific research with community engagement to help local communities to take action and empowers residents to be involved in deciding on the types of greenery that will be added to their streets to create cooler streets.

(Cool Streets, n.d.)

Figure 37. **Girl watering tree (From Cool Streets, n.d.)**

8 | Green Walls | Melbourne, AUS

As part of a pilot project, green walls were installed in Melbourne to help cool the urban areas, manage storm water and reduce energy consumption inside buildings by using the green walls as building insulation.

(Victoria State Government, 2019)

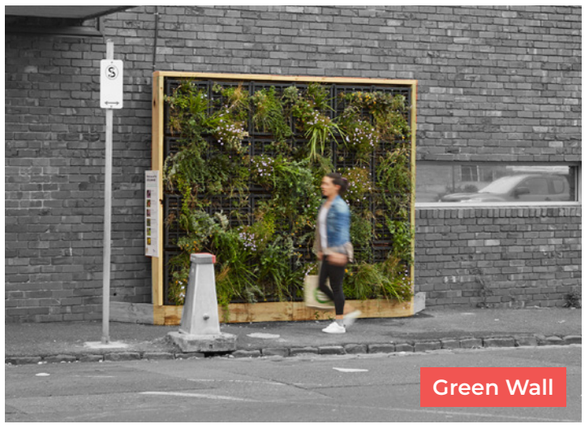


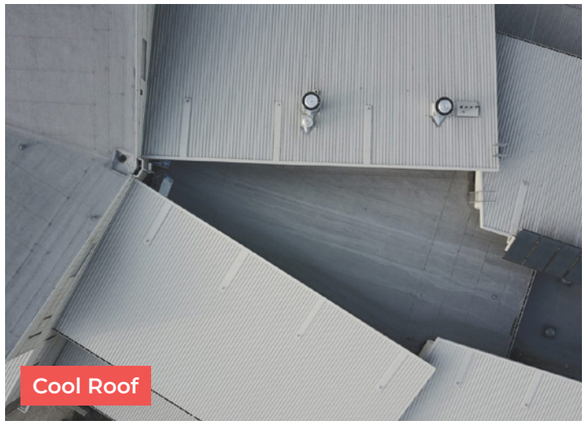
Figure 38. **Woman walking past green wall (From Russell, 2019)**

9 | Al-Nouq Square | Doha, QA

The Al-Nouq square has been designed with thermal comfort in mind and has a flexible shading structure that can be expanded during the day to create shade and can be pulled in at night to release the heat. Cool pools are installed as water bodies for extra evaporative cooling effects.

(Transsolar, n.d.)

Figure 39. **Al-Nouq Square, Msheireb Downtown, Doha, Qatar (From Peach, n.d.)**



10 | Cool Roofs Indonesia

As part of the Million Cool Roofs Challenge, the Cool Roofs Indonesia initiative managed to install cool roofs with coatings on top of over 70 buildings in 15 cities. Using cool, reflective surfaces can reduce the cooling demand in individual buildings but if spread across a city can also cool down neighboorhods and reduce local ambient temperatures.

((Sherry-Brennan, 2023))

Figure 40. **Roofs with light, cool coating (From Challenge Works, 2022)**

11 | Cool Island Network | Paris, FR

The city of Paris has developed a network of cool "islands" (parks, forests, pools, museums, etc.) and walkways that provide heat refuge during very hot days. All Parisians should be able to reach a cool island or walkway within 7 minutes. The cool spaces are usually 2-4°C cooler than other spaces thanks to the use of water and/or vegetation.

(C40 Cities Climate Leadership Group, Nordic Sustainability, 2019)

Figure 41. **From [Map of cool island network in Paris] (n.d.)**

12 | Green Ventilation Corridors | Stuttgart, GER

The city of Stuttgart implemented the concept of interconnected green ventilation corridors with the attempt to reduce air pollution and combat the urban heat island effect by creating pathways for cool air to sweep down from the hillsides and reduce the higher urban temperatures on a city wide scale.

(Oppla, 2022)

Figure 42. **Ventilation corridors network in Stuttgart (From Storck, n.d.)**

4.3 Placemaking & Wayfinding Strategies

Research into placemaking strategies helped to identify that besides addressing cooling needs, the toolkit should also contain strategies that address placemaking and wayfinding & walkability (Figure 43) aspects in order to make the cool pedestrian network not only cool but to also make sure that people can find it, move through it easily and feel invited to spend time there.

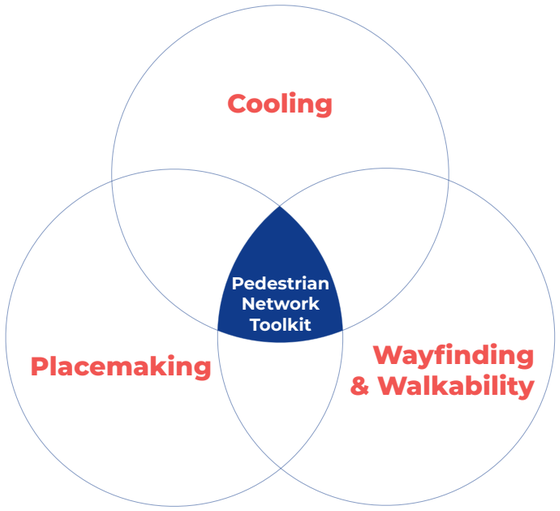


Figure 43. Combination of strategies for toolkit to develop cool pedestrian network

From Necessary Towards Optional Activities: Pressure on The Quality of Public Spaces

»Public spaces are those areas in the public realm that provide a public use or recreation function, such as parks, plazas and street spaces. Public spaces are generally located on publicly held land, are accessible to everyone and are managed and maintained by councils or other public agencies.« (DELWP, n.d.) Back in the days, public spaces were full of people engaging in necessary activities such as getting to work, running errands on a market or going to the post office (Gehl, 2011). Nowadays, many of these necessary activities can be carried out without having much interaction with public space as people have access to private transport or online deliveries and more and more people are working from home depending on their occupation. In Australia around 20% of the workforce has been working from home since the 1980s already and the numbers

»The optional character of most public life activities in present-day cities places very high demands on the quality offered by public spaces.« (Gehl & Litt, n.d.)

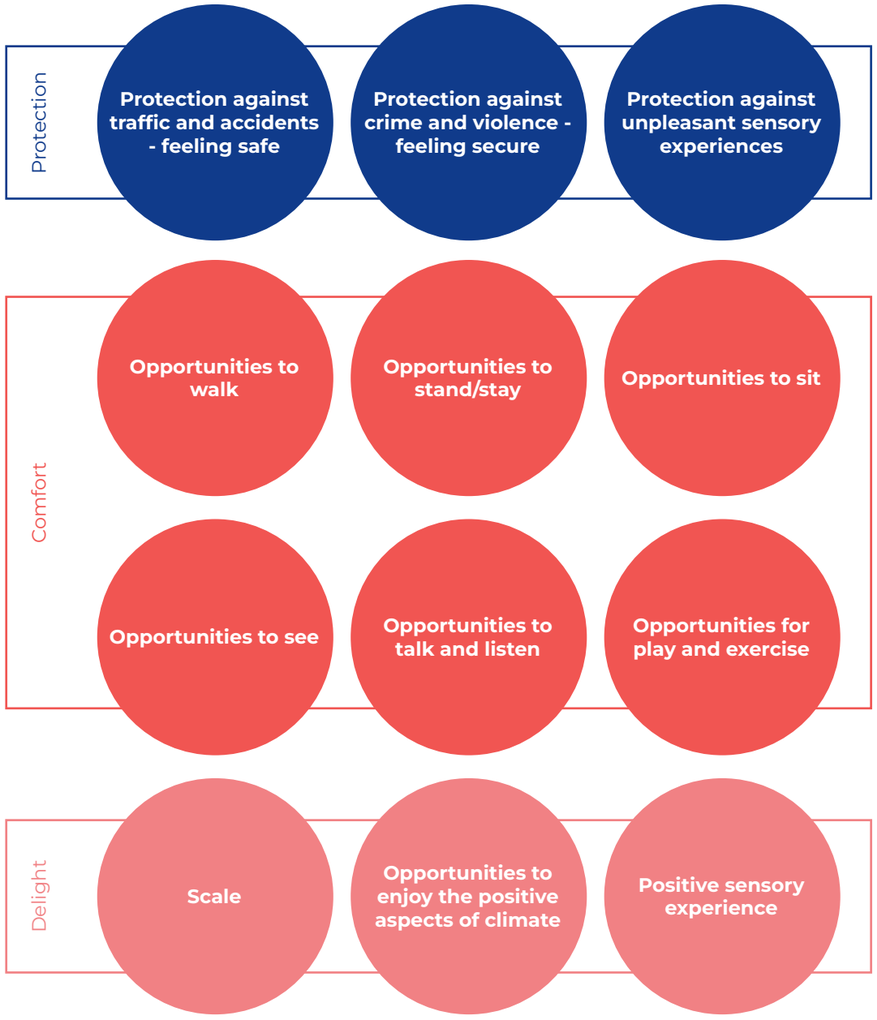


Figure 44. **12 Criteria concerning the pedestrian landscape, developed by Jan Gehl. This tool has been used for many years for teaching in the School of Architecture in Copenhagen, before it was first published in 'New City Life' (Adapted from Jan Gehl as presented in Matan & Newman, 2016)**

kept steadily growing until the Covid-19 pandemic led to a rapid expansion of people working from home all the time or most of the time depending on the viability in their sector. Even beyond the pandemic, in April 2022, 46% of Australians worked from home all the time and 30% worked from home most of the time (Wilson, 2022). Jan Gehl, a Danish architect and arguably a revolutionist in urban public design, has studied many public places across the world and noticed this shift in public space usage. He observed that people nowadays visit public spaces not because they have to, but because they want to - but only if the public spaces offer valuable opportunities. He therefore acknowledges that *"the optional character of most public life activities in present-day cities places very high demands on the quality offered by public spaces."* (Gehl & Litt, n.d.) In his book 'Life between buildings' Gehl shows how the quality of a public space correlates to the occurance of optional activities (Figure 45) and has developed a list of 12 criteria for developing people landscapes to help achieve great public places (Figure 44).

First Life, Then Spaces, Then Buildings

In his attempt to develop liveable cities, Gehl also criticises the way that public space is typically developed - *"first buildings, then spaces, then (perhaps) life"* and states the new formula must be *"first life, then spaces, then buildings"* with the attempt to first decide what kind of life is wanted, what places can fulfill these needs and to then design the buildings around that (Gehl & Litt, n.d.).

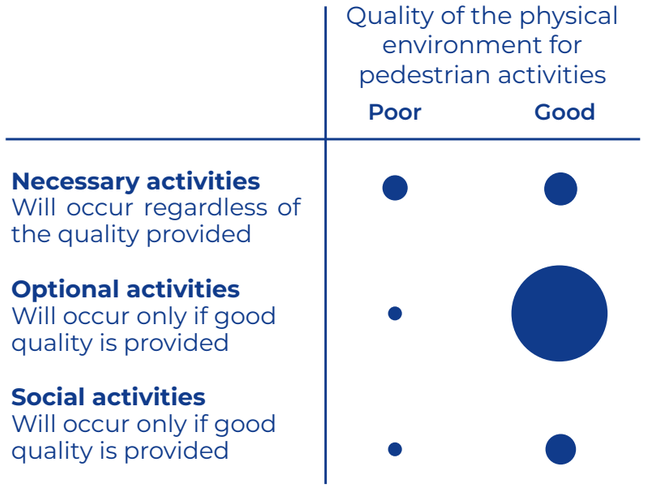


Figure 45. **When the quality of outdoor areas is good, optional activities occur with increasing frequency. Furthermore, as levels of optional activity rise, the number of social activities usually increases substantially (From Life between Buildings (Gehl, 2011))**

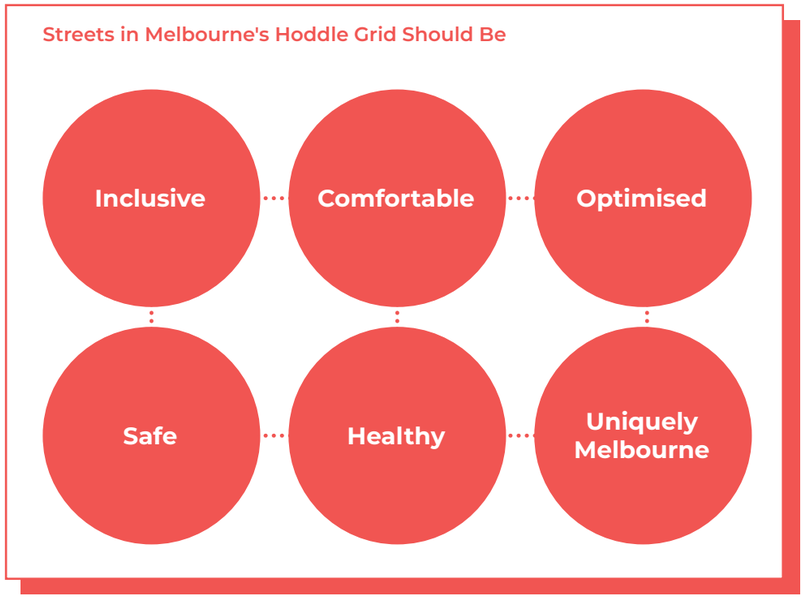


Figure 46. **Design principles for streets in Melbourne's hoddle grid (Adapted from "Future Streets Framework 2030 and Beyond," 2023)**

Designing Melbourne's Streets With Jan Gehl's Public Space Principles

Utilising the suggested approach of combining cooling with placemaking and walkability & wayfinding will help with achieving a good environment for pedestrian activities as defined by Jan Gehl. To make sure that the designed public spaces also align with Melbourne's design strategies, the design principles for streets in Melbourne's hoddle grid should be considered (Figure 46, the full overview and description of the design principles can be found in Appendix H).

Insights about placemaking and wayfinding strategies

- **The cool walking network should not only be aimed at necessary activities but also at optional and social activities and therefore not only contain cooling strategies but also strategies for placemaking and walkability & wayfinding**
- **Jan Gehl's 12 criteria for the pedestrian landscape can be combined with the design principles for Streets in Melbourne's Hoddle Grid**

5 Assignment Redefined

A Toolkit For A Cool Pedestrian Network

Based on the insights from the research and analysis phase in the previous two chapters, the project assignment could be redefined with a vision and design challenge and the corresponding design criteria.

5.1 Vision, Design Challenge and Scope

Vision

As discussed in “3.5 Design Opportunity”, the insights from analysing the current situation in Melbourne on a hot day helped to identify the opportunity of creating a cool pedestrian network through the city to provide cool outdoor space, improve walkability, and attract citizens to the city on a hot day. The underlying vision of developing the cool pedestrian network is to make it comfortable and safe for pedestrians to walk through and spend time in the city on a hot day.

Design Challenge

The toolkit is the design intervention to be developed and should help with realising the vision by engaging different stakeholders, support them in sharing their knowledge and provide them with guidance for designing streetscapes for the cool pedestrian network. The design challenge lies within making the toolkit tangible, actionable and focused on Melbourne’s specific climate as the precedent analysis showed that existing cooling toolkits are often very text-heavy and targeted at other countries and climates. To achieve the desired tangibility and actionability, another aspect of the design challenge is that the toolkit should be usable in a workshop context, with the idea that the council can use the toolkit to run co-design workshops together with community members and design practitioners. By using a co-design approach, the council and design practitioners can learn about citizens' behaviour on a hot day and their needs and wishes for the cool pedestrian routes. Through these co-design sessions the council can give the community a feeling of responsibility and ownership and develop viable, feasible and desirable design solutions based on community input.

Vision

Making it comfortable and safe for pedestrians to walk through the CBD on a hot day

Design Challenge

Developing a Melbourne-specific, tangible toolkit with which the council can run workshops together with community members and design practitioners to engage their knowledge and co-design streetscapes together for a cool pedestrian network in the city

Design Criteria

Based on the research and analysis carried out, the most important design criteria for the toolkit were defined. The final toolkit needs to meet these criteria in order to solve the design challenge.

- **The toolkit contains cooling, placemaking and wayfinding & walkability interventions**
- **The toolkit allows to mix and match interventions depending on space and typology**
- **The cooling interventions in the toolkit are focussed on passive cooling**
- **The cooling interventions in the toolkit are adjustable in scale and temporality**
- **The cooling interventions in the toolkit are targeted at Melbourne’s climate conditions**
- **The cooling interventions in the toolkit are backed up by literature (evidence-based)**
- **The toolkit is tangible and more than just a text document**
- **The toolkit is a living toolkit that can be updated and new interventions can be added**
- **The toolkit is accessible for different people such as council, practitioners, and citizens**
- **The toolkit is usable within a workshop context**

Project Scope

Besides defining the vision, challenge and criteria, the project scope is important to make it feasible to finish the project within the given time of five months. As Figure 49 shows, the aim is to run workshops with the toolkit to co-design ideas for retrofitting streetscapes to protect pedestrians from the heat. The insights from these workshops can be used by the council to give a more specific brief to their design practitioners who can then work out a detailed concept for the selected street. Every street that is redesigned can then become part of the growing cool pedestrian network.

There are many different streetscapes and topologies (an overview and description can be found in Appendix I) within Melbourne and in the future the toolkit should contain cooling, placemaking and wayfinding interventions for all of them. To keep the project feasible, it is however decided that the toolkit part that is worked out within this graduation project, is only focusing on laneways (Figure 48).

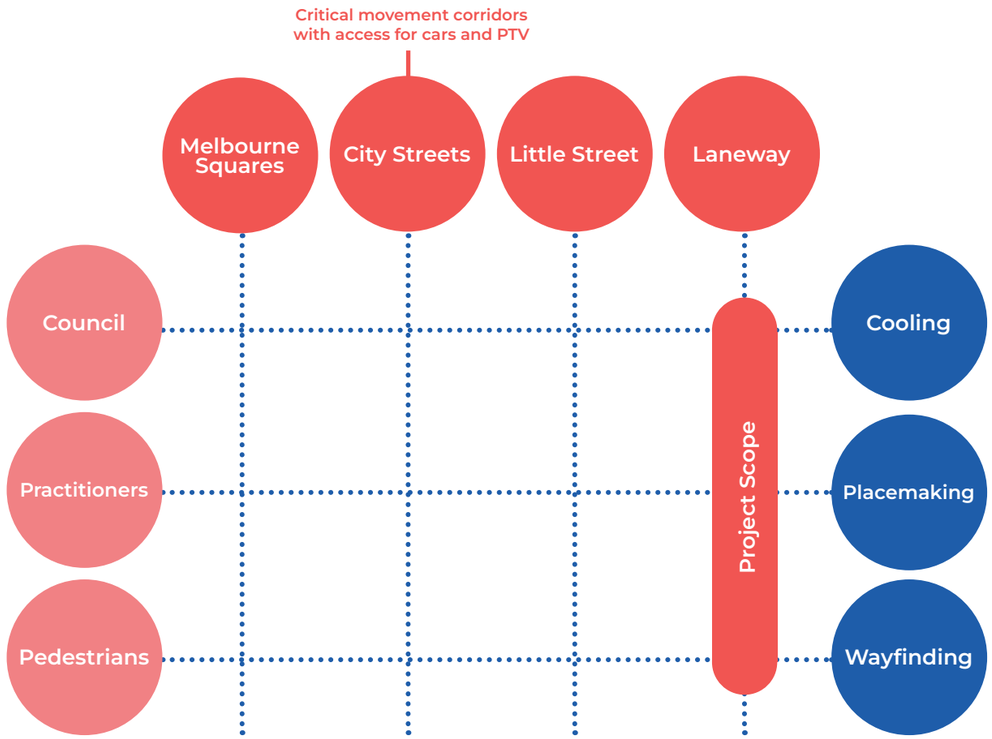


Figure 48. **Toolkit overview and project scope: Focus on laneways**

Figure 49. **Project focus and aim and vision of an expanding network of cool pedestrian routes**

6 Design Intervention
Toolkit & Workshop

In this chapter, the design intervention in the form of the toolkit is presented. This chapter elaborates on how the toolkit concept including the workshop structure and physical assets was developed and then further refined after being presented to the city council for feedback.

6.1 Toolkit Concept Development

Based on the design vision, challenge and criteria in the redefined assignment the toolkit was developed and the underlying strategy was further refined.

Toolkit Objective & Desired Output
The overall objective is for the toolkit to help with facilitating interactive workshops in which the council, design practitioners and community members share their knowledge and co-design laneways that are to become part of the cool pedestrian network. As discussed in "4.3 Placemaking & Wayfinding Strategies", the toolkit should primarily focus on developing cooling solutions for the laneways but also target placemaking and wayfinding & walkability aspects to develop a holistic streetscape concept beyond just cooling needs. By using the toolkit, the council should end up with a first streetscape concept for the selected laneway that can be further detailed afterwards. As the concept is developed with the input and feedback from community members, the council can use the community endorsement to develop a business case to receive funding for implementing the suggested changes.

Toolkit Users: Council, Design Practitioners and Community
As explained in the design vision and challenge the aim is that the toolkit can be used by the council to run co-design workshops in which design practitioners and community members participate and engage, share and gain knowledge. The **council** as municipality and decision maker is an important stakeholder and is responsible for urban development projects such as the cool pedestrian network. They would be the workshop facilitators and have the desire to learn about the community's behaviour, needs and wishes in order to respond to them. The **design practitioners** include internal and external designers, planners, consultants, etc. that work on urban development projects and would also be tasked with the detailed concept design after the co-design workshops. By including them in the sessions, they can contribute with their planning, design and engineering knowledge but more importantly they will be able to hear the community input first-hand and can consider it when developing the detailed concepts. The **community members** are ideally a diverse group of citizens that live in, visit or commute through the CBD as defined in "3.1.2 Focus On the CBD and Its Users". Community members are local residents and business owners but also other people that potentially pass through or spend time in the laneway. The community participation in the workshops is essential, as the citizens can share the experiences that currently shape their behaviour in the selected laneway and what changes they would like to see in the future.

6.1.1 General Idea for Toolkit Concept

Making the Toolkit and Workshop Tangible & Interactive
As stated in the toolkit design criteria in "5.1 Vision, Design Challenge and Scope", the goal was to make the toolkit tangible and usable within a workshop. In order to realise the desired interactive and tangible character, the underlying idea was to use a map of the to-be-redesigned laneway as a gameboard during the workshops (Figure 50). (Serious) games (e.g. "Kennistrekker" (Champlin et al., 2021), "Klimaatspel" (Play the City, n.d.) and "CityScope" (MIT Media Lab, n.d.)) and existing interactive toolkits (e.g. "Amplifying Weak Signals" (Champlin et al., 2023)) inspired the idea to translate the complex information about the different cooling interventions identified in "4.2.3 Cooling Strategies to Improve Thermal Comfort" into playing cards that contain only the most important information and can be moved around on the gameboard to discuss ideas and develop streetscape concepts. Similarly, the idea was to also develop playing cards that contain placemaking and wayfinding & walkability interventions. Originally, the idea was to also include 3D assets to represent buildings, trees, urban furniture and people and to use building materials such as lego and play dough to be able to make 3D prototypes during the workshops. To keep the toolkit simple and affordable, it was however decided to first develop the toolkit with a focus on 2D assets and only add 3D assets later on if needed.

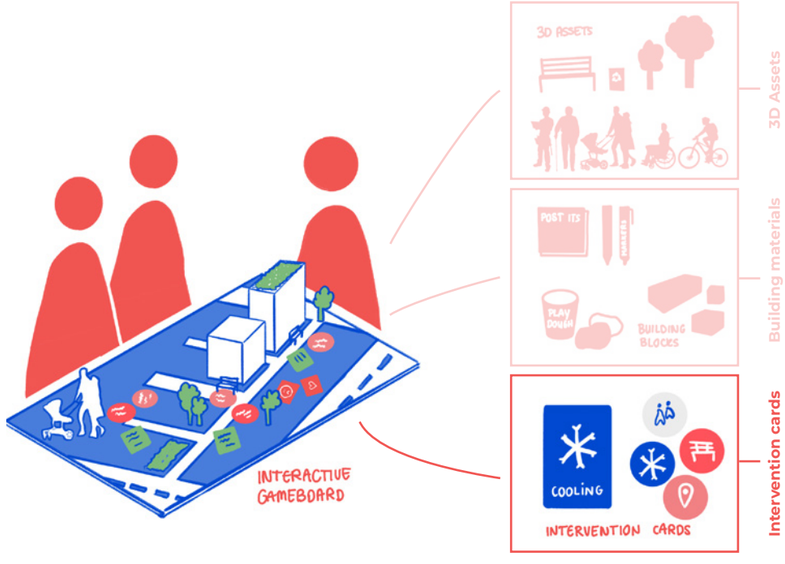


Figure 50. **Idea to develop an interactive toolkit with a map as gameboard and interventions as playing cards**

6.1.2 Suggested Workshop Structure

Experience-Focused vs. Cooling-Focused Workshops
When designing the workshop, the original idea was to facilitate one big workshop in which all stakeholders (council, design practitioners and community) would first learn about the community participants' behaviour, needs and wishes and then collaborate to develop a concept encompassing cooling, placemaking and wayfinding & walkability interventions. This would however mean that a lot of aspects would neeed to be addressed within just one workshop session. Furthermore, it appeared to be more valuable to split the workshop in two parts: One part of the workshop should be focussed on learning about the community's current and future desired experiences. The other part of the workshop should be more technical and focus on the cooling interventions that should come into place to enable the desired community experiences.

Developing a Series of Workshops
Based on the decision to split the workshop into experience and cooling focused parts, a co-design workshop structure with 5 steps was developed (Figure 51). First, a laneway is selected for a design intervention and a group of community members, ideally with diverse backgrounds and different interests in the laneway, is recruited to participate in the workshops. During the site visit, the laneway is visited with the community participants to get familiar with the laneway and to identify the current nuisances and delights and how they impact people's experience. These insights will be used in the future experience workshop where experience and community cards are used to come up with ideas for future desired experiences for different laneway users. In the next step, the council and design practitioners will come together to develop a design concept. That workshop mainly focuses on identifying which cooling interventions can be used in the laneway and how those can be combined with placemaking and wayfinding & walkability interventions to enable the desired community experiences. To identify suitable cooling interventions the cooling intervention cards will be used. After the workshop the concept will be further detailed before it's presented to the community participants in a feedback session to keep them involved and show how their input has informed the developed concept.

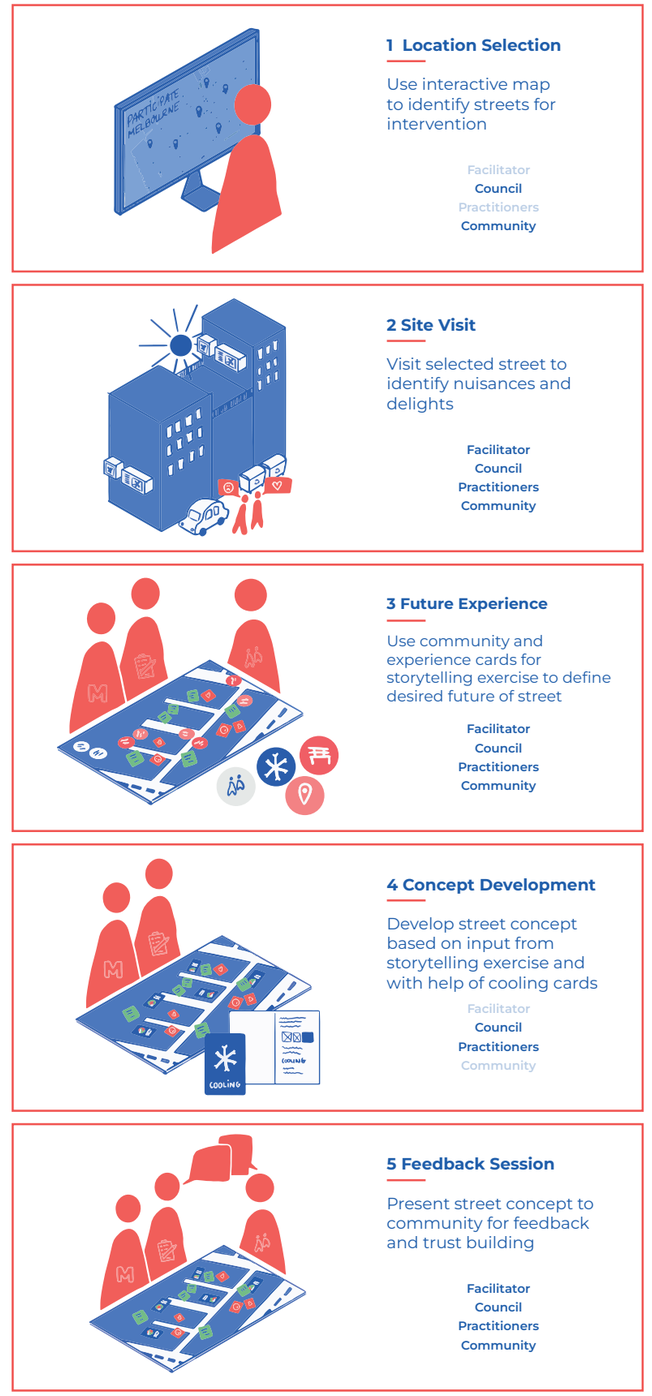


Figure 51. **Suggested workshop structure**

6.1.3 Suggested Assets for Experience Focus

Community and Experience Cards For Future Experience Workshop

The future experience workshop focusses on the laneway users' experiences and makes use of community and experience cards. The idea was to develop cards that contain different interventions/ experiences for the cooling, placemaking and wayfinding & walkability aspect of the place to help citizens come up with ideas for improving the selected laneway. To help workshop participants think from different user perspectives, community cards were added that contain different street user archetypes and are intended to help workshop participants consider the varying lifestyles, mobility matters and vulnerabilities of different street users (Figure 52). These community cards have been inspired by Champlin et al.'s (2023) "Amplifying Weak Signals" toolkit that introduces peripheral actor and knowledge type cards. Extra empty cards allow the workshop participants to bring in and write down their own ideas.

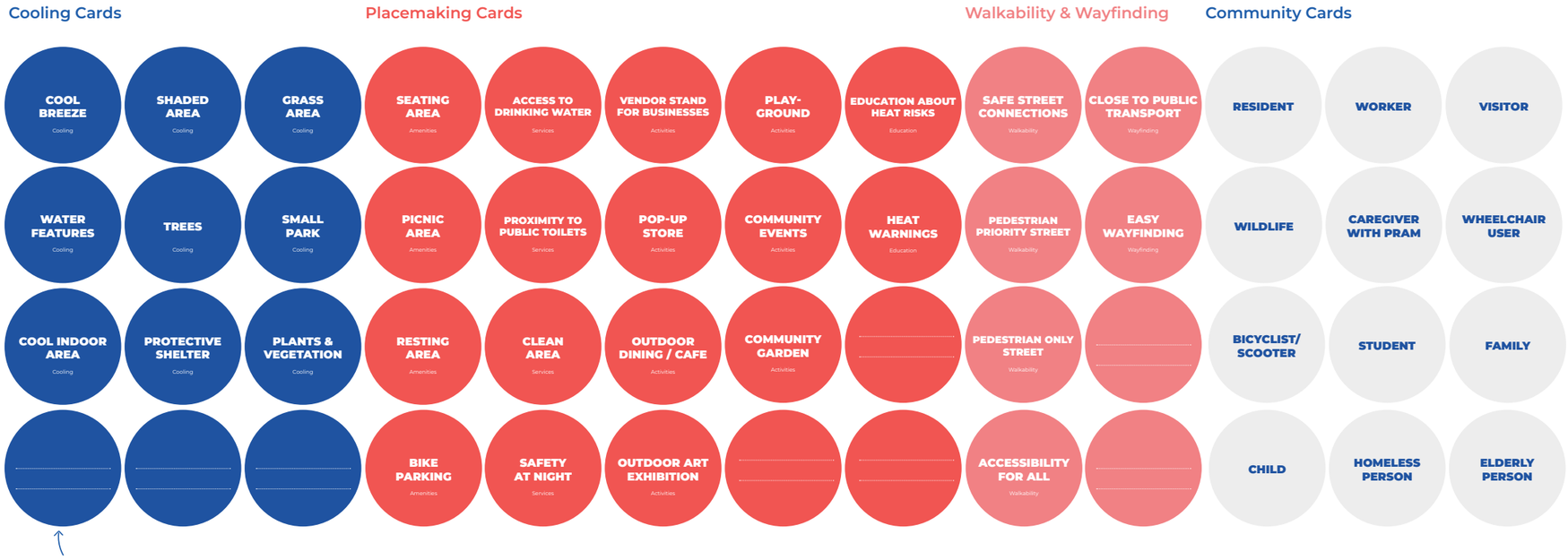


Figure 52.
Suggested interventions for experience cards and streetuser archetypes for community cards

6.2.3 Suggested Assets for Cooling Focus

Cooling Intervention Cards and Booklet for Concept Development Workshop

The concept development workshop focusses on the required cooling interventions and makes use of the cooling assets such as the cooling intervention cards. The idea was to turn all the detailed technical information from the cooling interventions identified during the research phase (Figure 54) into playing cards that are easy to flip through and read. The cooling intervention cards are a core element of the toolkit as they contain all the relevant information on cooling outdoor spaces. They are a translation of the text-heavy cooling toolkits analysed in "4.1 Cooling Toolkits Precedents" into a more tangible, easy-to-understand product. The accompanying booklet is intended to provide more detailed information for every intervention and contains research evidence about each interventions' cooling potentials (Figure 53).

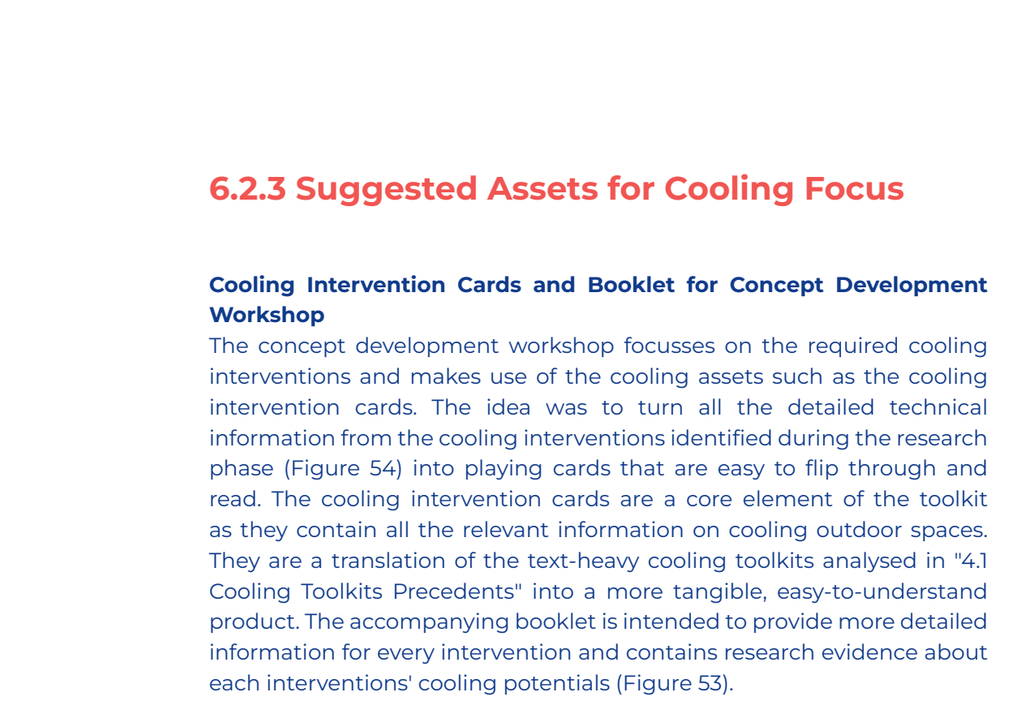


Figure 53. **Design suggestion for cooling intervention cards and accompanying booklet**

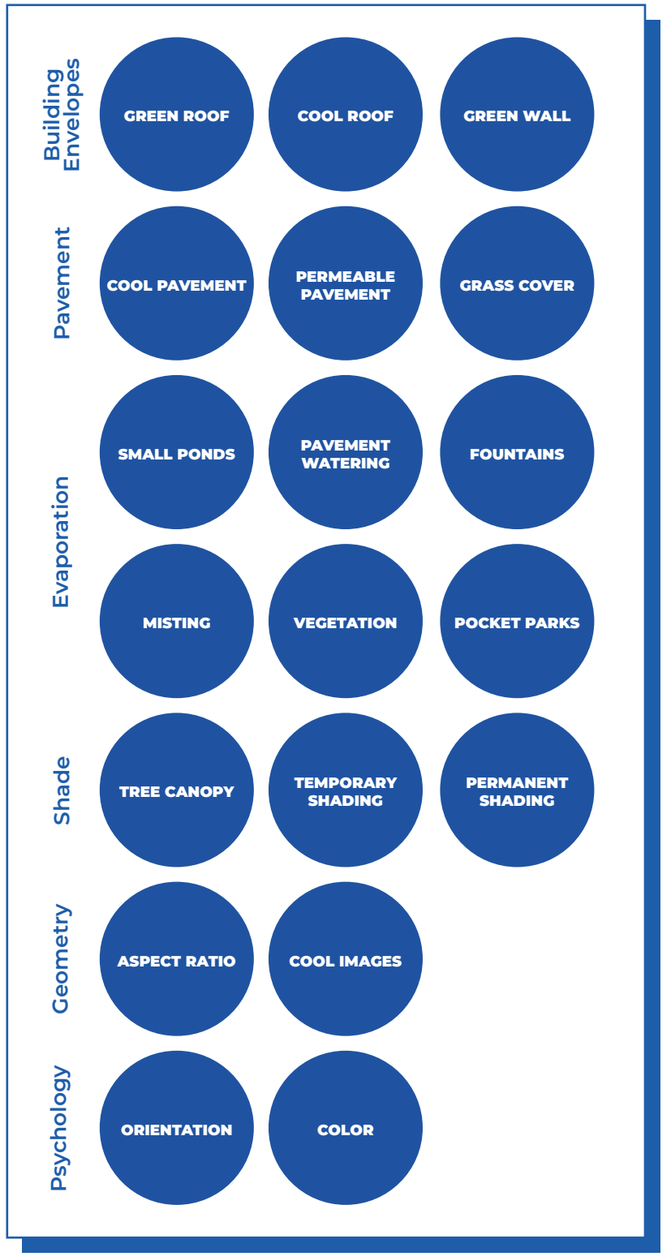


Figure 54. **Identified cooling interventions that are suitable for Melbourne's climate as identified in "4.2.3 Cooling Strategies to Improve Thermal Comfort" and "4.2.4 Cooling Strategies Fit For Melbourne"**

6.2 Council Feedback on the Suggested Toolkit Concept

With the base structure of the workshop defined and the most important toolkit assets (cooling cards and experience cards) worked out, a meeting with different city council employees was arranged to get feedback. A total of 6 employees with relevant backgrounds in strategic planning, landscaping, urban foresting and climate change adaptation joined the meeting (Figure 55, Figure 56).

Cool Pedestrian Network Is Desirable and the Interactive Workshop Approach Works Well in the Concept Development Phase

The overall feedback was that the design direction of a cool pedestrian network aligns well with outcomes of previous community surveys and with the council's vision of only cooling key areas and not the whole city. The council appreciates the *"interactive and almost gamified"* approach that allows people to play around with ideas and one of the landscape architects mentioned that the suggested approach works well in the concept development phase for landscape architects.

» I really love the cards that you have and I feel like the process really works well in the concept development phase for landscape architects «

Community Participants Become "Champions of the Intervention"

An important aspect of this feedback session was to validate whether the approach of several workshop sessions is feasible and realistic for the council to implement. As projects within the council often go through many rounds of community consultations the suggested workshop structure would be suitable. One meeting attendee highlighted the importance of curating a reference group that presents a good cross-section of the community and that could go through the whole journey and can be invited back for several sessions. When it comes to the amount of participants in a session there usually is no limit in workshops run by the council, but there are often already 10-20 internal stakeholders *"to make sure different council teams feel included and represented and to capture everyone's expertise"*. If the goal is to be community-focused, it might be useful to run separate workshops with the council teams and join the outcomes afterwards to not overpower the community participants.

» I can imagine you have a reference group for a particular location [...] and then those people will become champions of the intervention, too! «

Community Expectation Management

An interesting aspect that came forward during the feedback session is community expectation management. The council emphasized the importance of clearly stating at the beginning of every community consultation that the workshop is about understanding the feasibility of implementing ideas to build a business case and should be framed as a scoping process into the budget without promising too much upfront. They also mention that many laneways are privately owned which makes it particularly difficult to realise new concepts.

» This is about understanding the feasibility of these ideas, this is about building a business case. This is not necessarily promising that these ideas will be delivered, but we genuinely want to co-design with the community, so this is kind of a step toward that «

Figure 55. **Concept presentation at city council**

The Site Visit Is An Opportunity to Unlock Creativity

Another aspect to validate during the feedback session were the site visits and whether the council can imagine doing those as part of the whole co-design process. The idea was perceived very positively, as the council is already doing many site visits internally, but not very often with community members, despite it being a good way to refresh memories and unlock creativity, especially if part of the ideation is done at the site. That's why one of the meeting attendees suggested to even hold part of the ideation workshop on-site and call it a "walk-shop".

» We always do site visits but we don't always gather the participants to do it. But I think it's such a good tool to get everyone up to the same page. «

Connecting People By Using an Experience Focused Approach

In the next step, the storytelling exercise and the experience cards were discussed with the council to find out whether they think that this will provide them with valuable and workable insights for the following internal concept development phase. The council appreciates the user experience approach, as it helps them to connect people to existing strategies. "*The piece about user experience is really useful because I think that's a great way to connect people, [...] it's connecting people and communities to some kind of strategies that we're already developing.*" They also like the use of the experience cards, as they are simple yet very clear and could even be used onsite while walking around. One of the meeting attendees highlighted that she likes the inclusion of empty cards to add new ideas, but suggests not showing the experience cards at the start of the future desired experience workshop to not bias people's ideas and only start revealing cards when people get stuck. Another recommendation was to use constraints during the workshop, e.g. by letting people only pick one card or a value sitting underneath, as people otherwise might end up choosing all of the experience cards which won't help with decision-making.

» When we've used a set of things, often people want all of them and you end up having to still do most of the decision-making instead of letting the public guide that. «

Figure 56. **Looking through the cooling intervention and experience cards**

Cooling Cards Make Specialist Information Accessible to Non-Experts

The last aspect to validate was whether the cooling cards provide relevant information and will be helpful during the concept development workshop where the council and designers will have to choose cooling interventions that enable the community's desired experiences. The council confirmed that and appreciates the fact that the cooling intervention cards contain all the specialist information, which is often hard to manage due to the abundance of information, in an accessible way that doesn't require everyone to have the specialist lingo and technical knowledge about all the cooling interventions. Another point of discussion was whether the cooling cards contain enough information, which was also confirmed by the council, especially as they would be used in the concept stage and are accompanied by the booklet that provides more detailed information. The council envisions that it will be very helpful to pick several cards as design principles that can be tested and trialled and then be further refined in the detailed design phase. "*You've got a handful (of interventions) in your pocket of what you could trial. It's like these could be your principles. So you can design moves and then it changes when you get a bit more into the actual design*". Another aspect that was appreciated is that the cooling cards and the extra information in the booklet are all specifically targeted at Melbourne's climate. One suggestion was to add some sort of indication on the cards that shows how feasible or implementable each intervention is.

»It's really user-friendly, you don't have to have the lingo of the specialist to be able to use them. So I think that makes it easy. From like a visual perspective, you can sort of just see and get a visual of what's going on, so I think it's awesome. «

Insights from Council Feedback Session

- **» The suggested process works well for the city council and design practitioners and the suggested cooling intervention cards make specialist information accessible for everyone**
- **» Keep the current workshop structure including the site visit and work out the specific workshop activities**
- **» Don't reveal solutions too early in the desired future experience workshop, think about how to restrict the choices and possibilities so people can't pick everything**
- **» Keep the level of information on the cooling cards, but consider adding a ranking for feasibility/ implementability**

6.3 Refining the Toolkit

The feedback session with the city council gave valuable insights and confirmed that the general idea behind the workshop structure and the toolkit assets are suitable for the City of Melbourne to work with and use for co-design sessions. With the new insights, the toolkit could be further refined and finalised to be trialed in test workshops. An important refinement step was to work out the exact prompts and activities for every workshop and to adjust the required assets.

6.3.1 Finalised Assets for Experience Focus

Redesigned Experience and Value Cards

Taking the feedback from the council meeting into account, the experience cards were redesigned. The previous experience cards were very solution-oriented which might bias workshop participants and limit their own creative ideas. It was therefore decided to make the cards more abstract and value-based. For this purpose the 'Design Excellence Principles For Streets' from the Future Streets Framework and Jan Gehl's 12 Quality Criteria for developing people landscapes (both presented in "4.3 Placemaking & Wayfinding Strategies") were combined and summarized into a set of 18 value & experience cards (Figure 57). Rather than suggesting solutions, those new cards aim at inspiring solutions and prompting workshop participants to brainstorm design solutions that enable the selected values and experiences for the different street user archetypes included in the community cards.

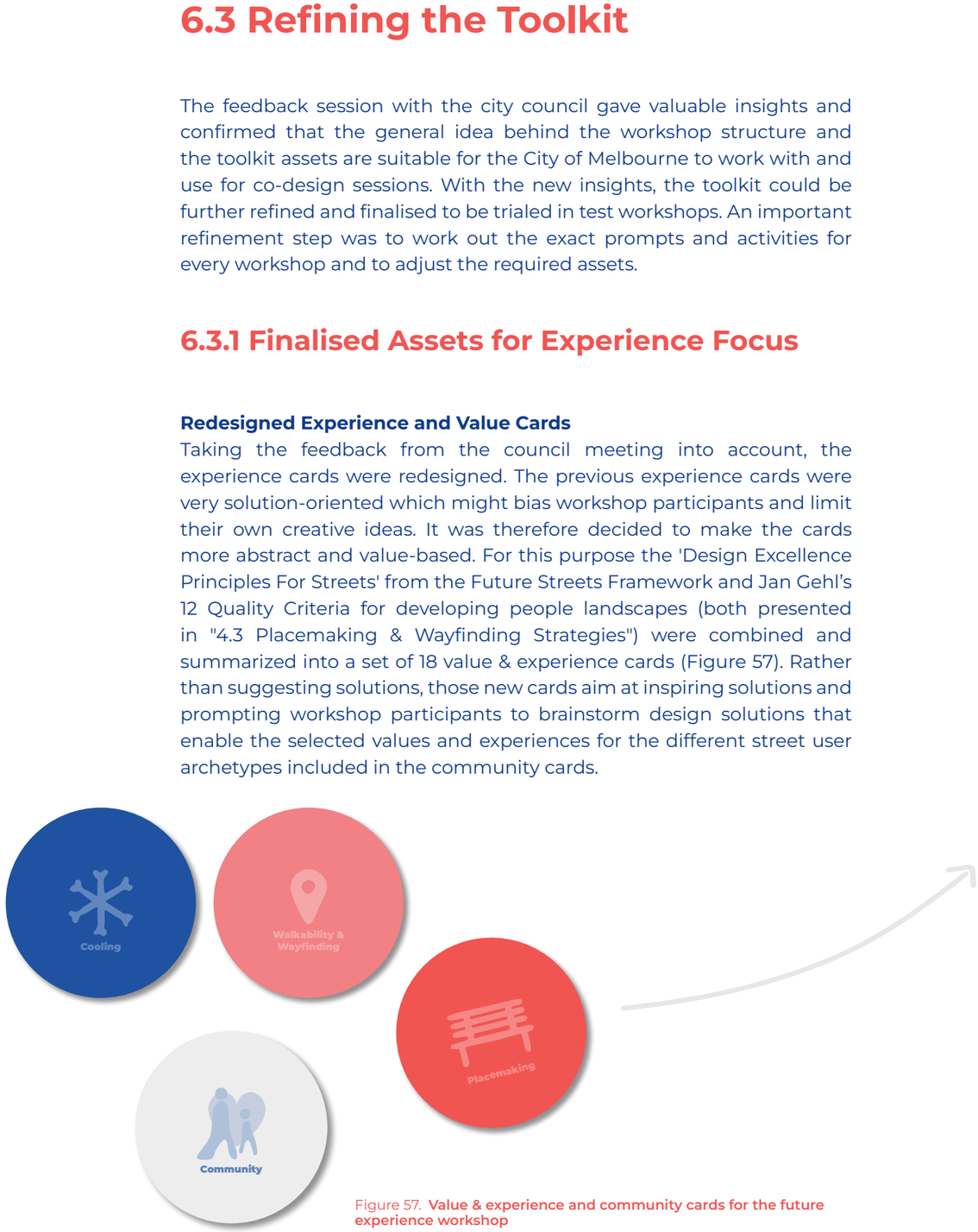


Figure 57. **Value & experience and community cards for the future experience workshop**

6.1.2 Finalised Assets for Cooling Focus

Cooling Intervention Cards

The first cooling intervention card prototypes were shown to the council in the feedback session and received very positive feedback. Based on that feedback the cooling intervention cards for all 24 suggested cooling interventions were worked out (Figure 59).

Figure 58. **Example of a cooling intervention card and the information displayed on it**

For each intervention, more research was conducted into its working mechanism, potential to cool down outdoor spaces and improve thermal comfort, its limitations and rules of application. This information was then condensed into the most relevant information that fits on a small playing card. The front of every card contains the intervention name, category and an illustration. The illustrations were designed to show what the intervention is about, while still keeping it abstract enough to come up with own ideas of how that intervention could take shape in a space. The backside of the cards contains information about the intervention, including a short description, an indication of what topology the intervention is suitable for and a ranking system that shows how much of a cooling potential each intervention has (Figure 58). In addition, rules for application help with deciding where and how to implement the intervention - this has been inspired by Champlin et al.'s (2021) "Kennistrekker" cards that contain similar rules and regulations. Different card sizes were tested to make sure the information is readable and the cards were tested for color blindness to make them inclusive and accessible for different users.

Figure 59. **Cooling intervention cards, the full overview including the backside of the cards can be found in Appendix J**

Cooling Intervention Booklet

Since the information on the cooling intervention cards is very concise, more detailed information needed to be provided elsewhere – that's where the booklet comes into place. It contains a detailed description of every cooling intervention and its rules of application and provides references to further reading material. The most important part of the booklet however is the research evidence it provides to prove that the interventions are suitable for Melbourne's specific climate. Based on this, research was conducted for every intervention with the aim to find scientific studies or simulations that were conducted in either Melbourne or in cities with climates like Melbourne. Based on this research, the booklet summarizes how much impact each intervention can potentially have in Melbourne's climate in terms of reducing air, surface and radiant temperatures and improving pedestrian thermal comfort (Figure 60). A QR code on each cooling intervention card leads to the matching page in the booklet. The digital version can be accessed here: **tinyurl.com/coolpedestrianbooklet**

Figure 60. **Example page from the booklet**

Digital Map

The City of Melbourne provides online access to many maps and datasets, e.g. with data about publicly accessible air-conditioned buildings, locations of public toilets and water fountains, etc. They also provide maps that show which roofs are suitable to be converted into green and cool roofs and which laneways are suitable for vertical greening and have the potential to be turned into park or forest lanes. Those maps all provide valuable information when designing the cool pedestrian network, however, they are not available in one combined map. Therefore, a digital map was designed that combines all the relevant maps and compliments the other toolkit assets with valuable information. Some cooling intervention cards are directly referring to the map to retrieve information (Figure 61). The digital map can be accessed here: **tinyurl.com/coolpedestrians**

Figure 61. **Preview of the complimentary digital map**

6.3.3 Finalised Workshop Structure and Activities

The following pages introduce the finalised structure for the suggested series of co-design workshops in which the experience and cooling focused assets that were introduced in "6.3.1 Finalised Assets for Experience Focus" and "6.2.3 Suggested Assets for Cooling Focus" will be used to co-design a streetscape concept.

1 Location Selection

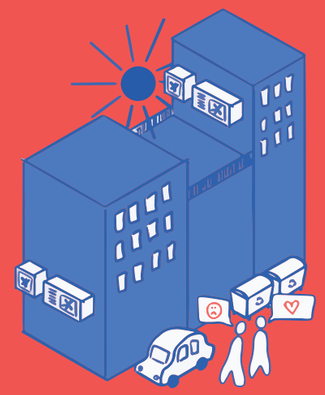
Objective The objective of the site selection is to identify laneways that should become part of the cool pedestrian network.

Who Is Involved Community members are able to get involved by nominating laneways that they would like to see become a part of the cool pedestrian network before the council makes the final decisions based on community input and other data.

Activities Although this is not a workshop, it can still be seen as a community consultation, that is inspired by other City of Melbourne community engagement projects like “Heat Safe City” and the “Laneway Greening Pilot” (Participate Melbourne, n.d.). For these projects, maps are provided on a website called Participate Melbourne and community members are asked to drop pins and comments on locations where they would like to see a change. The same can be done for the cool pedestrian network development, where people can drop a pin on laneways that they would like to be redesigned to become a part of the network. The council can then overlap these pins with their own data, e.g. heat vulnerability maps, in order to pick a laneway for intervention.

Desired Output The desired output from the site selection process is an overview of popular laneways that the community would like to be a part of the cool pedestrian network and the motivation behind the choices.

2 Site Visit



Objective The site visit has two main objectives. The first one is to get everyone to visit the laneway that is to be redesigned and to get a feeling for the space. The second one is to learn about people’s current experiences in the space: How do they move through the space on a hot day and what are the main nuisances and delights that shape the experience?

Who Is Involved The community members are the most relevant participants in the site visit, as the objective is to learn about their experience. Ideally, representatives from the council and design practitioners join as well, to hear first-hand about these experiences.

Workshop Activities When visiting the laneway (ideally) on a hot summer day, workshop participants are asked to have a look around the space to get a feeling for it. The first workshop activity will be for everyone to describe if and how they would move through the laneway on a hot day. Participants can draw their journey onto a printed map and add post-its as well. Afterwards, the participants will be prompted to think about the nuisances and delights of the space by a series of questions: What features do you like about this laneway? What features do you think provide relief from the heat on a hot day? What features do you dislike about this laneway? What features do you think make this laneway uncomfortable on a hot summer day? For each question, the participants will use different colour post-its and can put down the answers at the corresponding location on the map. The workshop activity sheets can be found in Appendix K.

Desired Output The desired output from the site visit is a visual map that represents the nuisances and delights that people experience in the space and how they impact the behaviour in and movement through the laneway.

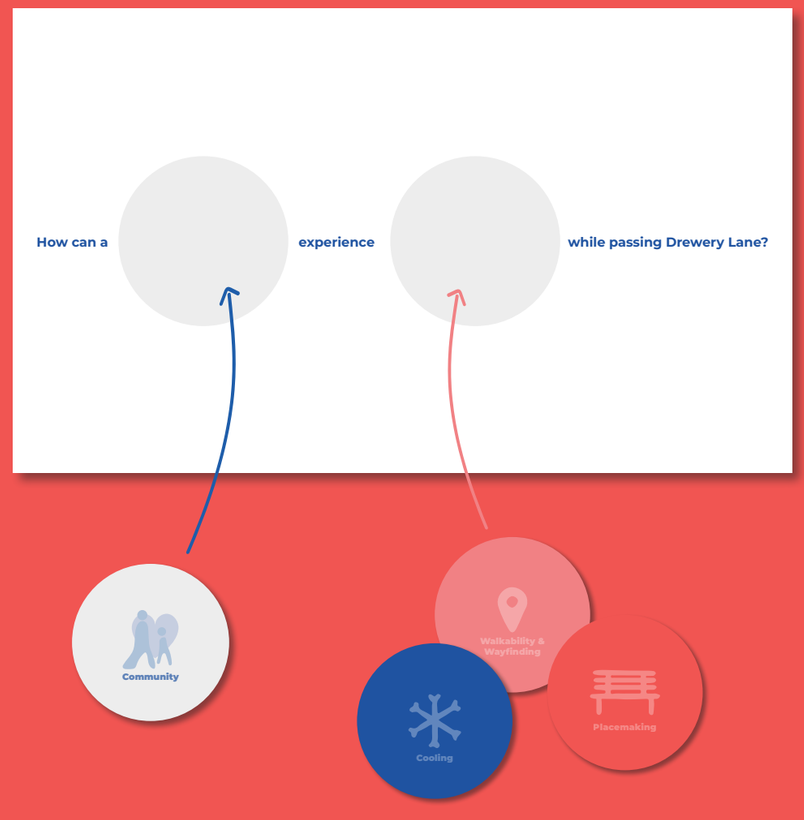
3 Future Experience with Experience Assets

Objective The objective of the future experience workshop is to define values and experiences (regarding cooling, placemaking and walkability & wayfinding) that are important for different user groups passing through the laneway and to come up with ideas on how these values and experiences can be achieved in the new street concept.

Who Is Involved Everyone is participating in this workshop – community members, council and design practitioners - to brainstorm ideas together. It is important for the council and design practitioners to be present in this workshop to hear the ideas from the community first-hand and be able to respond to them in the concept development workshop.

Workshop Activities In the future experience workshop, the participants will first be presented with the outcome of the site visit in order to refresh everyone's memory about the laneway's current user experience and its nuisances and delights. The following part of the workshop is based on Kankainen et al.'s (2012) co-design method called "Storytelling Group" where the goal is to create fictive scenarios of how a person is walking through the laneway and what experience that person is having. For this purpose, the community and value & experience cards will be used. Every workshop group picks a street user archetype from the community cards and then selects 3 placemaking and wayfinding & walkability value & experience cards that they find most important for the chosen archetype (the cooling experience cards are selected in addition by default). They are then prompted to start the storytelling by ideating on how the chosen archetype can experience the selected values and experiences when passing through the space and by placing post-its with the design ideas on a map of the laneway. One aspect of the Storytelling Group method is that it encourages participants to tell real-life stories from their own experiences while building the fictive story (Kankainen et al, 2012) - this should lead workshop participants to not only think from the perspective of their chosen archetype but to also share some of their own relevant experiences. Once the groups have brainstormed ideas for all selected value & experience cards, another round of brainstorming for another archetype can start if time permits. At the end of the workshop, each group presents their ideas by telling the story (and visually showing on the map) of how their chosen archetype gets to experience the selected values & experiences. The workshop activity sheets can be found in Appendix L.

Desired Output The desired output is an insight into which values & experiences are important for community members in the new laneway and to have a map with a range of ideas of how these values and experiences can take shap.



4 Concept Development with Cooling Intervention Assets

Objective The objective of the concept development workshop is to translate the insights and ideas from the site visit and the future experience workshop into a first concept draft and to explore which cooling interventions can come into place to realise the desired experiences of the community members.

Who Is Involved In this workshop, the council and design practitioners work together without any community participants as the focus now shifts from the experience level towards a more technical level.

Workshop Activities At the beginning of the workshop the insights from the community workshops including the design ideas from the future experience workshop will be shared, to get everyone on the same page. The first activity will focus on the cooling aspect of the laneway as the participants are tasked to pick suitable cooling interventions for the laneway to provide a cooling experience for pedestrians on a hot day. For this purpose, the cooling intervention cards, the booklet and the digital map can be used. Suitable cooling interventions can be selected and placed on a printed map. In the next two steps, the workshop participants are prompted to think about the placemaking aspect and the wayfinding & walkability aspects of the laneway by coming up with ideas that enhance the laneway's current delights and improve its current nuisances while also incorporating ideas from the community workshops. After those brainstorming rounds, an evaluation sheet will be used to check which community members the developed design concept caters for and which experiences and values are covered with the new design. If time permits, the design can be readjusted before the different workshop groups of council employees and design practitioners present their concepts and give feedback to each other. The workshop activity sheets can be found in Appendix M.

Desired Output The desired output from the concept development workshop is a first concept draft that contains a range of suitable cooling interventions selected from the cooling intervention cards and ideas for realising the desired placemaking and wayfinding experiences.

5 Feedback Session

Objective The objective of the feedback session is to present a further refined concept to the community members, to keep them involved in the process and show that their input counts by showing them how their ideas influenced the design concept. The aim is to provide the community members with a sense of ownership and to get community endorsement for presenting the business case within the council.

Who Is Involved In this session the community participants are joining again. The council and design practitioners join as well – and while not all of them need to be present at least a few representatives should join to present the developed concept and react to the community feedback.

Workshop Activity The insights from the site visit and future experience workshop are summarized before the new concepts are presented and explained to the community participants. The council and design practitioners will explain the choices they made and highlight which ideas were inspired by the previous community workshops. Community participants can ask questions and give feedback on the concepts.

Desired Output The desired output is to have a community-endorsed concept that can be further worked out based on the community feedback and be used to build a business case to push the project within the council. If the project gets approved, the design concept should help the council with writing a refined brief so that the design practitioners can further detail the concept and get it ready for implementation.

6.4 Final Toolkit

The final toolkit consists of the co-design workshop series presented in "6.3.3 Finalised Workshop Structure and Activities" and the different workshop assets (including the workshop suggested co-design workshop series and the workshop activity sheets), the experience assets (including the value & experience cards and the community cards with street user archetypes) and the cooling assets (including the cooling intervention cards, the booklet and the digital map) (Figure 63). Figure 62 provides an overview of the different workshops and the participants and assets that are required for each of the workshops.

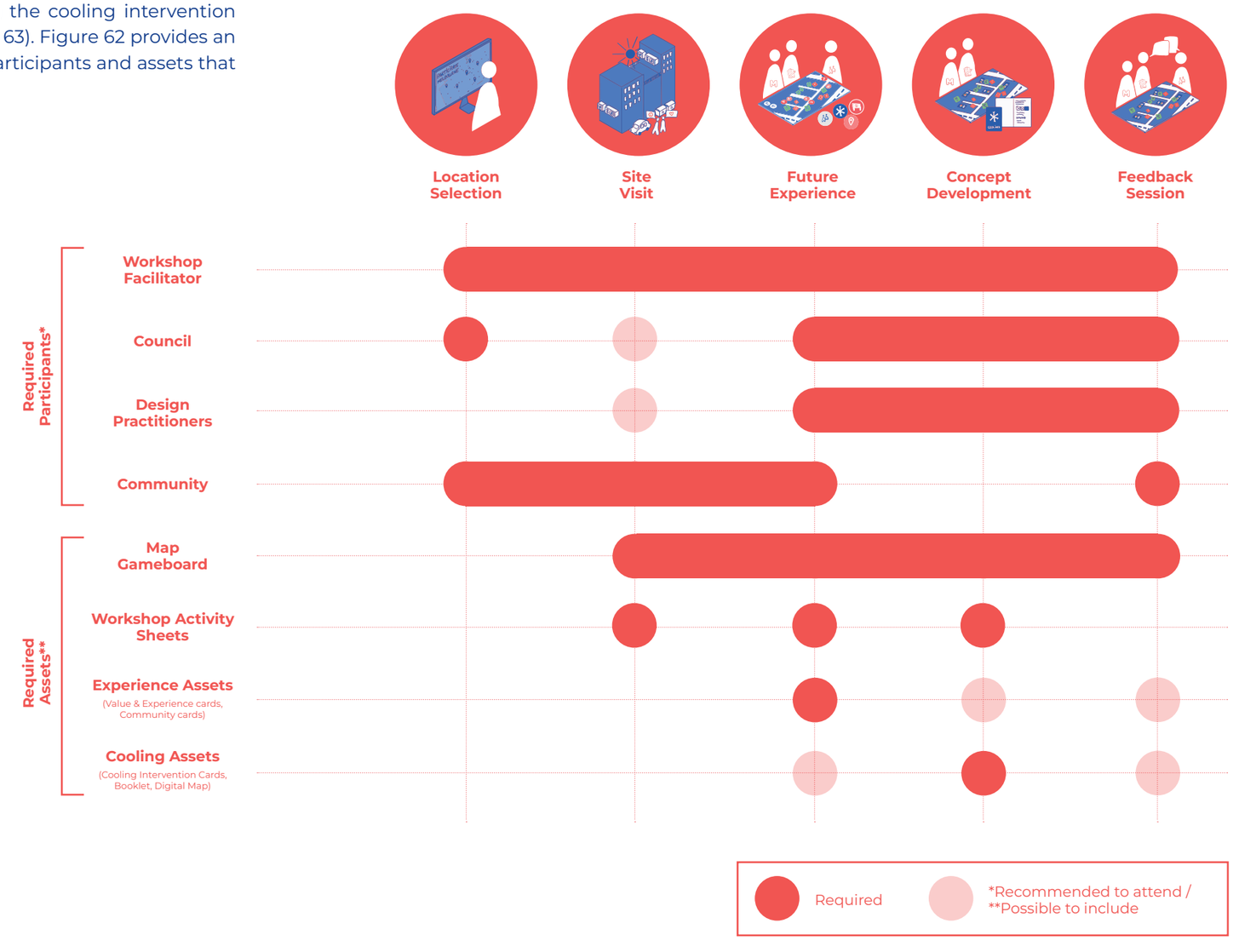


Figure 62. **Overview of required participants and recommended assets per co-design session**

Cooling Assets

(Cooling intervention cards, booklet and digital map)

Workshop Assets

(Activity sheets for site visit, future experience workshop and concept development workshop)

Experience Assets

(Experience & value cards and community cards)

Figure 63.
Overview of asssets included in the final toolkit

7 Toolkit Testing: Case Study

This chapter covers how the refined toolkit has been trialed by facilitating co-design workshops with different community groups and the city council to develop a concept for Drewery Lane in the CBD.

7.1 Case Study Approach

After refining the toolkit and working out all the workshop activities and physical assets, the toolkit was tested in a series of workshops with community members and the council (Figure 64). Looking back to the main research question presented in "2.1 Assignment and Research Questions" the main aim of this case study was to test whether the developed toolkit enables the engagement of different stakeholders while designing streetscapes for a cool pedestrian network and whether it supports them in sharing and gaining knowledge throughout the process. In addition, the case study aimed to give insights into how the workshop participants are interacting with the toolkit assets and whether they understand how to use them.

Does the developed toolkit enable the engagement of different stakeholders in the planning of heat-adapted public spaces and support them in sharing and gaining knowledge throughout the process?

How are the workshop participants engaging with the toolkit assets? Do they understand how to use them?

Drewery Lane as Case Study Location

For the purpose of the test workshops, Drewery Lane was selected as the streetscape that is to be redesigned with the help of the toolkit.

Three Trial Workshops with Community Members

The site visit and future experience workshop were tested in 3 separate community workshops with a total of 12 participants. The first community workshop group consisted of five students, including three design students. To also test the workshop with non-designers, the same workshop was repeated with a group of four people, both workers and students. For the last community workshop, three residents and a business owner of Drewery Lane were recruited with the aim to get input from people that are very familiar with the space and use the laneway every day.

One Trial Workshop with the Council

The concept development workshop was conducted with 4 council employees with backgrounds in climate adaptation, strategic design and urban planning. The insights from the community workshop are used as input for the concept development.

Informed Consent

The informed consent forms for the trial workshops can be found in Appendix N.

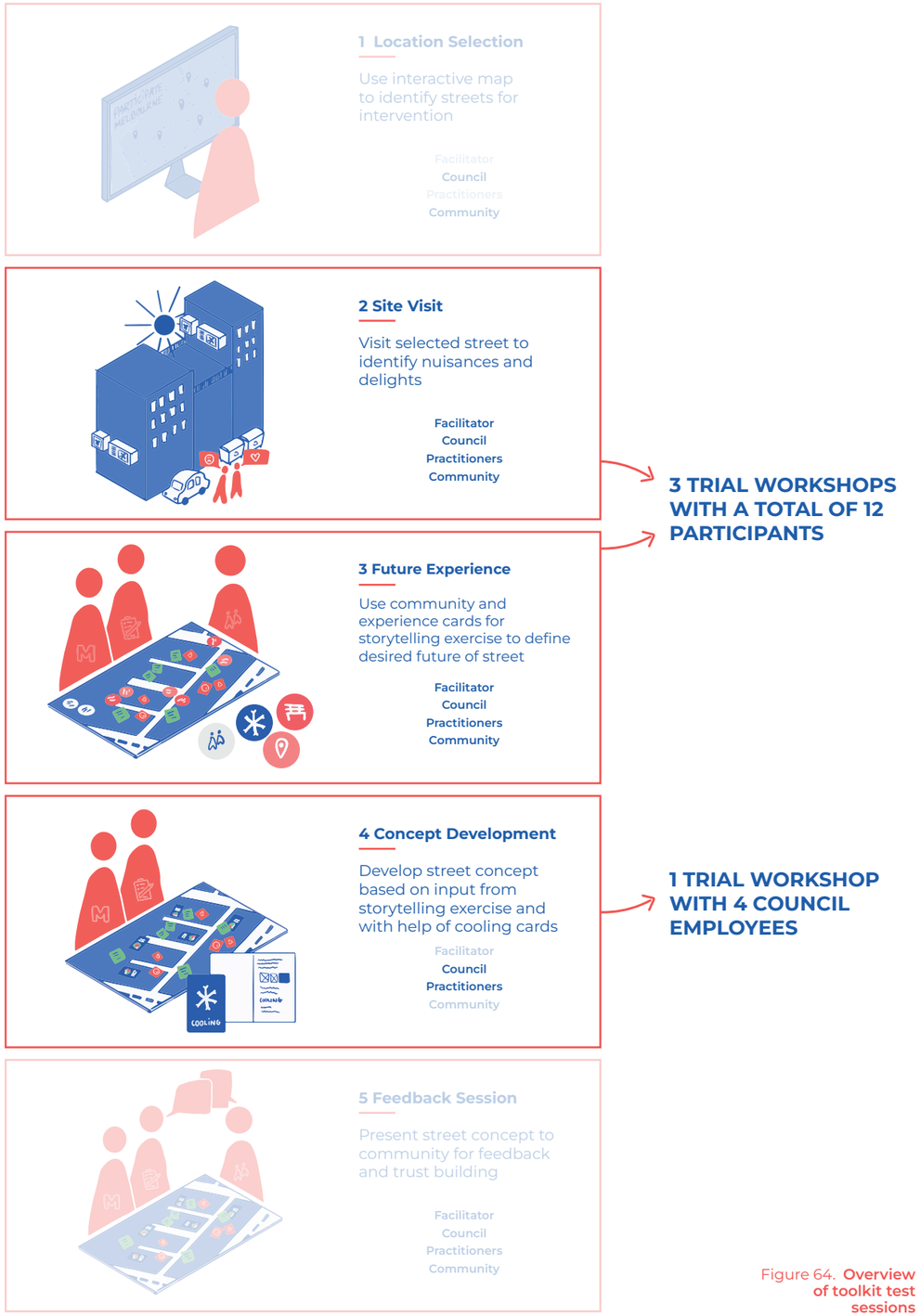


Figure 64. **Overview of toolkit test sessions**

7.2 Location Selection

Drewery Lane as Case Study Location

Drewery Lane is a laneway located in Melbourne's CBD and was selected as the case study location for the toolkit testing. Its central location right next to Swanston Street - one of Melbourne's busiest streets with many shops, restaurants and malls - makes Drewery Lane an interesting choice for the cool pedestrian network. Swanston Street gets a lot of foot traffic, so Drewery Lane could present an interesting alternative route, particularly as it is also located between two major train stations: Melbourne Central and Flinders Street Station. According to the 'Cooling and Greening Melbourne' map (Department of Transport and Planning, 2022), Drewery Lane also appears to be in a particularly hot and vulnerable area of the CBD, that could benefit from extra cooling measures. In addition, Drewery Lane has been a popular choice for the Green Your Laneway Pilot project in 2017, where many citizens nominated Drewery Lane for greening interventions, motivating their nominations with comments like: *"Anything! Green it!", "Drewery deserves a facelift as it is in a high foot traffic area.", "Plant some trees that will give this alley some more life."* and *"A forest in Drewery Place would look amazing. The end of the lane is an entrance to Melbourne Central. City workers often sit in the gutter to eat their lunch in the lane. It would be so much nicer for them to have somewhere nice to sit."* (Participate Melbourne, n.d.).

Drewery Lane has three other laneways branching off it: Drewery Alley, Drewery Place and Sniders Lane. Drewery Lane is surrounded by a combination of residential and commercial buildings and hosts two popular cafés, a bar and a nightclub. Drewery Lane is known for the artwork and graffiti on the building walls, but besides that it is a very plain laneway without any seating options for the many café visitors but with a lot of through traffic and a high number of rubbish bins, particularly in Sniders Lane (Figure 65).

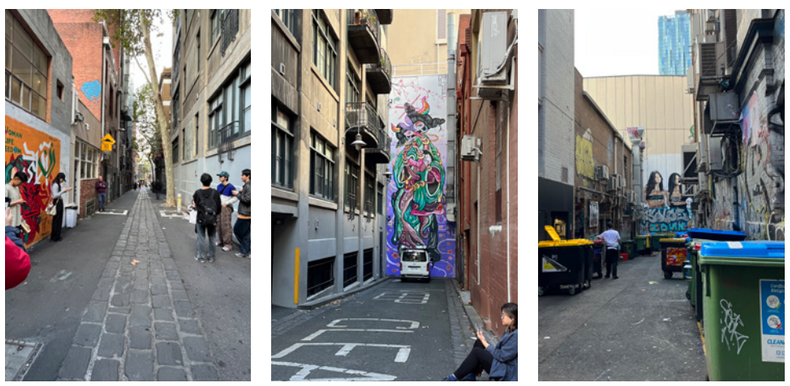
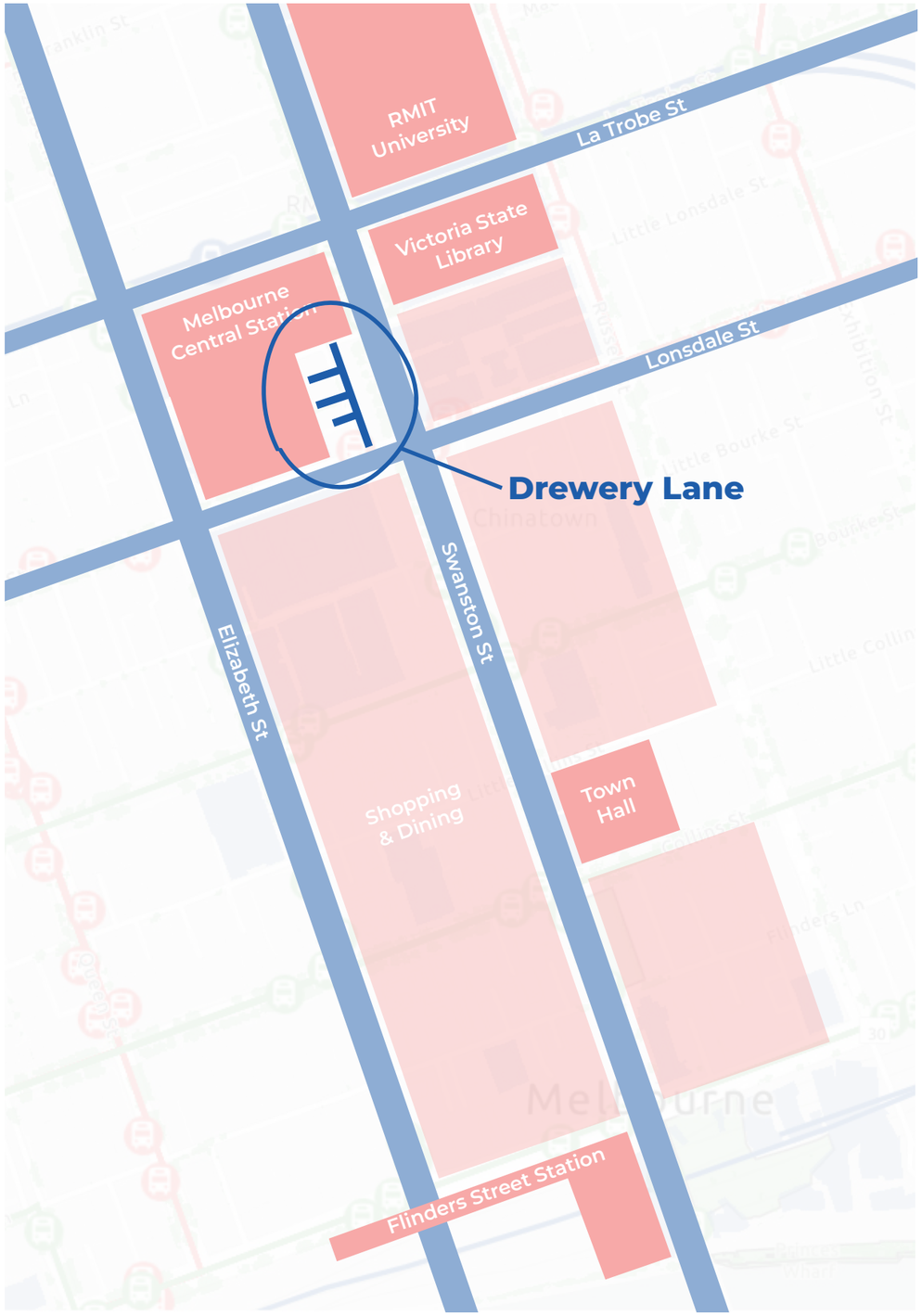


Figure 65. **Photos taken by author in Drewery Lane (left: Drewery Lane, middle: Drewery Alley, right: Sniders Lane)**



7.3 Site Visit Trial Workshops

The Site Visit was conducted with all three community groups. After being introduced to the project and the aim of the workshop, the participants were asked to walk around Drewery Lane to familiarize themselves with the laneway and its surroundings (Figure 67). They were then asked to talk about if and how they would pass through Drewery Lane on a hot day and stick post-its with their considerations onto a map of drewery Lane (Appendix O). With the help of the activity sheets in Appendix K, participants were prompted to think about the features they like and dislike in Drewery Lane, which of these features contribute to heat relief and which ones contribute to discomfort on a hot day. The answers to all these questions were noted on different coloured post-its and sticked onto the corresponding location on the map (Figure 68).

Output: A Map with An Overview of All Nuisances and Delights
Every one of the three site visits resulted in a map with sticky notes that show an overview of all the current nuisances and delights of the laneway including their location – some of the nuisances and delights are related to heat, while others are related to the general appearance and experience of Drewery Lane. The insights from all three workshops were visualised in one big overview map (Figure 66, see Appendix P for full size).

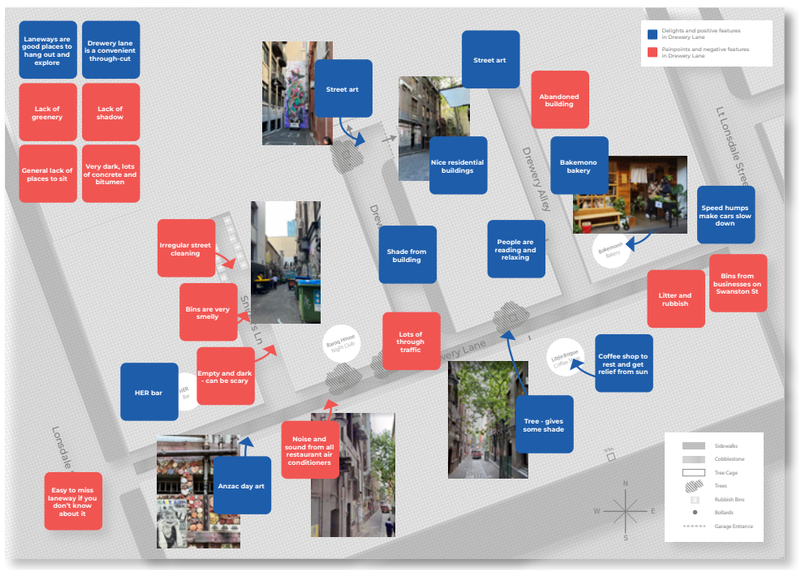


Figure 66. **Result after 3 community workshops: Overview of nuisances and delights of Drewery Lane**

"So on hot days, because we usually stay indoors, it's okay for us [...] But if you think from a customer's experience, if they line up outside, it gets too hot. I don't think it gets hotter than what you normally experience in other areas of the city, but rather because of the lack of shade, especially during noon, that will impact the customer experience. So, lack of shade is one of the things that comes to my mind. And also, just the laneway generally, because of what it is, on hot days you get a lot of smells. That's a big thing! The heat is one thing, but also the stench that's caused by the heat." Drewery Lane Resident & Business Owner

"When you walk further down where there are more restaurants in Swanston Street yeah, there are all these exhaust fans. And even in winter I try to walk on the other side of the street, and I have to do that, because there are two different smells coming out: one is from the sewage, and one is a hot greasy food smell. So that is an issue on a hot day, but also an issue all around." Drewery Lane Resident

Figure 67. **Workshop participants walking down Drewery Lane**

7.3.1 Insights and Learnings from Site Visit Trial Workshops

Site Visit Allows Direct Interaction with the Space And Thinking About Ideas For It - And Learning from Residents is Particularly Insightful
The site visit proved to be a valuable part of the workshop structure, as it allowed interaction with the space while talking about it and some issues started showing while spending time there, e.g. that there is no place to sit down and that there is a lot of disturbing through-traffic. Participants mentioned that being in the place and looking at the surroundings helped them to react to the prompts and coming up with ideas. Identifying nuisances and delights was particularly interesting in the workshop with the residents, as they have experienced the laneway in summer and know of issues that other passers-by and the council wouldn't notice, e.g. restaurants pouring out liquids into the laneway or the fact that walking on the left side of the laneway is uncomfortable all-year round due to the bad smell coming out of the restaurants' exhaust fans and from the rubbish bins.

»I liked walking around the laneway and thinking like, "Okay, what works here and what doesn't work?" Because at first, I had no idea what I would think and then I actually thought looking at stuff helped. «

»If you had maybe information on the laneway, as in things that maybe have already been changed recently or historical knowledge. Like something a lay person wouldn't know. It might be good to know that they've implemented XYZ already. Or that they're working on getting rid of that fan or something.«

Learning About People's Behavior and Experiences
Asking participants how they would walk through the laneway delivered interesting answers, but it was hard to capture those as participants didn't write down all important aspects that they had expressed verbally and the facilitator couldn't note all answers while also interacting with the participants. In the future, it would therefore be beneficial to include several facilitators in the site visit, so that one facilitator can prompt the participants to share their experiences while the other facilitator helps with writing down the most important insights on post-its so that the workshop participants can focus on the conversation. In the future it would also be interesting to test if letting participants draw their physical journey onto the 2D map would add interesting insights when learning about how they use the laneway on a hot day. In conclusion, the site visit helped with engaging and sharing knowledge as desired, however the means of capturing the knowledge can be improved. The site visit trial workshop also revealed that the knowledge sharing should be bilateral. It shouldn't be limited to knowledge extraction from the community, but also about sharing knowledge with them, as participants expressed their wish to learn about the history and recent development about the laneway at the start of the site visit.

Figure 68. **Workshop participants putting down post-its about their experience in Drewery Lane**

Insights from the site visit test workshops

- **The site visit is a great way to directly interact with the location - exploring the surroundings helps with identifying what works and what doesn't**
- **The site visit enables knowledge sharing and delivers a good insight and overview of the laneway's nuisances and delights**

Suggestions for future site visit workshops

- **Let participants draw their journey onto the map**
- **Include more facilitators to capture what is being said while participants describe their experiences and respond to prompts**
- **Make the knowledge sharing bilateral and provide participants with background information about the laneway**

7.4 Future Experience Trial Workshops

All three community groups participated in the Desired Future Experiences workshops, which took place directly after the site visit with fresh memories of the current laneway experience. The participants were seated around a large, printed map of Drewery Lane (Appendix O) and as the first activity had to pick two street user archetypes from the community cards - one archetype that represents the workshop group's participants the most and one archetype that they consider a more vulnerable user of the laneway. They then had to select a total of three value & experience cards that they considered most relevant for each of the chosen archetypes in addition to the by default selected experience of being protected from the heat and sun (Figure 69). After the selection was made, the cards were placed on the workshop activity sheet (Appendix L) and the participants had to brainstorm ideas that would enable the selected archetype to experience the chosen values & experiences and stick those onto the map with post-its. In the end, they had to tell a story of how the chosen archetype would walk through the laneway with the new experiences.

Output: Overview of Cooling, Placemaking and Wayfinding Ideas and Insights Into What is Most Important for Community

Every future desired experience workshop resulted in a map with many different ideas for cooling, placemaking and wayfinding interventions that could be installed in Drewery Lane to enable the selected desired experiences for the different community members (Figure 70). The maps also highlight which of the suggested ideas the participants found most relevant and important to be considered by the council in the next step. All map outcomes were translated into digital versions that can be found in Appendix Q, Appendix R and Appendix S.

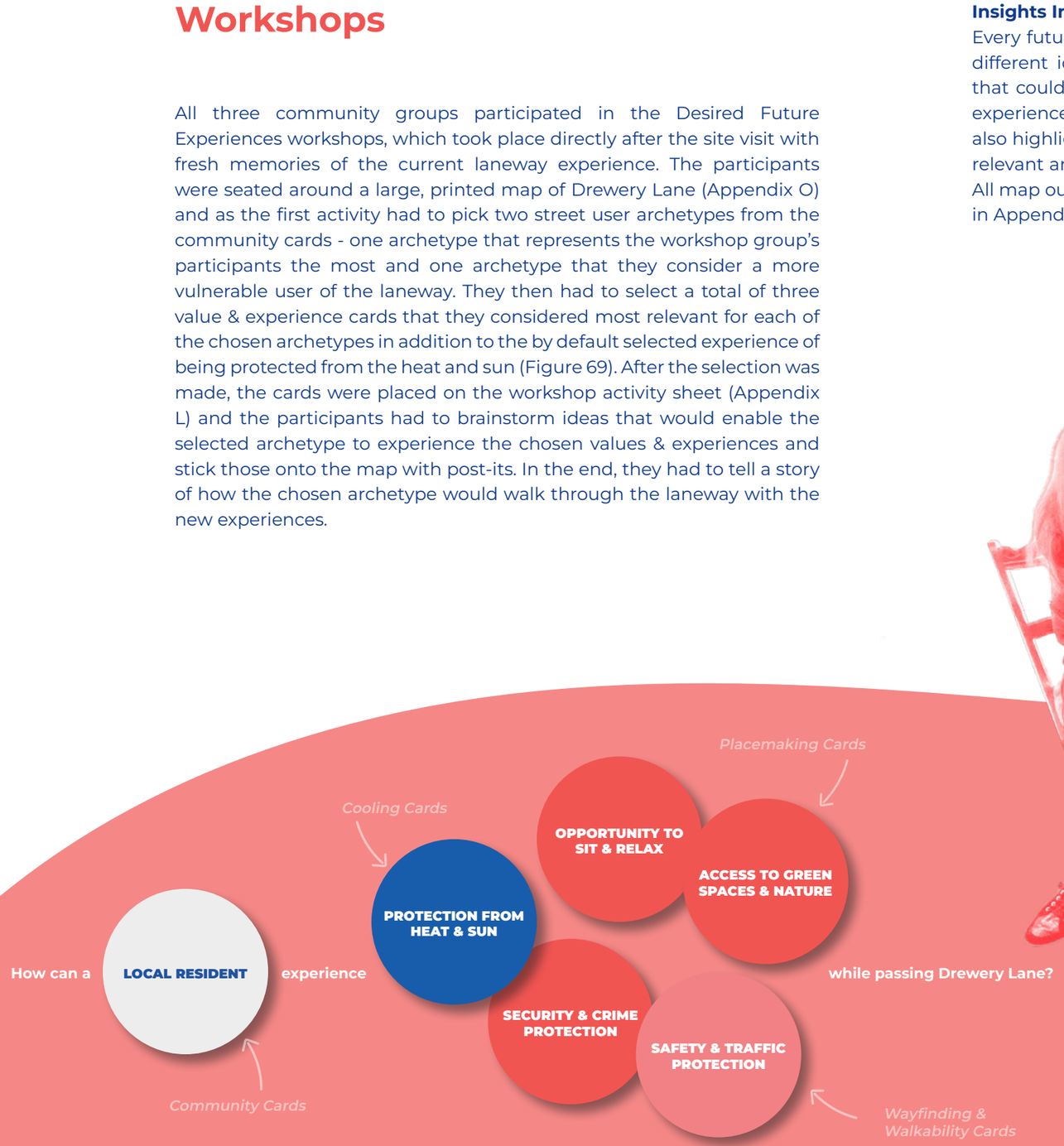


Figure 69. **Future desired experience workshop with residents of Drewery Lane. Left: Selected values & experiences that residents find important**

7.4.1 Insights and Learnings from Future Experience Trial Workshops

Storytelling Approach Delivers Insights into People's Thoughts and Experiences

Overall, the future experience workshops delivered valuable and insightful results, not only because of the final map outcome with an overview of all the ideas but also because of the underlying learning about people's behaviour and experiences. As stated in "3 Future Experience with Experience Assets" on page 96, the aim of the applied storytelling approach is that while crafting a fictive story for a user, participants also talk about their own lived experiences. This also showed during the test workshops as participants dropped interesting comments about their own needs and wishes while brainstorming ideas for the chosen archetype. Just like with the site visit, in the future, it would be helpful to have multiple facilitators, so that one can document what is being said, while the other facilitator can fully focus on guiding the activities.

Value & Experience Cards: Helping with Brainstorming and Looking at the Issue from Different Perspectives

The redesigned value & experience cards fulfilled their intended purpose of inspiring workshop participants to come up with ideas for the laneway redesign without being directly presented with possible solutions.

Figure 70. **Future desired experience map output from the first community workshop**

Participants mentioned that the cards helped them to think about the laneway redesign from perspectives they would have not considered otherwise. Participants also appreciated the "How can ___ experience ___ in Drewery Lane" worksheet as a guidance that helped them come up with ideas. *"I really loved having the fill-in-the-blanks and the fact that there were options because I think it was helpful to like brain map it, and just I don't think I would be able to come up with all of these good topics."*

Community Cards: Thinking from Different People's Perspectives is Helpful and Still Represents Own Views and Ideas

One big question was whether having to pick archetypes from the community cards and coming up with ideas for them would deliver interesting results and whether workshop participants would still see their own views represented while having to think for another user group. Most participants liked having these prompts and being forced to think from different people's perspectives and consider their experience – particularly as it helps to remember and consider certain demographics that may not often be represented in a regular workshop group. When being asked if the storytelling approach with the community cards would still represent their own needs and wishes for the future desired experience, participants mostly agreed and said that even when they had to think from other people's perspectives, the ideas they came up with still overlapped a lot with their own needs and wishes.

»It gave us a lot of ideas that we didn't think of before. Like all these cards, I didn't even consider these topics when I was doing the greening project. I was sort of a bit narrow-minded in just the greening and not sort of incorporating this into it.«

»I liked having those prompts. Because then you think of community members that you otherwise wouldn't think of. Even like wildlife, I wouldn't have thought of that [...] You only reach a certain demographic with the workshop, so the big groups of people. For example, if you always have able-bodied people, they might not think about how to access the laneway with a disability.«

Include Challenge and Inspiration Cards to Boost the Creativity

"Like when you said "Imagine this will be in 100 years" - I feel like that really changed how I thought about the activity." The ability to come up with crazy ideas and *"going as wild in terms of ideas, being able to go to extremes"* was appreciated by the workshop participants. However, they also mentioned, that constraints or interesting challenges would help to boost creativity, e.g. having to come up with ideas that can be realised with a budget of $100. Some participants also mentioned that it would have been nice to be provided with some inspiration about what other cities do in terms of cooling or placemaking, so an idea for the future is to include challenge and inspiration cards that can be drawn when people get stuck during the workshop.

»Right now, I feel like I'm being heard, but it will be the end product that will validate it. Like did you actually take into consideration what I said, or did you listen to me and just did whatever you wanted anyway?«

»Because I've written like a bunch of these trying to brainstorm, I think I would like the opportunity to say "I wrote all those ideas, but this is the most important thing for me."«

Workshop Provides Community with a Sense of Ownership, but the Council's Final Concept Will Show How Serious Community Opinions Were Taken

When being asked whether this workshop would provide them with a sense of ownership and the feeling of being able to bring in ideas, all workshop participants confirmed it would. However, some of them mentioned that only the end concept will really reveal whether the council took their ideas seriously or not. Some participants also mentioned wanting to have an opportunity to highlight certain ideas for the council that are particularly relevant to them. That's why it was decided to let everyone star their favourite two ideas at the end of the workshop so that the council can easily see which topics and ideas are most relevant to the community.

What's In It for Me? Provide Feedback on Ideas to Let Participants Go Home with the Feeling They Learned Something

"Like this session will be carried out by the City of Melbourne. So, well I am happy to do this because right now I don't have much to do. But let's just say I'm a very busy person you got to ask, like, what's in it for me?"

One question that was brought up in one of the community workshops was how to incentivise community members to participate in the workshop and this is something that needs to be considered in the future. In another community workshop, participants mentioned that they would appreciate feedback on their ideas to go home with the feeling that they also learned something new in the workshop in return for participating - this reflects the need for bilateral knowledge sharing that was also identified in the site visit trial workshop. Rather than only sharing their own knowledge by sharing their experiences and ideas, participants would also like to gain knowledge through their workshop participation.

»There could be a bit more education about what is actually effective cooling mechanisms and what other countries are doing. [...] And then I think it's also interesting because then the participants feel like they've learned something, too. So they've given something to the workshop and they've also come away with some new knowledge.«

Insights from the future experience trial workshops

- **The value & experience cards help to be creative and the community cards help with considering other people's perspective while still bringing in the participants' own needs and wishes**

Suggestions for future experience workshops in the future

- **Enhance creativity by including challenge cards with design constraints and inspiration cards with examples of what has been done in other cities**
- **Let everyone pick the two ideas that are most relevant for them at the end of the workshop to highlight those for the council**
- **Think about incentives for people to participate and provide them with a learning experience to enhance bilateral knowledge sharing**

Figure 71.
Workshop participants writing down ideas in future experience workshop

7.5 Concept Development Trial Workshop

After running test workshops for the site visit and future experience with the 3 different community groups, the results from these workshops were taken to the council to conduct the concept development workshop with them (Figure 72). The participating council employees were made familiar with Drewery Lane and were then shown the map with the summarized nuisances and delights identified in the community workshops. In addition, they were introduced to the ideas that the community members came up with in the desired future experience workshops. The first and most important part of the concept development focused on identifying suitable cooling interventions for Drewery Lane: the participants were provided with the cooling intervention cards and links to the booklet and the digital map and in groups of two had to select suitable interventions that can help with cooling Drewery Lane. The workshop activity sheets (Appendix M) prompted them to write down the selected interventions and to place the selected cards on the corresponding locations on a large, printed map. The following workshop activities focused on placemaking and wayfinding & walkability and prompted the council employees to come up with ideas that would help with improving current nuisances and enhance current delights while also considering the ideas that the community members proposed in the desired future experience workshop. As a last activity, the participants were provided with the evaluation activity sheet, where they had to tick off which community users their draft concept is catering for and which values & experiences their design incorporates. Given that the workshop time was limited, the concept development ended here, but with more time the evaluation sheet could have prompted some more changes and considerations for the developed draft concept. At the end of the workshop, the two groups presented their ideas to each other.

Output: Draft Concepts That Can be Further Detailed and Tested

The concept development workshop resulted in two draft concepts for a redesign of Drewery Lane with a focus on suitable cooling interventions but also with ideas for enhancing the placemaking and improving the wayfinding & walkability experience (Figure 73, see Appendix T and Appendix U for full size). These draft concepts can be further worked out and tested on feasibility before they can be shown to the community for feedback.

Figure 72. **Council employees participating in concept development workshop and developing draft concept (see above)**

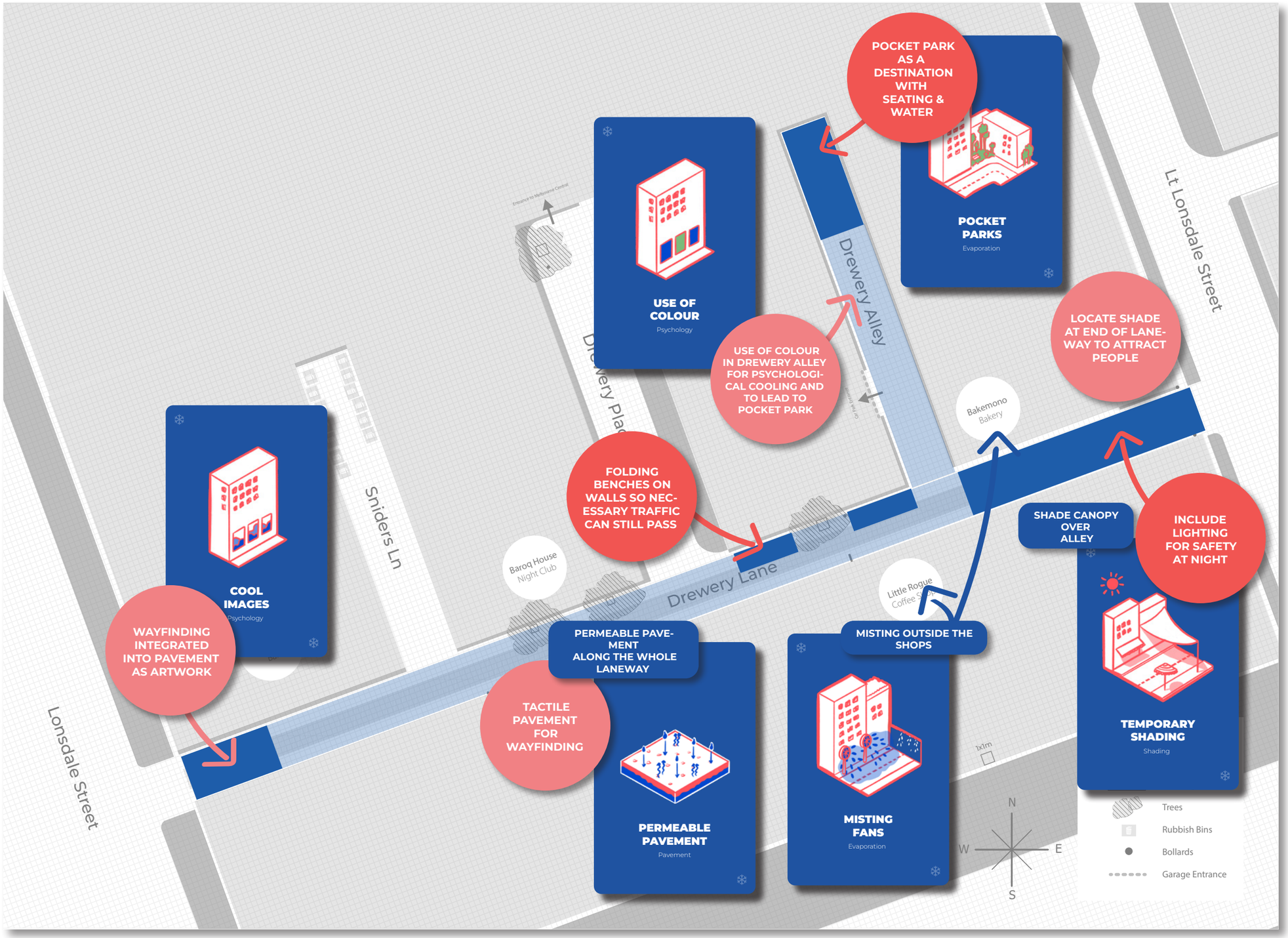


Figure 73. **Digital version of draft concept that was developed in the workshop (see Appendix T and Appendix U for full size)**

7.5.1 Insights and Learnings from Concept Development Trial Workshop

Smooth Interaction with the Cooling Cards But Limited Interaction with the Booklet and Digital Map

Overall, the workshop with the council members went well and it was great to see how they interacted with the workshop materials. It was interesting to see how the cooling intervention cards were used in both groups – the participants flicked through them and quickly organised the cards by their suitability for Drewery Lane. The pile with suitable interventions was then looked at more in detail before choosing a few interventions and arranging them on the map. One group also made use of the digital map to decide which roofs are most suitable for greening interventions. As the workshop time was very short due to everyone's availability, participants said they would have needed more time to properly read the cards. None of the participants scanned the cards to access the booklet which may have also been a result of the limited time.

Comparing Own Ideas to Ideas from Community Workshops

It was great to see how the participants interacted with the materials that were provided from the community workshops. They often kept looking at the nuisance and delights map (Figure 74) to check what can be improved and where and compared their own ideas to ideas that the community participants had, saying things like *"Look, this [intervention] is something that the residents wanted as well, so let's choose that"*. In the future, ideally, some of the planners and council employees would already be present in the community workshops first-hand, but it's great to see that even the digital maps with the community ideas support knowledge sharing and help the council to incorporate and consider those ideas. They were provided with 3 maps from the community workshops, in the future, it would be recommended to combine all maps into one to make it easier for the council to compare their ideas with the community ideas.

»I think it's super inclusive and transparent. And, you know, often when we're talking about places in the City of Melbourne, we don't have any visuals. We're just basing it on prior knowledge or experience. But this opens it all up and gets everyone on the same sort of knowledge base. It's tactile, so it makes it more engaging to have a conversation. It almost feels like we need to do more of this type of activity when we're talking about places.«

Toolkit is Engaging, Interactive and Tactile

Overall the toolkit and the workshop have been perceived very positively by the participating council members, who appreciated the toolkit's inclusivity and transparency and its tactile character. Using the cards and the simple images helps with visualising ideas quickly and moving them around on the map – something that the council would like to start using for other urban planning projects as well.

Figure 74. **Comparing the cooling interventions with future desired experiences of community**

Figure 75. **Filling in the workshop activity sheets with the selected cooling interventions**

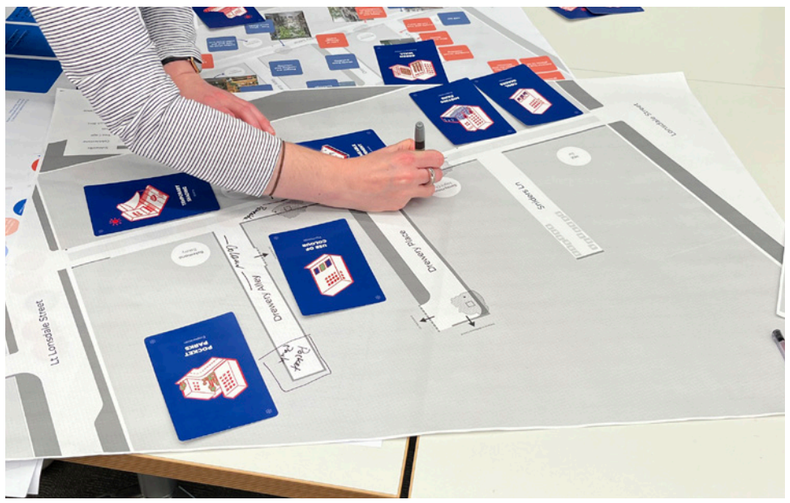


Figure 76. **Placing the cooling intervention cards on the map and adding notes**

Workshop Assets Are User Friendly and Help with Collating Feedback

"I just really love the cards, just the design and everything." The workshop assets, including the map, the workshop activity sheets, and the cooling intervention cards were all perceived as very user-friendly. One of the participants highlighted how the workshop activity sheets were very easy to use (Figure 75), due to the visual links between the activity sheets and the physical workshop assets. The last activity included the concept evaluation which was also appreciated to tick the boxes of what the groups already achieved with the first concept and what might still be missing.

»Yeah, having an evaluation of what you're trying to achieve. And even things like just the way that these *(points at workshop sheets)* **are designed for collating feedback and how you know, just the card that matches the activity sheet and the visual links and things, I think that's really good. It's very user friendly.«**

Workshop Helps Come Up With A Concept Base for Feasibility Testing Before Being Presented to the Community for Feedback

When asked what the council's and practitioners' next step would be with the workshop outcome, they responded that the next step would be feasibility testing to check more in detail if the suggested ideas would actually fit in the specific location and work within the given budget and policies. This would also be when they can check more in detail if the selected cooling interventions work within the space and have experts simulate the potential cooling impacts. Once the concept is more refined and tested for feasibility, they would then present it to the community to collect further feedback. "*I think we'll probably do a little bit of feasibility testing before we present it, because we wouldn't want to present anything that just wasn't possible to deliver or that wasn't appropriate for the space we chose or you know, was going to be too astronomically expensive or contravenes on the kind of policy*"

Figure 77. **Council employees comparing cooling interventions to community ideas**

Digital Version to Help Capture the Physical Workshop Output Could be Next Step

One topic that kept returning during the feedback session, was the possible digitalization of the whole toolkit. The council believes that it would be of big value if there was a digital tool that allowed to quickly summarize the workshop outcome in a digital way e.g. by allowing to drag and drop selected interventions on a digital map. This would help with communicating the workshop outcome with other planners, project managers etc.

»There's definitely a digital version of this to be made. because I think this is great, but then you kind of want it to lead to products that can be used for communication. If we tried to explain this to anyone outside of this, it would be hard for them to understand without something physical.«

The full transcript from the council feedback session after the concept development can be found in Appendix V.

Insights from the concept development test workshop

- **The concept development workshop helps with generating a first concept that can then be further detailed before being shown to community**
- **The workshop activity sheets work well in guiding the participants through the exercises, and particularly the evaluation sheet is appreciated**
- **The workshop participants used the maps with overview of community ideas to match their interventions to community wishes**
- **The workshop and toolkit are perceived as interactive, inclusive and user-friendly**

Suggestions for future concept development workshops

- **Give more time for exercises and to fully read the cards**
- **Test if more time enables the participants to use the booklet and digital map to learn more about their usability in the workshops**
- **A digital toolkit version could be developed to help with easily communicating the physical workshop results in a digital manner in the future**

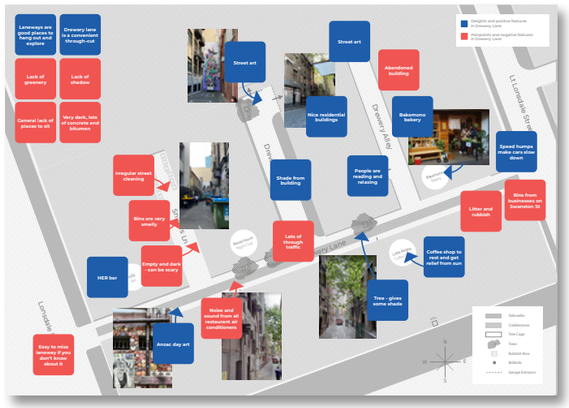
7.6 Case Study: Main Findings

Trialling the toolkit by running test workshops with community members and the council has been an interesting and insightful journey. By applying the suggested workshop structure and using the toolkit assets, draft design concepts could be developed for Drewery Lane that contain several cooling interventions and build up on knowledge gained in the community workshops (Figure 78). The draft concept does not only contain cooling interventions but also incorporates placemaking and wayfinding & walkability interventions to ensure that pedestrians are protected from the heat (e.g. through the suggested shade canopy and misting fans), but are also able to find and access the laneway and feel invited to spend time there (e.g. in the suggested pocket park in Drewery Alley).

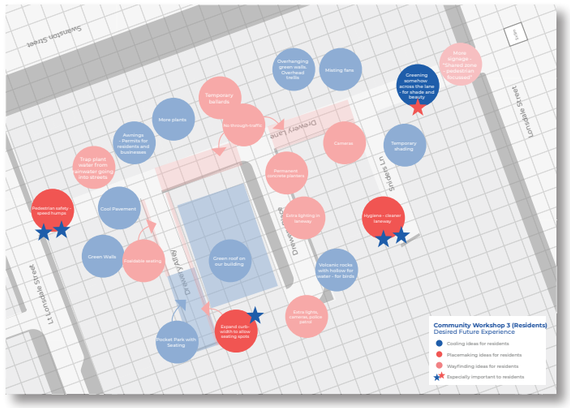
While the toolkit trial was targeted at Drewery Lane as the streetscape for intervention, the actual developed concept for Drewery Lane matters less than the insights about 1) the ability of the toolkit to engage stakeholder knowledge and 2) the usability of the toolkit and its assets.

Does the Developed Toolkit Enable the Engagement of Different Stakeholders in the Planning of Heat-Adapted Public Spaces and Support them in Sharing and Gaining Knowledge in the Process?

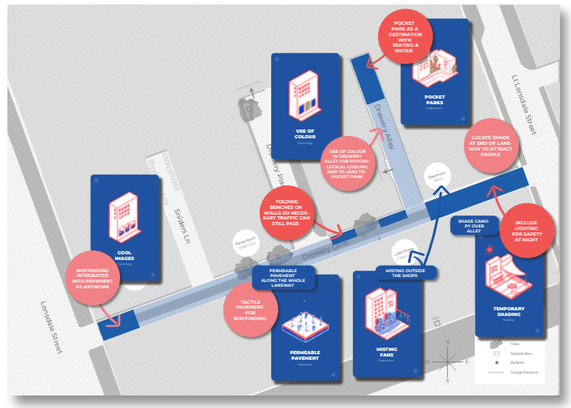
The case study showed that the toolkit can be successfully used to engage stakeholder knowledge in the development of new streetscapes, particularly during the site visit and future experience workshop where community members were able to share their experiential knowledge and bring in their ideas. Community participants expressed that they appreciate the opportunity to contribute to the design of places in their city and felt that depending on the final concept that the council will work out these workshops can provide them with a sense of ownership. However, the workshops also showed that the knowledge sharing should be bilateral as community participants expressed their wish to gain new knowledge in return for their workshop participation. Unfortunately, there was no opportunity yet to organise a combined workshop where all stakeholders work together and can share their knowledge with each other. However, it was good to see that the council actively used the maps with insights from the community workshops, when developing their draft streetscape concept. In the future, it should be tested how



Current Experience

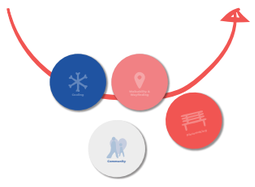


Future Desired Experience



Draft Streetscape Concept

Figure 78. **Process and results of the case study**



Experience-Focused Assets

Cooling-Focused Assets

all stakeholders interact with each other when working together and what kind of knowledge sharing that direct interaction can enable. An important learning was the realisation that more than one workshop facilitator is needed to capture relevant knowledge that is verbally expressed throughout the workshops.

How are the Workshop Participants Engaging with the Toolkit Assets? Do They Understand How to Use Them? What Do They Think About Them?

In each of the test workshops, the participants were provided with the relevant toolkit assets to guide them through the workshop activities and by carrying out the given tasks it showed that they understood how to use them. In the future experience workshops, participants expressed their appreciation for being provided with the value and experience cards and the fill-in-the-blank workshop activity sheet as it helped them come up with ideas and think about the streetscape redesign from different, previously not considered, topics and perspectives. They similarly appreciated the provision of the community cards, as they helped them consider different community member perspectives while still being able to bring in their own needs and wishes when coming up with ideas. Participants suggested to include challenge and inspiration cards that can be used as creativity boosters when people get stuck with their ideas.

In the concept development workshop, the council experienced the toolkit and its assets (including the map, the workshop activity sheets, and the cooling intervention cards) as user-friendly, engaging, interactive and tactile. They quickly sorted the cooling intervention cards into piles and made a selection of suitable interventions that they placed on the map. Due to the limited workshop time, the participants expressed not having enough time to reaad all the cards and didn't really make use of the accompanying booklet and the digital map - their usability should be further tested in the future. In addition to having the physical, tangible toolkit, the council expressed the wish to have an additional digital version, that helps to easily communicate the workshop results with other stakeholders.

Next Steps and Recommendations

While the trial showed that the toolkit supports the council in co-designing streetscapes for the cool pedestrian network by engaging different stakeholders and their knowledge, it also brought forward a few suggestions for improving the toolkit, such as including challenge and inspiration cards for the future experience workshop and potentially the development of a digital toolkit version that helps the council with easily communicating the concept development results. The next step for further testing the toolkit would be to detail and feasibility-test the draft concept and the included interventions, to then present the concept back to the community participants for feedback and to check if they feel that their ideas, needs and wishes were considered.

Insights from the case study

- **The toolkit successfully engages the knowledge of the different stakeholders in the process of developing cool pedestrian streetscapes**
- **The toolkit and its assets are perceived as user-friendly, engaging, interactive and tactile**

Main suggestions for the future

- **Include challenge and inspiration cards**
- **Consider the development of a digital toolkit that helps with visualizing the workshop results**
- **Detail and feasibility-test the draft concept and the included interventions,**

8 Discussion & Conclusion

8.1 Discussion

This project aimed to tackle both a climate adaptation and stakeholder engagement challenge as the assignment was to develop a toolkit that provides guidance in developing heat-adapted public places in Melbourne by engaging different stakeholders and their knowledge in the planning process.

Research Insights that Informed the Toolkit Design

The research and analysis phase focused on answering the sub-research questions to inform the toolkit design and help answer the overarching research question. Street observations and interviews with pedestrians and the city council helped to identify the need for more cool public outdoor spaces where pedestrians can walk, rest and spend time on a hot day while being protected from the heat. With that design opportunity in mind, research into the shortcomings of existing cooling toolkits that are often text-heavy documents targeted mostly at governments, policymakers and planning professionals motivated the aim of creating a tangible and interactive toolkit that is accessible to council and practitioners but also planning laypersons like citizens. As existing toolkits are mostly kept general or targeted at e.g. the tropical climate in Singapore, it also brought forward the council's desire to have a toolkit specifically targeted at Melbourne's climate. Desktop and literature research helped to identify the different general types of cooling interventions suitable for improving pedestrian thermal comfort and the strategies that are particularly suitable for Melbourne: evaporative cooling strategies are suitable for Melbourne's hot and dry summers and shading structures (artificial and vegetative) help to deal with the strong solar radiation and high UV levels in Melbourne. In addition, insights from placemaking research inspired the inclusion of placemaking, wayfinding, and walkability aspects into the toolkit to address the overall pedestrian experience beyond just cooling.

A Tangible, Engaging and Accessible Toolkit with Mix-and-Match, Evidence-Based (Cooling) Interventions

Insights gained throughout the research and analysis phase informed the refined design challenge of developing a Melbourne-specific, tangible toolkit with which the council can run workshops together with community members and design practitioners to engage their knowledge and co-design streetscapes together for a cool pedestrian network in the city. The resulting toolkit design criteria (Figure 79) guided the toolkit design process and are reflected in the final toolkit that includes a series of co-design workshops and a range of **cooling interventions** presented in the form of playing cards and an accompanying booklet. As the intention was to not limit people's creativity or bias their ideas, the final toolkit does not contain specific **placemaking and wayfinding &**

- The toolkit contains cooling, placemaking and wayfinding & walkability interventions
- The toolkit allows to mix and match interventions depending on space and typology
- The cooling interventions in the toolkit are focussed on passive cooling
- The cooling interventions in the toolkit are adjustable in scale and temporality
- The cooling interventions in the toolkit are targeted at Melbourne's climate conditions
- The cooling interventions in the toolkit are backed up by literature (evidence-based)
- The toolkit is tangible and more than just a text document
- The toolkit is a living toolkit that can be updated and new interventions can be added
- The toolkit is accessible for different people such as council, practitioners, and citizens
- The toolkit is usable within a workshop context

Figure 79. **Design criteria for the toolkit design as defined in "5.1 Vision, Design Challenge and Scope"**

walkability interventions, but instead contains cards with relating values and experiences that prompt people to come up with their own ideas. The toolkit playing cards allow for an easy **mix-and-match** process for any space, which also showed during the trial workshop in which council members quickly sorted the cooling cards into "suitable" and "unsuitable" for Drewery Lane and then moved them around on the map gameboard to find suitable arrangements and combinations. The cooling interventions in the toolkit are focussed on **passive cooling** - exceptions are "pavement watering", "water fountains" and "misting fans" that were still included as evaporative cooling was identified as a promising cooling method for Melbourne. The cooling interventions range in **scale and temporality** - e.g. "temporary shading" can be as small as an umbrella and can be removed and adjusted depending on weather or seasons, while "street orientation" is almost impossible to change and a more suitable strategy for newly built areas. In the future, it would be interesting to include each intervention's scalability and temporality and its ability to cool passively on the playing cards to support decision-making. All cooling interventions are **targeted at Melbourne's climate** by indicating each intervention's cooling capacity in Melbourne on the playing cards. This information is based on research into scientific simulations and experiments carried out in climates analogous to Melbourne and referred to in the accompanying booklet to provide **research-evidence** for each intervention. Through the gamification approach that inspired the creation of the gameboard-like-map and the physical playing cards, the toolkit is **tangible and interactive.** This has also been acknowledged and appreciated by the city council who stated that the tactility makes it more engaging to have a conversation. To achieve the characteristics of a **living toolkit**, empty cards have been included in the toolkit to enable workshop participants to actively shape the toolkit and its contents and add elements that might have previously been forgotten, not considered, etc. That the toolkit is **accessible for different users and usable within a workshop context,** has been proven throughout the different test workshops in which both planning experts (council and practitioners) and planning non-experts (citizens) interacted with the toolkit contents and expressed that they found them user-friendly and accessible and that they perceived the workshops as engaging and interactive.

Engaging Different Stakeholders in the Planning of Heat-Adapted Public Spaces and Supporting Them in Sharing and Gaining Knowledge

Besides fulfilling the design criteria, the final toolkit also provides an answer to the overarching research question that was: How can toolkitting enable the engagement of different stakeholders in the planning of heat-adapted public spaces and support them in sharing and gaining knowledge throughout the process? The toolkit shows how a co-design approach with a series of workshops can bring together relevant stakeholders (council, practitioners and citizens) to collaborate in developing a streetscape concept with a focus on cooling. The trial workshops showed that the toolkit supports the engagement of different types of knowledge: During the site visit, citizens shared information about their current behaviour and experiences in the streetscape and throughout the storytelling group exercise they shared their future desired experience and came up with ideas for a redesign of the selected streetscape. This generated knowledge was used by the council and design practitioners in the concept development workshop where they also engaged their own specific policy and planning knowledge to develop the draft concepts. The cooling assets served as another source of knowledge in the workshops as they informed the council and practitioners about suitable cooling interventions and their implications. Unfortunately, during the test workshops, no joint workshops with all stakeholders have taken place yet, so no direct knowledge was exchanged between the council and practitioners and the citizens. In the future it will be interesting to investigate what kind of knowledge exchange the direct interaction and collaboration can engage.

An Opportunity for Citizens to Be Heard and to Contribute to the Design of Their City

Throughout the toolkit trials, it showed that the suggested co-design process provides an opportunity for citizens to get involved with the design of their city. This was particularly appreciated by the residents of Drewery Lane who felt that it is usually very hard to get heard by the council and saw this workshop as a way to communicate their needs, wishes and ideas to the council. One of the residents has already been coming up with some ideas for greening Drewery Lane but felt that it was hard without any council support. He and the other residents expressed that the workshop activities helped them to look at the laneway redesign from new perspectives beyond just greening, which they had not previously considered. They appreciated that the workshop enabled them to learn from each other, e.g. from the business owner who also joined the workshop. This showed that the ability to contribute and exchange knowledge forms an integral part of the workshops for the citizens. This desire for knowledge exchange has also been expressed by the community workshop participants who said that they would like the workshops to be more educative, so that they feel like they learn something in return for their participation.

An Opportunity for the Council to Learn From the Citizens and Build Business Cases For Project Funding

During interviews in the research and analysis phase, the council pitied that current toolkits are too general and not targeted at Melbourne's climate. They appreciated that the new toolkit provides cooling interventions with literature directly referring to climates analogous to Melbourne and appreciated that the cooling intervention cards contain all the specialist

information in an accessible and user-friendly way. After the test concept development workshop, the council members stated that the engaging and interactive approach of the toolkit makes a big difference to their normal development process, in which no visuals are used and where everything is just based on prior knowledge and experience of the involved planners. The council expressed a genuine interest in co-designing with the community as they want to learn from the citizens and provide them with a sense of ownership in planning projects. The resulting community endorsement can help the council with building business cases for project funding. After the concept development workshop the council expressed interest in a digital version of the toolkit in order to easily visualize and communicate the workshop outcome. They envisioned that this digital toolkit could contain an overview of all cooling interventions that can be dragged and dropped onto a digital map. This is an interesting suggestion for the further development of the toolkit and could possibly be combined with an online database in which all cooling interventions and their information is included and managed. However, if a digital toolkit version is developed, it would be important to only design it as a communication and visualization tool and not as a replacement for the interactive in-person workshops with physical workshop assets.

Contribution of Integrated Product Design to Spatial Planning

Analysing existing cooling toolkits revealed that most of them are text-heavy documents, written in high-level language and targeted at planning experts like governments and policy makers. This project shows how designers can help to make the information contained in those toolkits more engaging and interactive by 1) translating complex information into easy-to-understand resources that are accessible to different stakeholders and 2) by applying co-design methods that help to engage relevant stakeholder knowledge in planning processes.

It also demonstrates how product designers can contribute to spatial planning processes by introducing tactile and engaging physical products into the otherwise abstract planning process. A city council employee stated that *"Often, when we're talking about places in the City of Melbourne, we don't have any visuals. We're just basing it on prior knowledge or experience. But this opens it all up and gets everyone on the same sort of knowledge base. It's tactile, so it makes it more engaging to have a conversation. It almost feels like we need to do more of this type of activity when we're talking about places."* This shows the impact that the introduction of this new toolkit and its gamified, tangible assets can have on existing planning processes - those related to heat-adaptation and climate resilience but also other spatial planning processes.

8.1.1 Limitations & Recommendations

Unlike other cooling toolkits that are often developed by a group of e.g. researchers, this toolkit has been developed by only one researcher and within the limiting graduation project time frame of 5 months. Therefore, not all aspects of the toolkit have yet been worked out and tested. When defining the scope of the toolkit development, it was decided to only focus on laneways for the time being to keep the toolkit realisation feasible. In the future it could be investigated how the toolkit could be scaled to include interventions for other street topologies. The suggested co-design workshop series includes the location selection as the first step in the process of developing streetscapes for a cool pedestrian network in Melbourne. While this is an important step and an opportunity to engage citizen knowledge through community consultations, also here the decision had to be made to skip that step and focus on the facilitation of the site visit, future experience and concept development workshops instead. How exactly the location selection could look like and what results it would deliver should be further tested in the future.

Further Refine and Test the Toolkit Through Co-Design Workshops with All Stakeholders

The toolkit trials with community members and council employees were a great way to test the refined toolkit design and validate the toolkit's applicability for co-designing cool streetscape concepts, however, this validation is only based on insights from a small number of workshop participants and from workshops where community members and council employees worked separately and not together. The main recommendation for the future development of the toolkit is to further test and refine the toolkit through co-design workshops in which all stakeholders (council, design practitioners and citizens) are present. Further test workshops would also be a good opportunity to develop and test the challenge and inspiration cards that participants suggested to include in the future experience workshop. Candace Jordan from the City of Melbourne, brought up the idea to test the toolkit within the newly set up City of Melbourne Heat Lab that wants to *"experiment on community-focused, place-based interventions to address severe heat impacts"* (Candace Jordan, personal communication).

Investigate How Resulting Streetscape Concepts Can be Evaluated in Terms of Their Cooling Capacity

When trialling the toolkit, not only the location selection had to be skipped but also the feedback session workshop in which it could have been tested if the developed concept represents the needs, wishes and ideas that the citizens expressed during the future experience workshop. This was because the council's draft concept from the concept development test

workshop would have needed to be further refined and feasibility-tested before being presented to the community for feedback. This brings up the question of how concepts developed with the toolkit can be feasibility-tested - specifically in regard to the feasibility of their cooling capacity. While the cooling intervention cards and the booklet contain information about the possible cooling impact of each intervention, this project has not yet explored how this general information can lead to more specific statements about each intervention's cooling capacity within a specific location and when being combined with other interventions. This project shortcoming could be turned into another research project that aims to identify how streetscape concepts developed with the toolkit can be evaluated in terms of their possible cooling capacity. This investigation could possibly be linked to the development of the digital toolkit version that the council suggested, to explore if this digital toolkit could also help with evaluating the cooling capacity of (draft) concepts.

Develop A Community-Led Toolkit Version

The last recommendation for the future development of the toolkit came forward from a conversation with Candace Jordan and the council's Green Laneway team. They suggested translating the toolkit that is currently focused on guiding the council in running co-design workshops, into a toolkit that enables citizens to run their own co-design workshops in which they can develop streetscape concepts that they can then use to apply for a greening permit (potentially a cooling and greening permit in the future) for their street. The development of this community-led toolkit version might also entail including a specific set of cooling intervention cards that are all implementable by the citizens without requiring council support or funding.

8.1.2 Conclusion

The developed toolkit suggests a new approach to developing heat-adapted public spaces. While existing cooling toolkits are mainly text-heavy documents targeted at governments, planners and policymakers, this new toolkit aims to engage both experts (such as the council and design practitioners) and non-experts (such as citizens) to collaboratively develop concepts for cool streetscapes in Melbourne. Through its gamified approach, the toolkit provides an interactive and engaging manner of exchanging knowledge – by 1) learning about citizens' current and future desired experiences within the streetscape, 2) engaging the council's policy and the design practitioners' planning knowledge and 3) by providing relevant yet easy-to-understand and accessible information about different cooling interventions. Unlike other cooling toolkits, this toolkit also addresses the overall pedestrian experience beyond just cooling. By prompting the consideration of different placemaking, wayfinding and walkability aspects it helps with developing a holistic street concept - this approach could also be adopted for other non-cooling-focused planning projects.

Main recommendations for the future are to 1) further test and refine the toolkit through co-design workshops in which all stakeholders are represented, 2) investigate how resulting streetscape concepts can be evaluated in terms of their cooling capacity and 3) consider the development of a community-led toolkit version.

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10 Appendices

Appendix A. **Original Brief**

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Kaiser 6355
initials: AK given name: Alina
student number: 5486157
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):
IDE master(s): ★ IPD ○ DfI ○ SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ○ Honours Programme Master
specialisation / annotation: ○ Medisign ○ Tech. in Sustainable Design ○ Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Dr. Carissa Champlin dept. / section: HCD / DCC
** mentor: MSc. Laurens Kolks dept. / section: HCD / DA
2nd mentor: Dr. Olivier Cotsaftis
organisation: Royal Melbourne Institute of Technology (RMIT)
city: Melbourne country: Australia
comments (optional): Olivier Cotsaftis will arrange a workspace for Alina at RMIT

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

TU Delft

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Dr. Carissa Champlin date 15 - 03 - 2023 signature Carissa Champlin Digitally signed by Carissa Champlin Date: 2023.03.15 20:54:47 +01'00'

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 30 EC
Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC
List of electives obtained before the third semester without approval of the BoE

★ YES all 1st year master courses passed
○ NO missing 1st year master courses are:

name Robin den Braber date 21 - 03 - 2023 signature Robin den Braber Digitaal ondertekend door Robin den Braber Datum: 2023.03.21 07:55:52 +01'00'

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ★ APPROVED ○ NOT APPROVED
Procedure: ★ APPROVED ○ NOT APPROVED
comments

name Monique von Morgen date 04 - 04 - 2023 signature

Public space design for heat-focused climate adaptation in Melbourne — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 23 - 02 - 2023 — 21 - 09 - 2023 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

Average temperatures are increasing worldwide and the amount of extreme weather events such as heatwaves, droughts, floods, storms and fires are increasing as a result of climate change (WMO, 2022). This can also be felt in Melbourne, Australia, where unusually hot days and heatwaves have increased since 1960. Between 1986-2005 Melbourne already experienced an average of 8 days per year with temperatures above 35°C and this number is projected to double by the 2050s (DELWP, 2019). In January 2022 Melbourne hit a record with 17 days above 30 degrees - the hottest of those days reaching 37.1°C (BOM, n.d.). In addition, the abundance of heat-storing concrete streets and buildings and the lack of green infrastructure cause the city to be much hotter than surrounding rural areas - a phenomenon known as the urban heat island effect (NIHHIS, n.d.). Human activities (e.g. use of polluting transportation modes and electricity consumption) can intensify the urban heat island effect (NSW Government, n.d.) particularly within highly populated and lively cities like Melbourne, with many people transiting through the city for work or leisure and to enjoy the great variety of shops, restaurants, bars, culture and sports events.

Extreme heat can lead to physical health issues and hospitalisations, increased violence within communities and even mental health issues due to inaccessibility of cool places and jobs being shut down (Myrivili, 2022). Research has also shown that mortality increases with temperatures above 28°C (Kjellstrom & Weaver, 2009). In fact, with the increase of hot days, the likelihood of heatwaves with unusually high day and nighttime temperatures for 3 or more consecutive days (BoM, n.d.) increases as well, and heatwaves are claimed to be more hazardous for humans than any other natural disasters (Nairn and Fawcett, 2014). Loughnan et al. (2010) identifies that age and socio-economic disadvantages correlate with a higher risk of hospital admissions during hot weather. Risk groups in Melbourne are people older than 65, children, people with disabilities and people that live in poverty with bad housing conditions that force them to go outside or people that experience homelessness (City of Melbourne, personal communication). These risk groups as well as regular citizens need to continue their daily life during the hot days while being protected from the dangers of the heat.

The City of Melbourne acknowledged the severity of heat-related issues by assigning their first ever Chief Heat Officers in 2022. They want to improve the city's climate resilience to better react and adapt to heat-related chronic stresses (urban heat island effect) and acute shocks (heatwaves). To get Melbourne and its citizens heat-ready the city already has several initiatives in place: a heat-health-alert activation plan, a heatwave and homelessness program, neighbourhood maps showing cooling infrastructure, greening projects to cool the city and a "cool routes" app showing the most shaded route through the city (Figure 2) (City of Melbourne, n.d.).
Besides the existing initiatives, the City of Melbourne wants to implement more public spaces in Melbourne that focus on heat relief and climate adaptation. The existing "cool routes" app presents an opportunity for further exploration as it seems it is currently not being used much and does not seem aligned with people's movement patterns through the city (Cotsaftis, personal communication) but contains information about Melbourne's hottest areas.

The primary stakeholders for this project are the City of Melbourne as municipality and decision maker as well as the end users such as the local citizens, communities and businesses as the beneficiaries of the design. Secondary stakeholders are the state government, financial partners and construction and facility maintenance partners.

space available for images / figures on next page

introduction (continued): space for images

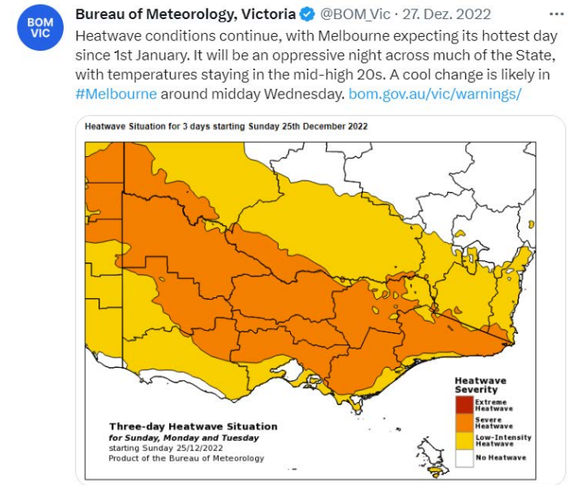


image / figure 1: Heatwave alert from December 27th, 2022 (Bureau of Meteorology, Victoria [@BOM_Vic], 2022)

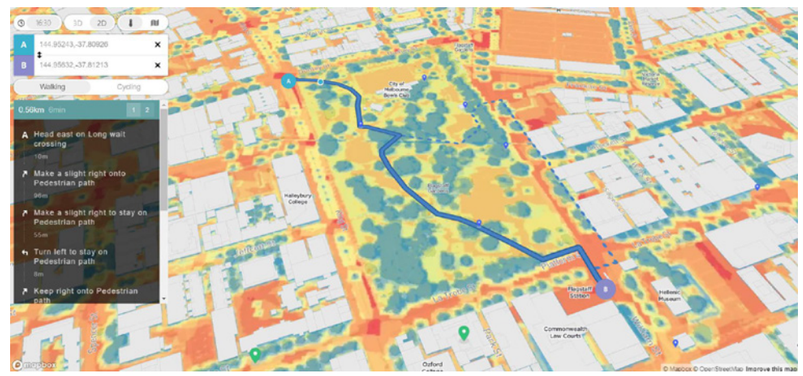


image / figure 2: Planning a walking route with the cool routes app (City of Melbourne Cool Routes, n.d.)

Personal Project Brief - IDE Master Graduation

TU Delft

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Hot summer days pose an increased health risk for Melbourne's citizens, yet most people are unaware or ignore the risks and continue their daily life. While the City of Melbourne already has some initiatives in place, they need to better prepare the city and its citizens for the heat by incorporating more public spaces that provide heat-relief for people in the city. The already existing "cool routes" app helps people to navigate through the city using the coolest route, but is suspected to not really be used at this moment. It can however be an interesting starting point for exploration.

The main research question to be explored during this project is: If climate adaptation protects people and places by making them less vulnerable to the impacts of climate change, how can public spaces improve city resilience and protect citizens from increasing average temperatures?

Subquestions to this overarching research question are: What features and elements do public places in the City of Melbourne need to protect citizens from increasing temperatures and to contribute towards city resilience? What passive and non-energy consuming cooling precedents for public spaces or infrastructures within public spaces are already being used in Australia and other hot-climate countries? Can the Cool Routes App be used to identify desirable locations for public spaces and increase the likelihood of these public places being used by citizens?

The research insights will be used to develop design guidelines for a toolkit that helps to design public spaces for climate adaptation with a focus on heat-relief. The toolkit and public space are to be designed for Melbourne and its specific climatic conditions with a focus on the heat-issue. However, to make the design suitable for all-year round use and to be desirable for the city to implement, other extreme weather situations should also be considered. Since the project focuses on climate resilience, a biophilic design approach will be used and elements with cooling purpose used within the public space should ideally be passive and non-energy consuming.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Develop a toolkit with design guidelines that help to design public spaces for climate adaptation with a focus on heat. Use the toolkit to design a public space within a chosen location in Melbourne to demonstrate its working and showcase how public spaces that improve city resilience and protect citizens from the heat can look like.

By the end of this project I expect to deliver a combination of a toolkit and an example of a public space design for a chosen location within Melbourne. The design guidelines within the toolkit will be based on the research that is conducted and that aims at identifying how public spaces can improve city resilience and protect citizens from increasing average temperatures.

The result should mainly be desirable and feasible but it also needs to be viable. A biophilic and nature-inspired design approach will be used and the focus will lie on using passive and non-energy consuming cooling methods within the public spaces to contribute towards the desired climate resilience.

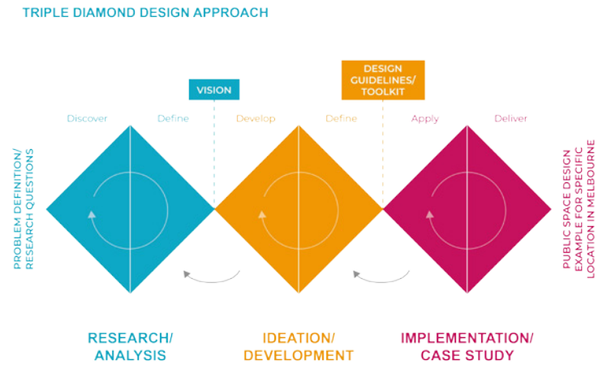
Personal Project Brief - IDE Master Graduation

TU Delft

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 23 - 2 - 2023 21 - 9 - 2023 end date



This project will be approached using an adapted double diamond design approach, that acknowledges that at least 3 converging/diverging phases will be needed. As a design process is hardly ever very linear, iterations within and between the phases will be natural. The detailed planning overview on the next page shows an overview of the expected activities per phase. During the research and analysis phase the initial problem definition will be approached by conducting research with the attempt to answer the posed research questions via a combination of literature and desktop research, field research via observations, questionnaires and/or interviews and a spatial analysis. This way the project context can be discovered and new insights can be gained that help answer the research question. All insights will then help to redefine the problem and to develop a project vision by the end of the research and analysis phase. During the following ideation and development phase the vision and research insights will be used to generate a broad variety of ideas for the toolkit and the elements that the toolkit should contain as well as their form, material and function. Those ideas can be discussed with experts and will then be defined into a final concept for the toolkit. The toolkit can then be tested during the implementation and case study phase, during which the toolkit can be applied to experiment with designing a public space at a chosen location. The design outcome can then be evaluated with expert or user interviews, based on which both the public space design concept as well as the toolkit can be adjusted before delivering the final project result which will consist of a toolkit, an example public space design and a virtual or physical prototype of the latter.

The majority of the project work will take place in Melbourne, where I will be working on the project 4 days a week to have one extra day for other work. I will return to Delft shortly before or after the green light meeting to finalize and present the project. Due to the summer holidays at TU Delft, I will pause the project for 4 weeks, before presenting the final outcome in September (the exact date will be confirmed closer to the graduation).

Important (preliminary) dates:

Kick Off Meeting	Thursday, February 23rd
Midterm Evaluation	Tuesday, April 25th
Green Light Meeting	Monday August 28th
Graduation	Thursday September 21st

Personal Project Brief - IDE Master Graduation

TU Delft

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

During my exchange semester at RMIT in Melbourne I joined the "Service Design" elective where we worked on a project for the City of Melbourne. Our service design proposals were targeted at how the municipality can get Melbourne heat ready and support risk groups during a heatwave. This is where I first became aware of the risk that heatwaves are posing for humans, the environment and also the economy. During my graduation project I would like to dive deeper into this topic and learn more about heatwaves and how cities can deal with them to become more climate-resilient. I find this particularly interesting as heatwaves are not only an issue in Australia but all around the world with the ongoing global warming. When addressing climate resilience I believe that my learnings from "Designing for Sustainable Systems", another RMIT elective, will also come in useful as that elective taught me how to map out and analyse systems in order to find leverage points.

I have always been interested in the intersection between product design and architecture, and working on a public spatial design is a great way to explore this direction. During my ACD project in the IPD masters I worked on a biophilic interior design concept to reduce stress for parents and nurses on the neonatal intensive care unit. During this project I became fascinated by the research that shows the positive effect that nature can have on the human health and well-being and how biophilic design is attempting to use nature aspects and patterns to integrate nature and its positive effects into a design. Therefore I am very interested in learning more about biophilic design during the concept phase of this project and explore if it can be implemented into the urban heat-relief infrastructure and how a biophilic design concept can contribute towards a more resilient Melbourne.

During the ACD project we also learned how to incorporate cultural aspects into a design project. This will also be of relevance when working on a public spatial design, particularly in a city like Melbourne where many groups of people with diverse cultural backgrounds are living. Therefore I would also like to use this project to learn about participatory design methods in order to involve different stakeholders and potential target groups in the development of the design.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name AK Kaiser 6355 Student number 5486157

Title of Project Public space design for heat-focused climate adaptation in Melbourne

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Appendix B. **Pedestrian Interview**

To get an understanding of how people experience hot summer days in Melbourne, pedestrians were asked to participate in short interviews conducted on the street on a hot day.

The following questions were asked after the participants gave verbal consent to anonymously participate in the study.

1. Have you been in Melbourne this summer during the very hot days above 30°C?
2. What do you think the risks are on a hot day?
3. How do the hot days affect your daily life? Where do you go on a hot day?
4. What is your choice of transportation on a hot day and why? (Public transport, walking, bike, private vehicle?) Does it differ from your usual choice of transportation?
5. On a scale from 1-10, how well do you think Melbourne as a city is prepared for very hot days above 30°C? What is still missing in the city in your idea to make the hot days more comfortable?
6. And last question, have you ever heard of the cool routes app from the City of Melbourne? Its like Google Maps, but it shows you the coolest routes through Melbourne on a hot day.

Appendix C. **Interview Consent Form**

Interviews about heat(waves) and public space interventions for heat adaptation in Melbourne

This research is conducted as part of the MSc study Integrated Product Design at the Technical University Delft.

Student: Alina Kaiser
Contact details: [redacted]
Project Title: A toolkit for co-designing heat-adapted pedestrian routes in Melbourne

Informed consent participant

I participated in research consisting of the following two research activities:

1. *Interview on April 14th, 2023: What is the council currently doing to adapt the city to the heat? What are opportunities to adapt public spaces for heat in the future?*
2. *Interview on June 15th, 2023: Feedback session for design direction and toolkit design ideas*

Prior to the interviews, I gave verbal consent to participate in the research and my participation was voluntary. I acknowledge that I received sufficient information and explanation about the research and that all my questions have been answered satisfactorily. I was given sufficient time to consent to my participation. I was able to ask questions for further clarification at any moment during the research.

Prior to the interviews, I verbally consented to data being collected during the interviews in the form of notes, photos and video and/or audio recordings. I was informed that the collected data will be processed and analysed and that photos and/or videos will be used for illustrating research findings in publications and presentations about the project.

I hereby give written permission for using research insights, quotes, photos and/or video recordings of my participation: *(select only the one that applies)*

- X in which I am recognisable (with my name and occupation being mentioned) in publications and presentations about the project.
- ☐ in which I am not recognisable in publications and presentations about the project.
- ☐ for data analysis only and not for publications and presentations about the project.

I give permission to store the data for a maximum of 5 years after completion of this research and using it for educational and research purposes.

I acknowledge that no financial compensation was and will be provided for my participation in this research.

With my signature, I acknowledge that I have read the provided information about the research and understand the nature of my participation. I understand that I was and am free to withdraw and stop participation in the research at any given time.

__Jordan_____	_____Candace_____
Last name	First name
_21 / _08/ 2023	[redacted]
Date (dd/mm/yyyy)	Signature

Appendix D. **A Heat Safe City Survey**

The City of Melbourne is currently running a project called “Heat Safe City - Participate Melbourne” in which they engage the community via surveys and in-person consultations to learn about their heat experiences in the city and to define “Heat Safe City Principles” based on the engagement insights. The insights from that survey with 135 Melburnian participants also reflect the findings from the observations and the pedestrian interviews in "3.2 Melbourne On A Hot Day" on page 22.

Most Melburnians Try to Stay Home on a Hot Day

More than 75% of participants indicated to stay indoors on a hot day, and almost half of the participants cancel plans to avoid exposure to hot spaces and 20% even change their work hours or commute (City of Melbourne, 2023)

Citizens Want More Trees, Cool Green Corridors and Shade in the City

When being asked about what cooling solutions the community would like to see more of in the city, trees were ranked highest on average, followed by “cool green corridors such as linear streetscapes of trees, vegetation, and water bodies” as second option and shade structures ranking third choice on average (Figure 18). When it comes to services and facilities, the community ranked parks and gardens as their highest priority, followed by cooling centres such as libraries and community hubs on second and pools on third place on average (Figure 19).

Confirmation of the Pedestrian Interview Insights

The answers in that survey confirm the insights from the pedestrian interviews, that the community would like to generally see more greenery and shade areas in the city and would like to have more publicly accessible cool places, like cooling corridors or cooling centres.

Insights Survey

- **People tend to stay home on a hot day**
- **There is a desire for more greenery, cool green corridors and shade in the city**
- **The community would like to see more parks and gardens and cooling centres**

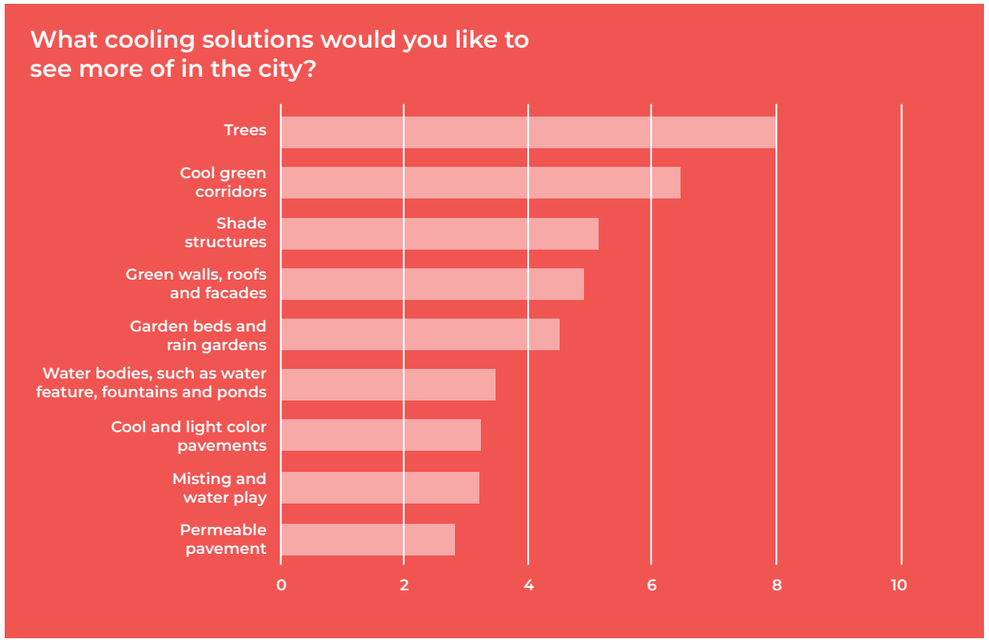
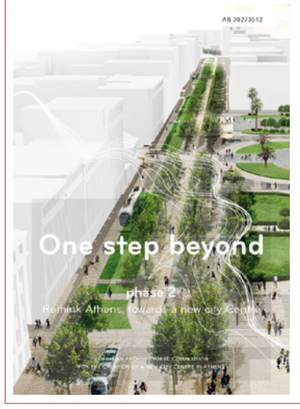


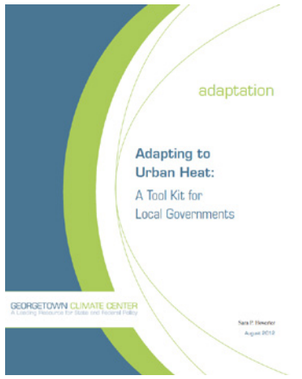
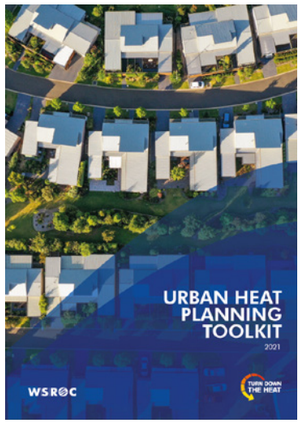
Figure 80. **Score from Ranking: What cooling solutions would you like to see more of in the city? n=130 (Data from City of Melbourne, 2023)**

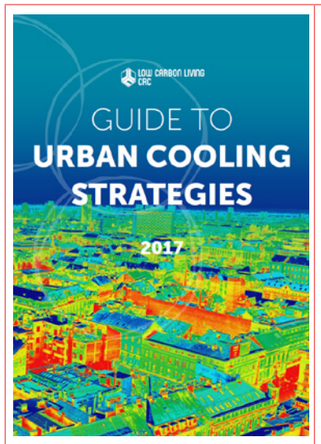
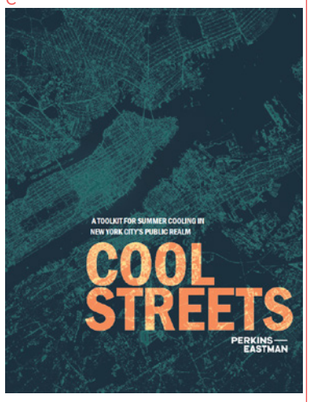
Figure 81. **Score from Ranking: What services and facilities could council offer to help you stay cool during hot days? n=128 (Data from City of Melbourne, 2023)**

Appendix E. **Cooling Toolkits Precedents**

To get an understanding of what already existing cooling toolkits look like, eight different toolkits were analysed to see their strengths and weeknesses and to get inspired for the to be developed toolkit for the City Of Melbourne.

Toolkit		Description	Audience	Suggested Strategies	Pros	Cons
	Beating the Heat: A sustainable Cooling Handbook For Cities (UNEP - UN Environment Programme, 2021)	A guideline book with background information about climate change, heat and resilience and with a guideline on how to achieve a city cooling action plan and with a framework for for prioritizing and organizing city interventions towards sustainable urban cooling.	Planners	→ Heat-resilient Urban Design and Infrastructure → District Cooling → Energy Efficient and Thermally Efficient Buildings → Community-centric Initiatives To Advance Heat-Equity And Access To Cooling	→ Contains a matrix to support strategic assessment of city interventions for sustainable urban cooling → Case studies from different cities and countries → Whole system approach	→ 208 pages → Very text heavy → Missing introduction on how to use this guidebook → Very high level language and content
	**One Step Beyond: Rethink Athens Toolkit** (OKRA, 2013)	A heat mitigation toolbox placed within a design proposal for redesigning Athen as part of a competition.	City of Athens	→ Blue Infrastructure → Green Infrastructure → Grey Infrastructure	→ Icons for different cooling elements, simple overview	→ Part of a concept, so not really worked out as independent self explanatory toolkit

	**Adapting to Urban Heat: A Tool Kit for Local Governments** Georgetown Climate Center (Hoverter, 2012)	Decision making framework for governments to decide which (combination) of the 4 suggested built-environment strategies works best for them. It provides two criteria to evaluate the suggested methods: outcome criteria (What is the impact on heat, economic, public health, and environment?) and governance criteria (Is this strategy within current legal authority or administrative capacity?)	Local Governments, Policy Makers	→ Cool Roofs → Green Roofs → Cool Pavements → Urban Forestry	→ Providing only 4 strategies keeps the choices easy to overview → Explains benefits and challenges per strategy → Providing many resources → Easy to understand tables with summary of outcome and governance criteria	→ Extremely text heavy, hardly any visuals → 92 pages → Not location or climate specific
	**Urban Heat Planning Toolkit** Western Sydney Regional Organisation of Councils (WSROC, 2021)	Toolkit that focuses on strategies that can be implemented in new development and redevelopment to reduce urban heat and adapt to hotter climate. The toolkit acknowledges that a resilience approach is needed as heat(waves) cannot be eliminated and adaptation is therefore needed.	Local Governments in Western Sydney	→ Energy efficiency → Rooftop PV → Transport & Waste → Orientation → Cool Roofs → Cool Paving → Green Cover → Evapotranspiration → Building Materials → Passive design → Heat Rejection → Sky View Factor → Canopy Cover → Shade → Irrigation → Evaporative Cooling → Rainwater harvesting	→ Focused on Western Sydney specifically → Use of visuals that increase interest → Explains Urban Heat Resilience Framework → Matrix that shows which design strategies correspond to Heat Resilience Framework → Table with cooling capacity for different design strategies → Comprehensive summary of design strategies per framework type	→ 92 pages → Doesn't feel very concrete and actionable
	Strategies for Cooling Singapore Cooling Singapore 2017 (Ruefenacht et al., 2017)	A catalogue of 80+ measures to mitigate urban heat island and improve outdoor thermal comfort. Review of potential measures to tackle the UHI with a focus on humid tropical cities like Singapore. The aim is to translate existing scientific data into actionable knowledge.	Policymakers	86 strategies in 7 clusters → vegetation → urban geometry → water features and bodies → materials and surfaces → shading → transport → energy	→ Climate specific for Singapore → Easy to understand language → Small illustration with every strategy to show what it looks like → Describes impact of strategy on UHI and OTC, applicability in tropical area, integration in urban planning and research status	→ Too many strategies to be actionable? → 185 pages

	**Guide to Urban Cooling Strategies** Low Carbon Living CRC (Osmond & Sharifi, 2017)	Practical guidance for built environment professionals and regulatory agencies that want to moderate urban microclimates and mitigate the urban heat island effects. The guide focusses on different climate zones, cities and urban topologies within Australia.	Built Environment Professionals and Regulatory Agencies	→ Cool surfaces (Cool paving, High albedo paving, High emissivity paving, Permeable paving, Cool building envelopes, High albedo roof surfaces) → Urban vegetation (Street trees, Natural turfs and grass cover, Parks, Green roofs, Green walls) → Evaporative cooling (Surface/ running water, Misting fans) → Shading (Shading structures, Temporary shading)	→ Focussed on different climates within Australia → Identifies both active and passive design strategies → Comprehensive explanation of the UHI → Summary of common technologies per topic including an overview of impact and issues → Overview of cooling capacity of different strategies → Matrix that shows effectiveness of strategy depending on urban context and climate zone	→ Not directly actionable assets
c 	**Cool Streets - A Toolkit for Summer Cooling in New York City's Public Realm** (Fischer & Perkins Eastman, 2018)	A toolkit for New York, that is supposed to help communities and local governments to create potentially life-saving cooling outdoor spaces. The toolkit contains a system to identify priority locations for intervention and a suite of cooling strategies and tools. The toolkit aims to provide cooling strategies with people in mind.	Communities and Local Governments	→ Paving technology → Building Massing and Design → Shade → Evaporation → Psychology → Energy-Driven-Systems → Information Sources → Placemaking Strategies	→ Interesting Matrix with Cooling Strategies and Placemaking Strategies mapped according to their effectiveness and with information regarding cost price → Design strategy: connect cooling assets with "attractors" (placemaking strategies) that encourage people to come and spend time in the place → Illustrations show a range of interventions per strategy → Case Study at chosen location: minor, medium and major intervention	→ Location Selection Toolkit could be more specific and provide a checklist
	Urban Cooling Toolbox (C40 Cities & Ramboll, 2021)	A toolbox developed by C40 Cities and Ramboll to present cooling strategies to municipalities, designers, planners, administrators, and users to help them with creating liveable cities and resilient communities.	Municipalities, Designers, Planners, Administrators, and Users	→ Green infrastructure → Blue infrastructure → Grey infrastructure → Communication and outreach → Policy → Urban development	→ Reader manual → Easy to understand cards per tool → Simple language → Icons indicating the co-benefits → Links to examples per tool/strategy	→ No information about efficiency → Not focused on specific climate or location

Appendix F. **Factors Impacting Thermal Comfort**

In "4.2.2 Outdoor Thermal Comfort" the different human-based and environment-based factors (Figure 82) that impact the outdoor thermal comfort (OTC) of people are introduced. Below each of the factors is explained more in-depth.

Climatic and Meteorological Conditions
Climatic and meteorological conditions include 1) meteorological parameters such as air temperature, wind velocity, relative humidity, and solar radiation as well as 2) land characteristics of the locations such as topography, altitude, latitude, longitude and surface coverage (Aghamolaei et al., 2022). According to Lai et al. (2020), several studies find that solar radiation has the highest impact on outdoor thermal comfort among the meteorological parameters, while a few studies in a temperate climate (which Melbourne also classifies as) find that wind has a greater influence than radiation.

Physical Characteristics
Physical characteristics include 1) morphology and geometry (building layouts, orientation, street canyon aspect ratios), 2) the existence of green and blue infrastructure to achieve cooling through evaporation, evapotranspiration, and shading and 3) material properties such as the albedo coefficient and heat-storage capacity (Aghamolaei et al., 2022).

Individual Parameters
Age, metabolic rate, individual clothing insulation and especially gender can play a big role in how thermal comfort is experienced from a physiological point of view. Besides these physiological parameters, psychology also plays a role in how thermal comfort is perceived: The most discussed psychological parameters that impact outdoor thermal comfort are experience, expectation and perceived control. People's past experiences affect how they perceive outdoor thermal environments and past experiences can also impact their expectations. If people expect it to be hot due to their past experience, their discomfort is lower in the heat. People also feel less discomfort, if they have a degree of control or autonomy over the source of discomfort (Nikolopoulou & Steemers, 2003).

Social Parameters
Social parameters that play a role in experiencing outdoor thermal comfort are social, economic and cultural aspects that all influence how people perceive the OTC. Aljawabra & Nikolopoulou, (2011) found culture influences what people use outdoor spaces for and how often and found that people with better socio-economic circumstances are more sensitive to environmental conditions and that this may be related to their financial situation that allows them to spend more time indoors in air-conditioned spaces.

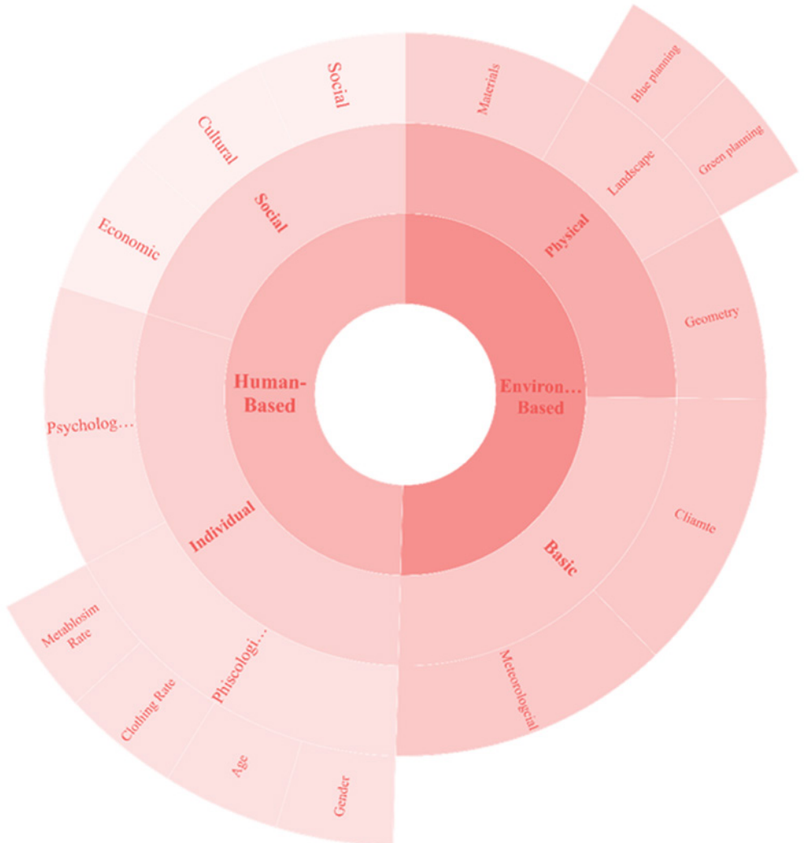
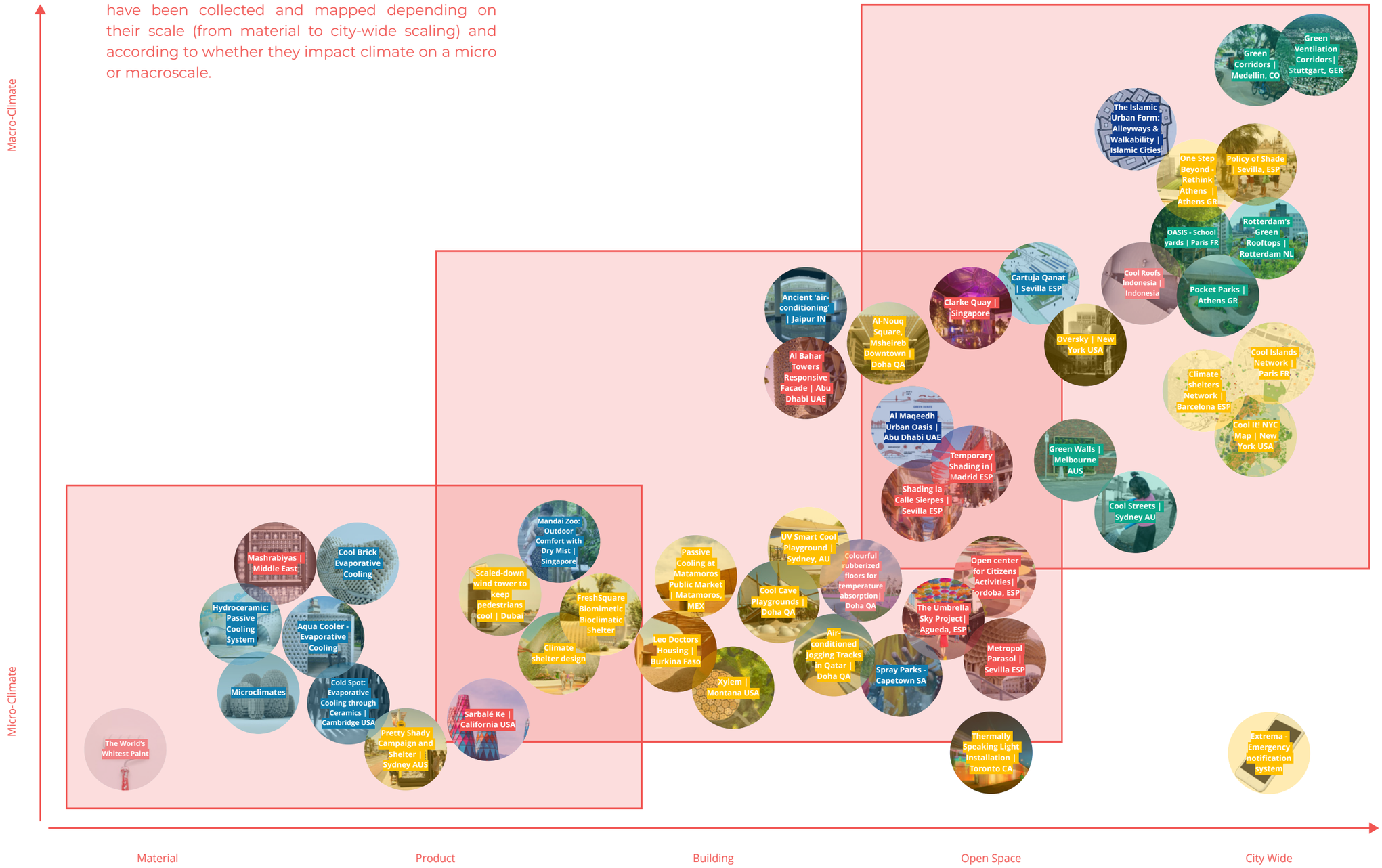


Figure 82. **Factors affecting outdoor thermal comfort in urban environments (Aghamolaei et al. 2022)**

Appendix G. **Cooling Precedents Mapping**

Different precedents for a variety of cooling strategies have been collected and mapped depending on their scale (from material to city-wide scaling) and according to whether they impact climate on a micro or macroscale.



Appendix H. **Design Excellence Principles for Melbourne's Streets**

The page below shows the overarching design principles for the streets in the City of Melbourne. These principles can be found on page 34 and 35 in the draft version of the "Future Streets Framework 2030 And Beyond" (2023) that aims at guiding the design and delivery of streets in Melbourne's hoddle grid.

DESIGN EXCELLENCE PRINCIPLES FOR STREETS

An overarching set of principles are fundamental to high quality street design. These principles contribute to the ongoing economic, social and environmental success of the central city.

Image 23: Sandridge Bridge

Image 24: Exhibition Street

Image 25: Bourke Street

Image 26: Swanston Street

Image 27: Chinatown

Image 28: Princess Theatre Forecourt

Inclusive

Streets in the Hoddle Grid should:

- Foreground designing with Country in collaboration with Traditional Owners.
- Recognise, promote and celebrate the layers of history and the mix of cultures and stories.
- Cater to a spectrum of user requirements through integrated universal design.
- Provide diverse spaces for everyone to enjoy and occupy.
- Maximise opportunities for community agency and expression.
- Support presence and participation of women and gender diverse people in public spaces.
- Integrate commemorative justice for Aboriginal and intersectional communities.

Safe

Streets in the Hoddle Grid should:

- Support low speed environments through speed limit reductions and traffic calming measures.
- Provide well-lit environments and complement 24/7 land uses to improve perceived safety.
- Reduce physical obstacles, declutter footpaths and remove barriers to access.
- Rationalise signage to reduce visual clutter and improve navigation.
- Provide surfaces and transitions that are safe and comfortable for small wheel sizes.

Comfortable

Streets in the Hoddle Grid should:

- Provide comfortable journeys for pedestrians by minimising congestion, clutter and pinchpoints.
- Maximise convenient mid-block crossing points to support walkability and permeability.
- Provide pedestrian amenity, including convenient provision of bins, seating, drinking fountains and shade.
- Support intuitive navigation and wayfinding.

Healthy

Streets in the Hoddle Grid should:

- Integrate sustainable water management interventions.
- Contribute to urban cooling through improved tree canopy cover and increased planting.
- Consider a range of green infrastructure options suitable for the site to positively contribute to urban forest and the water cycle.
- Support biodiversity through vegetation and bio-links.
- Support residential communities and worker populations through provision of high quality open spaces, including integration of recreational and playful elements.

Optimised

Streets in the Hoddle Grid should:

- Serve a variety of functions at different times of the day and enable regular or intermittent closures.
- Prepare and futureproof street space to address emerging projects and anticipated changes.
- Provide flexible space to facilitate special events, parades, festivals and demonstrations.
- Support 24/7 land uses and nighttime activation.
- Provide flexible kerbside space to support loading and servicing needs, and street activities.
- Allow for integration of emerging technologies and low carbon materials.
- Integrate wayfinding hubs to reduce the amount of signage.

Uniquely Melbourne

Streets in the Hoddle Grid should:

- Showcase renowned destinations and complement heritage character through sensitive interfaces and materials, and maximising space for people at frontages.
- Maintain and reinforce key views and vistas to landmarks and landscape features.
- Nurture the character of existing places to provide a range of experiences.
- Explore options for integrating public art and street art.
- Respond to history, memory and identity by engaging with local communities' needs and wants.

Appendix I. **Melbourne Street Types Overview**

The page below shows an overview and description of the different street topologies in Melbourne's hoddle grid as presented on page 32 and 33 in the draft version of the "Future Streets Framework 2030 And Beyond" (2023).

STREET TYPES OVERVIEW

The Hoddle Grid is comprised of distinct street types, all with significant place functions.

	STREET TYPE	DESCRIPTION
	Melbourne Square	Melbourne Squares serve as gateways to the city, centered around transport interchanges and prominent civic destinations. They are typically intense and lively places at all times of the day and must support high pedestrian flows. These streets provide a strong sense of arrival, while serving a multitude of functions for residents, workers and visitors alike. These streets showcase Melbourne's unique character, in particular Melbourne's iconic tram network, prominent heritage buildings and connections to popular retail and dining precincts. A significant amount of change is anticipated to occur in Melbourne Squares over the coming years in response to the Melbourne Metro Tunnel Project and tram stop upgrades.
	City Street • With trams • With buses • With bikes	City Streets are critical movement corridors. They are often experienced in their entirety, moving north-south or east–west from the periphery of the city. These streets must support multiple transport modes and high place functions. While all City Streets have a strong movement function, the varied transport they support and adjacent land uses create a variety of conditions. There are three distinct city street sub-types within the grid each prioritising different modes: trams, buses and bicycles.
	Little street	Melbourne's little streets are significant places that support small businesses and other fine grain uses. While they do not have a high movement role, they provide crucial servicing and loading to support residents, commerce and trading. Little streets are distinctive in character and activity. Some little streets form part of cultural, dining and retail precincts including Chinatown on Little Bourke Street and Flinders Lane. These streets are popular destinations; facilitating high volumes of pedestrians and accommodating outdoor dining. Little streets have considerable capacity for renewal due to no public transport infrastructure and low volumes of through-traffic. The Transport Strategy 2030, identifies little streets as optimal locations for the shared movement of people.
	Laneway	One of the defining characteristics of Melbourne is the intricate and diverse network of laneways. Many laneways are celebrated for their important place function, comprising of fine grain uses, street activities, outdoor dining, greening and public art, enabled within a pedestrian-friendly environment. Many laneways also provide a combination of service and loading functions to support businesses, which can sometimes operate at specific times of the day to balance both movement and place needs. The inherent eccentricity of laneways mean there is no one-size-fits-all approach to the design and upgrade of laneways.
	Primary traffic through route	Managed by Department of Transport and Planning (DTP), key streets have been identified to serve important connections to surrounding neighbourhoods and municipalities. These routes will continue to serve a critical role for vehicle through movement.

Figure 22: Street types

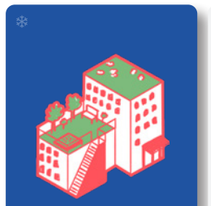
Key

- Melbourne Square
- City Street with trams
- City Street with buses
- City Street with bikes
- Little street
- Laneway
- Station hub
- Primary traffic through route

Note:

- Dotted lines indicate arterial roads managed by Department of Transport and Planning.
- In addition to King Street and Victoria Street, it is proposed that through vehicle access will be maintained on Lonsdale, Queen, Russell, La Trobe and Exhibition Streets.
- The street types are a general categorisation of streets with similar design principles. Each street segment is subject to further analysis of contextual circumstances, traffic assessment, feasibility studies and modal priority anomalies to inform detailed street design.
- Some streets may shift street types from day to night.

Appendix J. **Cooling Intervention Cards**



GREEN ROOF
Building Envelope

Street Square | Laneway Crossing | ❄❄❄

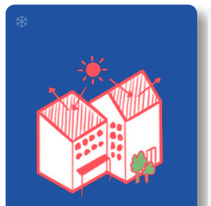
GREEN ROOF

Green Roofs insulate buildings and thereby reduce cooling and heating energy demands. They cool their surroundings by evapotranspiration and improve pedestrian thermal comfort. Extensive green roofs are easier to maintain, but intensive green roofs can be accessed as rooftop gardens.

> To impact pedestrian comfort, install green roofs on buildings lower than 10m

> Use the map to check that the roof is suitable for green roof usage

> Use an intensive green roof system if you want to offer recreational access and an extensive green roof for easier maintenance



COOL ROOF
Building Envelope

Street Square | Laneway Crossing | ❄❄❄

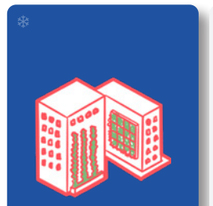
COOL ROOF

Cool Roofs make use of highly reflective roof materials or coatings, often white or light-coloured, that can radiate up to 75% of visible light and infrared radiation away from the roof. Cool roofs are less insulating than green roofs but can also reduce cooling energy demand and improve pedestrian thermal comfort.

> Install on buildings lower than 15m to impact pedestrian comfort

> Use the map to check that the roof area is suitable for cool roof usage

> Make sure that cool roofs don't reflect sunlight onto surrounding buildings and avoid glare



GREEN WALL
Building Envelope

Street Square | Laneway Crossing | ❄❄❄

GREEN WALL

Vertical greening systems insulate buildings by shading their walls, thereby increasing indoor thermal comfort, and reducing cooling energy demands. Cooling through plant foliage and evaporation leads to improved pedestrian thermal comfort.

> Place green walls within 3m from ground level to have most impact on pedestrian thermal comfort

> Place green walls facing south for the biggest cooling impact

> Use the map to check if the laneway is suitable for vertical gardens

COOL PAVEMENT
Pavement

Street Square | Laneway Crossing | ❄❄❄

COOL PAVEMENT

Cool pavements have a higher reflectivity and higher emissivity than conventional paving materials that heat up a lot during summer. Due to their reflectivity, cool pavements absorb less solar energy and the high emissivity leads to the stored heat being released quicker.

> Install in open places with few obstacles so that the heat and light are directly reflected into the sky and not reflected onto other buildings

> Choose a coating for a temporary retrofit of existing pavement and cool pavement material for new construction and longer cool pavement surface life

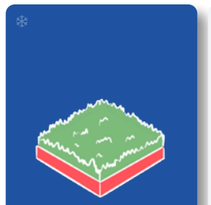
PERMEABLE PAVEMENT
Pavement

Street Square | Laneway Crossing | ❄❄❄

PERMEABLE PAVEMENT

Permeable pavement materials allow stormwater drainage through its pervious or porous structure. The stormwater can be stored in the soil underneath and when it evaporates again it will cool the pavement and its surroundings on a hot day. Porous asphalt, pervious concrete, block pavers or vegetated pavement are different options for permeable pavement.

> Install in low-traffic areas such as sidewalks, driveways and parking lots



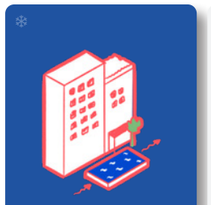
GRASS COVER
Pavement

Street Square | Laneway Crossing | ❄❄❄

GRASS COVER

Grass cover can reduce surrounding air and mean radiant air temperatures. On a hot day, it has up to 20°C cooler surface temperature than conventional paving material such as asphalt or concrete and is providing a much better thermally comfortable surface for pedestrians.

> Install in areas without through-traffic and low serviceability, e.g. in a park or a laneway that doesn't have bins and driveways



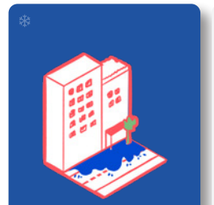
SMALL POND
Evaporation

Street Square | Laneway Crossing | ❄❄❄

SMALL POND

Small ponds installed on street level or on roofs can reduce the air temperature and improve pedestrian thermal comfort. Water has a much higher thermal capacity than urban materials like concrete and asphalt and therefore stays much cooler in summer. In dry and hot climates like Melbourne, the cool surface water can use the surrounding ambient heat to change from its liquid state to water vapour, which cools the surroundings via evaporation.

> Install ponds in the direction of the prevailing winds for the biggest cooling impact, North-South direction in Melbourne



PAVEMENT WATERING
Evaporation

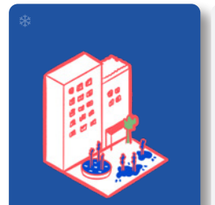
Street Square | Laneway Crossing | ❄❄❄

PAVEMENT WATERING

Cooling through pavement watering can be achieved by wetting street areas to cool the pavement and surrounding air by evaporation. This can be applied on both permeable and non-permeable surfaces and leads to an improvement in pedestrian thermal comfort.

> Reuse stormwater for pavement watering and apply water sensitive urban design principles

> Combine pavement watering with shading solutions to achieve the highest cooling effect



WATER FOUNTAINS
Evaporation

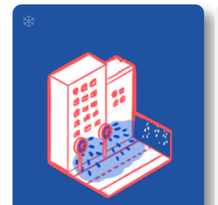
Street Square | Laneway Crossing | ❄❄❄

WATER FOUNTAINS

Due to their evaporative effect, fountains can have a strong effect on air temperatures, particularly on the leeward side. However, fountains do not reduce radiative temperatures and don't impact pedestrian thermal comfort. When they are used for water play they can however provide a refreshing experience for pedestrians and provide additional cooling through pavement wetting.

> Apply water sensitive urban design principles when installing fountains

> Install fountains on ground surface for water play and pavement watering



MISTING FANS
Evaporation

Street Square | Laneway Crossing | ❄❄❄

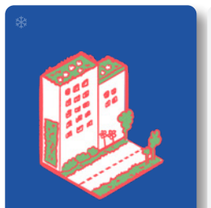
MISTING FANS

Misting fans produce clouds of very fine water droplets that help to cool down the air temperature as the water droplets absorb the ambient heat to vaporise. The high pressure and very small size of the water droplets lead to a cool and dry feeling on people's skin.

> Install 2.4-3m above ground level

> Install within 5 meters ground distance of the area to be cooled

> Apply water sensitive urban design principles when installing misting fans



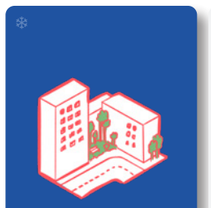
MIX OF VEGETATION
Evaporation

Street Square | Laneway Crossing | ❄❄❄

MIX OF VEGETATION

Installing different types of vegetation such as grass, flowers, shrubs and trees positively effects the climatic conditions. Due to their additional shading effect, trees have the biggest impact on pedestrian thermal comfort, but grass and shrubs have a better effect on reducing surface temperatures. In Melbourne, increasing vegetation has a particularly positive effect on night-time temperatures.

> Use the urban nature planting guide to select the right type of vegetation depending on growing conditions, desired plant characteristics and desired biodiversity benefits



POCKET PARKS
Evaporation

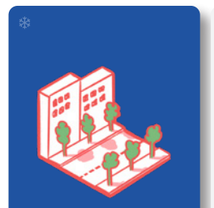
Street Square | Laneway Crossing | ❄❄❄

POCKET PARKS

Pocket parks are small parks installed in dense urban neighbourhoods, thereby providing more liveable and comfortable urban areas and providing citizens with the advantage of living in proximity to green areas. Even very small parks with less than 400m² in size can reduce air temperatures in the park but also in the neighbourhood.

> Use the map to check if the laneway is suitable to be turned into a park lane

> Place pocket parks at distances of 200m from each other for a cooling effect connection between them



STREET TREES
Shading & Evaporation

Street Square | Laneway Crossing | ❄❄❄

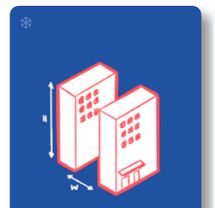
STREET TREES

Trees block most solar radiation - only transmitting about 20% through their canopy - and cool their surroundings through means of shading and evapotranspiration, impacting temperatures on both the street and city-wide level. Trees greatly impact the mean radiant temperature and significantly improve pedestrian thermal comfort.

> Use deciduous trees to provide shade in summer and sunlight in winter

> Prioritise planting trees in E-W streets with low H/W ratio for biggest cooling impact

> Check on map if laneway is suitable to be turned into a forest lane



ASPECT RATIO
Geometry

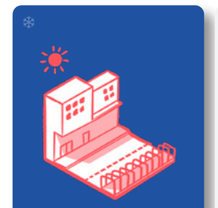
Street Square | Laneway Crossing | ❄❄❄

TEMPORARY SHADING

Temporary shades are non-permanent , moveable or extractable shading structures such as awnings, umbrellas or shade sails that can be applied based on the climatic needs, e.g only during the summer when shading is needed. Temporary shading can reflect up to 98% of solar radiation.

> Use temporary shading in areas where you want to block sun in summer but benefit from it in winter

> Install at a higher elevation to shade an entire street canyon



PERMANENT SHADING
Shading

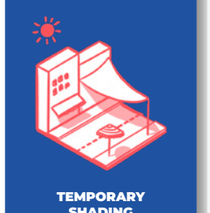
Street Square | Laneway Crossing | ❄❄❄

PERMANENT SHADING

Permanent shading structures include urban pergolas, shade sails, framed canopies, shelters, or even solar cells. They are often not adjustable and fixed in their position, but are great options as continuous weather protections, not only from sun but also rain.

> When placed in a laneway, install shading structure at 3.5 to 5 m in height and do not cover more than 1/3 of the width of the laneway

> Make sure that the position of the structure blocks sun in summer lets it transmit in winter



TEMPORARY SHADING
Shading

Street Square | Laneway Crossing | ❄❄❄

ASPECT RATIO

The H/W ratio describes the aspect ratio between an urban canyon's height and width and thereby defines how deep or shallow a street is. Changing the H/W ratio is an effective cooling strategy, as high aspect ratios help to reduce mean radiant temperatures and result in increased pedestrian thermal comfort during the day. Deep canyons however experience higher night-time temperatures due to heat being trapped between buildings.

> Increase the H/W ratio in streets where you want to reduce daytime temperatures and decrease the H/W ratio in streets where you want to reduce night-time temperatures

STREET ORIENTATION
Geometry

Street Square | Laneway Crossing | ❄❄❄

STREET ORIENTATION

Street orientation is an important parameter relating to solar access and windspeeds and therefore relevant for passive cooling. E-W streets experience more solar exposure than N-S streets throughout the day and provide lower pedestrian comfort. In N-S streets there is higher human thermal stress on the east sidewalk in the morning and higher thermal stress on the west sidewalk in the afternoon.

> Provide more shading in E-W streets to reduce solar exposure

> In N-S streets analyse at what time of the day pedestrian use is the highest and provide shade on east side in the morning and west side in the afternoon

COOL IMAGES
Psychology

Street Square | Laneway Crossing | ❄❄❄

COOL IMAGES

Temperature can be contagious – that means that our own body temperature can be influenced by the people around us and how hot or cold we think they feel. Using images that display something cold or an interaction with the latter can therefore influence body temperature and human thermal comfort and make us feel colder on a hot day.

> Install cooling images or art installations that create a sense of coolness

USE OF COLOUR
Psychology

Street Square | Laneway Crossing | ❄❄❄

USE OF COLOUR

The use of specific colours can influence people's thermal comfort experience. Warm colours like yellow and red can be used in cold environments to increase people's thermal sensation and cool colours like green and blue can be used in a warm environment to decrease people's thermal sensation and improve their thermal comfort on a hot day.

> Use cool colours such as green and blue to improve pedestrian thermal comfort on a hot day

NAME:
Type:

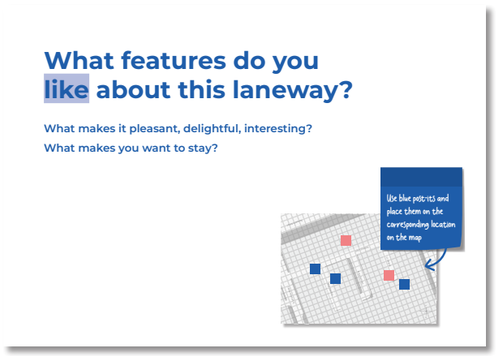
Street Square | Laneway Crossing | ❄❄❄

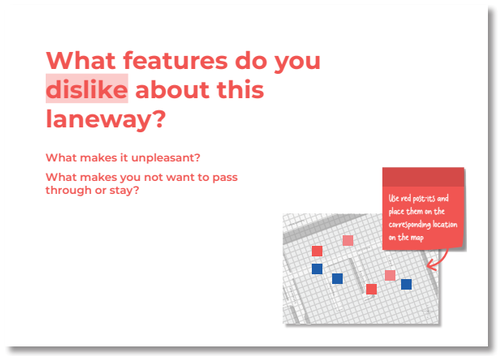
NAME:

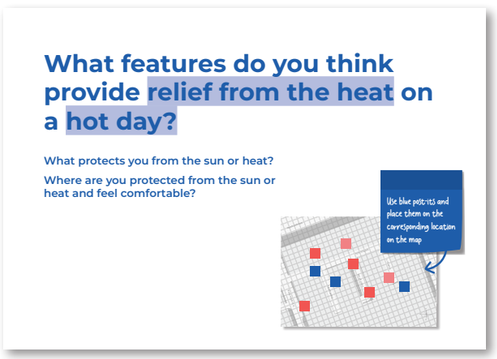
What is it:

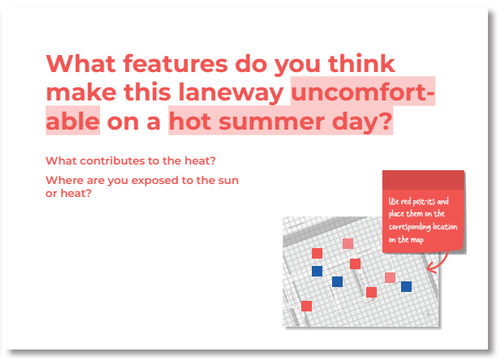
Rules:
>
>
>

Appendix K. **Workshop Activity Sheets for the Site Visit**

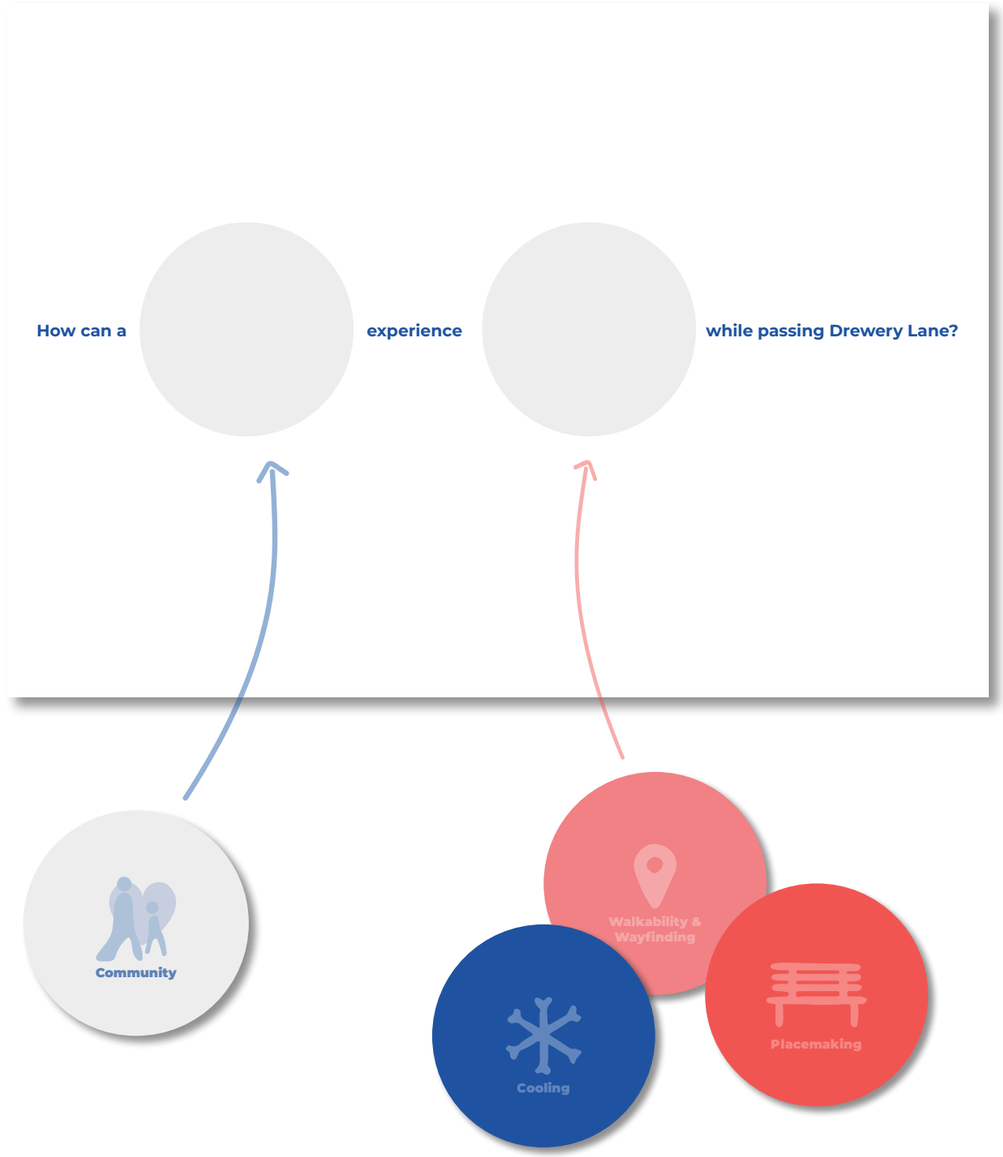








Appendix L. **Workshop Activity Sheets for the Future Experience Workshop**



Appendix M. **Workshop Activity Sheets for the Concept Development Workshop**

Cooling: **How can this laneway provide a cooling experience for pedestrians on a hot day?**

Go through the blue cards and pick suitable interventions to cool down the laneway on hot summer days. Use the printed map to draw in where you would place those cooling interventions.

Which cooling interventions did you pick? Write the most important ones down here:

If you picked more than 3 cooling interventions write them down here:

Wayfinding & Walkability: **How can this laneway be easy to find, navigate through and be accessible and walkable for anyone?**

Have a look at the current nuisances and delights - how can the nuisances be improved and the delights be enhanced? Can you find ways to incorporate ideas from the community workshops? Use the printed map to draw in where you would place those placemaking interventions.

Which wayfinding and walkability interventions did you come up with? Write the most important ones down here:

If you came up with more than 4 wayfinding and walkability interventions write them down here:

Placemaking: **How can this laneway be an inviting laneway that people like to walk through and spend time in?**

Have a look at the current nuisances and delights - how can the nuisances be improved and the delights be enhanced? Can you find ways to incorporate ideas from the community workshops? Use the printed map to draw in where you would place those placemaking interventions.

Which placemaking interventions did you come up with? Write the most important ones down here:

If you came up with more than 4 placemaking interventions write them down here:

Evaluation

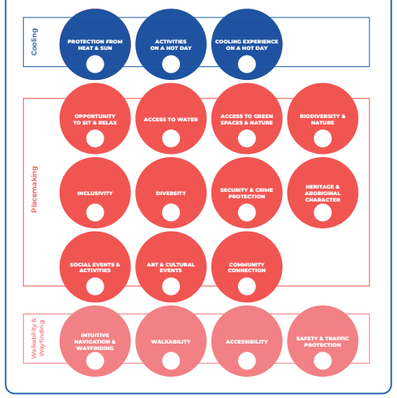
Users

Below you can find an overview of different users that the cool pedestrian network should cater for. Put a checkmark on the users that you think you cater for with your design ideas. Which ones are left? Are there ways to adapt your design to cater for them as well?

- RESIDENT
- WORKER
- VISITOR
- WILDLIFE
- CAREGIVER WITH PRAM
- WHEELCHAIR USER
- BICYCLIST/ SCOOTER
- STUDENT
- FAMILY
- CHILD
- HOMELESS PERSON
- ELDERLY PERSON

Experiences

Below you can find an overview of different desired experiences for the cool pedestrian network. Put a checkmark on the experiences that you covered with your design ideas. Which ones are left? Are there ways to incorporate those experiences as well? (not all experiences need to be covered)



Appendix N. **Consent Forms for Co-Design Workshops**

Participant ID: .....

Co-design session for cool pedestrian network toolkit

This research is conducted as part of the MSc study Industrial Design Engineering at the Technical University Delft.

Student: Alina Kaiser
Contact details: [redacted]
Project Title: A toolkit for co-designing heat-adapted pedestrian routes in Melbourne

Informed consent participant

I participate in this research voluntarily.

I acknowledge that I received sufficient information and explanation about the research and that all my questions have been answered satisfactorily. I was given sufficient time to consent my participation. I can ask questions for further clarification at any moment during the research.

I am aware that this research consists of the following activities:

1. *Site visit and co-design session*
2. *Feedback session for toolkit design*

I am aware that data will be collected during the research, such as notes, photos, video and/or audio recordings. I give permission for collecting this data and for making photos, audio and/or video recordings during the research. Data will be processed and analysed anonymously (without your name or other identifiable information). The data will only be accessible to the research team and their TU Delft supervisors.

The photos, video and/or audio recordings will be used to support analysis of the collected data. The video recordings and photos can also be used to illustrate research findings in publications and presentations about the project.

I give permission for using photos and/or video recordings of my participation:
(select what applies for you)

- ☐ in which I am recognisable in publications and presentations about the project.
- ☐ in which I am not recognisable in publications and presentations about the project.
- ☐ for data analysis only and not for publications and presentations about the project.

I give permission to store the data for a maximum of 5 years after completion of this research and using it for educational and research purposes.

I acknowledge that no financial compensation will be provided for my participation in this research.

With my signature I acknowledge that I have read the provided information about the research and understand the nature of my participation. I understand that I am free to withdraw and stop participation in the research at any given time. I understand that I am not obliged to answer questions which I prefer not to answer and I can indicate this to the research team.

_____	_____
Last name	First name
___ / ___ / 2023	_____
Date (dd/mm/yyyy)	Signature

Participant ID: .....

Co-design session for cool pedestrian network toolkit

This research is conducted as part of the MSc study Industrial Design Engineering at the Technical University Delft.

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I am aware that this research consists of the following activities:

1. *Co-design session for concept development*
2. *Feedback session for toolkit design*

I am aware that data will be collected during the research, such as notes, photos, video and/or audio recordings. I give permission for collecting this data and for making photos, audio and/or video recordings during the research. Data will be processed and analysed anonymously (without your name or other identifiable information). The data will only be accessible to the research team and their TU Delft supervisors.

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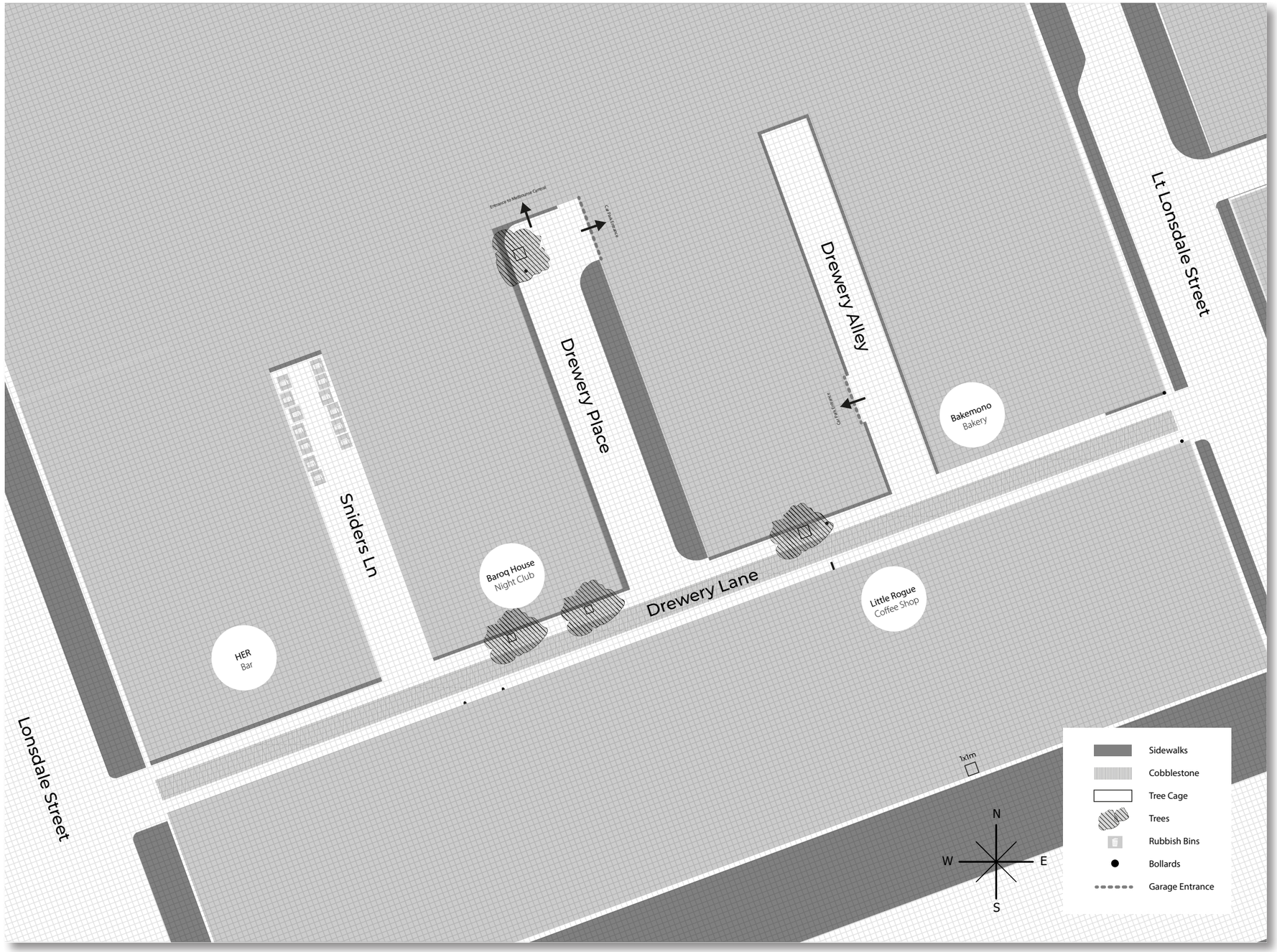
_____	_____
Last name	First name
___ / ___ / 2023	_____
Date (dd/mm/yyyy)	Signature

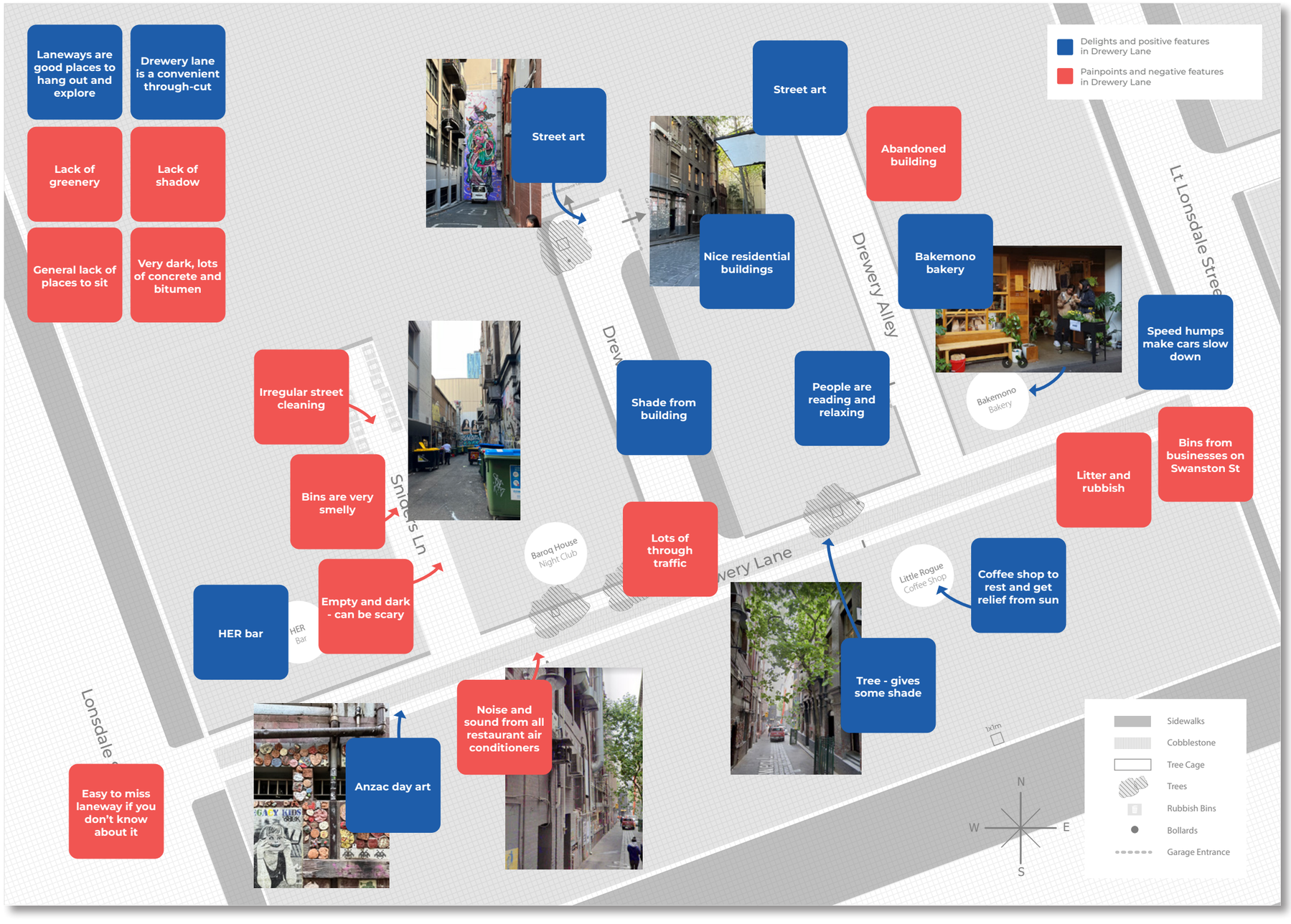
Appendix O. **Map of Drewery Lane**

This map of Drewery Lane has been created for the different trial workshops where it was printed in A0 size to be used as an interactive gameboard. It contains information about the laneway's measurements, shops and restaurants and serviceability issues to consider, e.g. entrances to car parks, bin locations, etc.



Appendix P. **Site Visit Output: Nuisances and Delights of Drewery Lane**

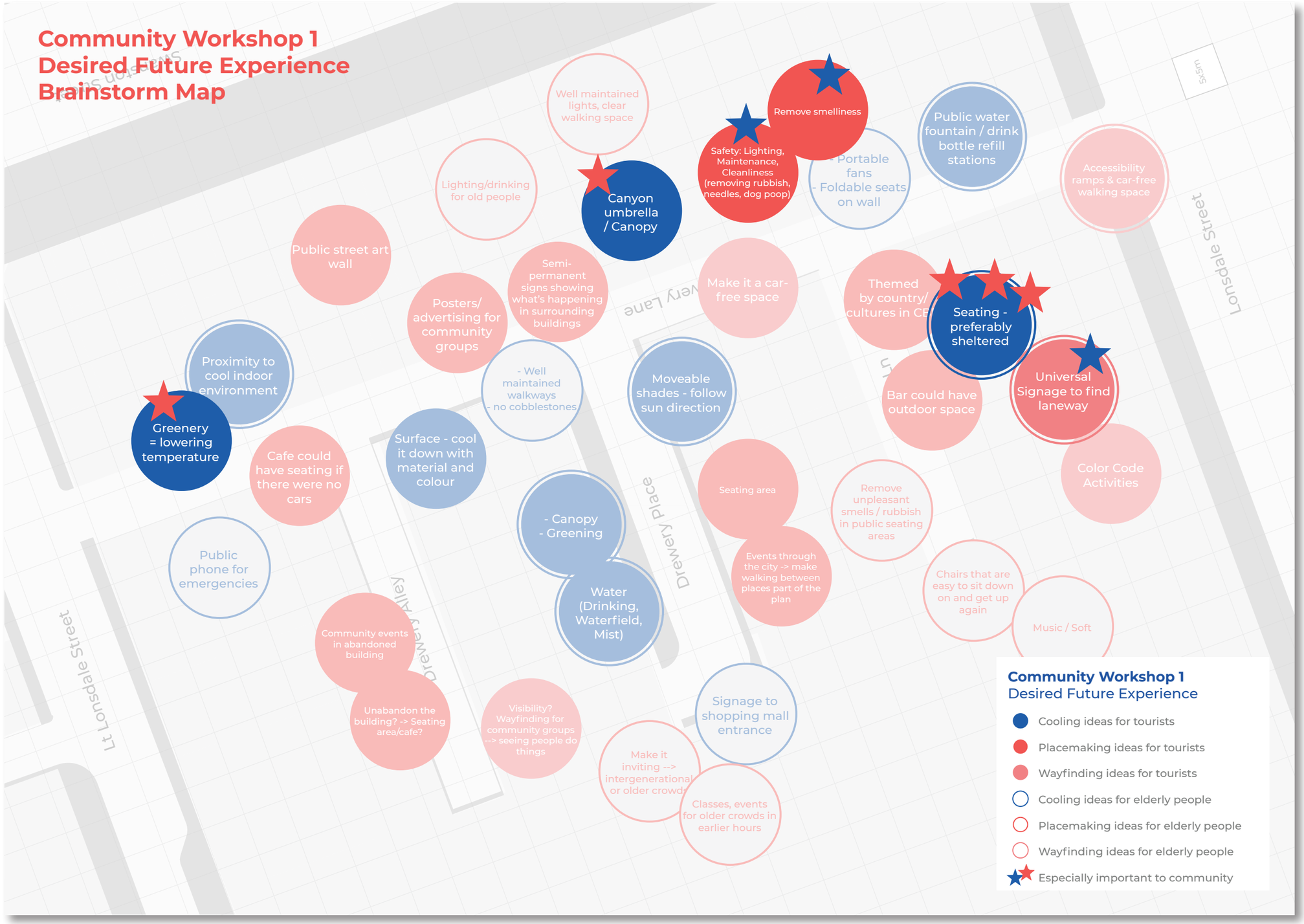
This map shows an overview of all the nuisances and delights of Drewery Lane that were identified in the site visit community workshops.



Appendix Q. **Results Future Desired Experience Community Workshop 1**

The participants of the first 'Future Desired Experiences' community workshop have selected an elderly person and a student as street user archetypes that they wanted to brainstorm solutions for. The workshop activity sheets on the right show which value & experience cards the participants considered most important for the archetypes. Based on their selection they had to brainstorm ideas for how the street user archetypes can experience the selected values & experiences in Drewery Lane. The results from that brainstorming session can be found on the next page.

Community Workshop 1
Desired Future Experience
Brainstorm Map



Appendix R. **Future Desired Experience Community Workshop 2**

The participants of the second 'Future Desired Experiences' community workshop have selected a tourist and an elderly person as street user archetypes that they wanted to brainstorm solutions for. The workshop activity sheets on the right show which value & experience cards the participants considered most important for the archetypes. Based on their selection they had to brainstorm ideas for how the street user archetypes can experience the selected values & experiences in Drewery Lane. The results from that brainstorming session can be found on the next page.

Community Workshop 2
Desired Future Experience
Brainstorm Map

White noise earplugs

Foster / animal shelter

Crochet club/ shop/cafè

Dog club

Ice cream

Temperature gauge

Educational art pieces

Outdoor dining

UV protection shield

Employ Frozone

More seating areas

Flatten street incline

Umbrellas

Live music

Chinese satellite placed above drewery lane to provide shade

More shade

Remove cobblestones

Street sanitation

Zipline

Trees / greenery

Water fountains

Noise cancellation

City of Melbourne volunteers

Maps with QR code

Water sprinkler

Public toilets

Block cars - only allowed at certain times

Food truck

Water installation to cool down (kids can also play in it) like the one they had in city square

Signage for different areas “cooling” “events”

Information for efficient navigation

Conveyor belt

Community bulletin

Infographic for hydration & free sunscreen

Arrows

Vending machine for umbrellas & sunscreen

App map

Lt Lonsdale Street

Drewery Alley

Lonsdale Street

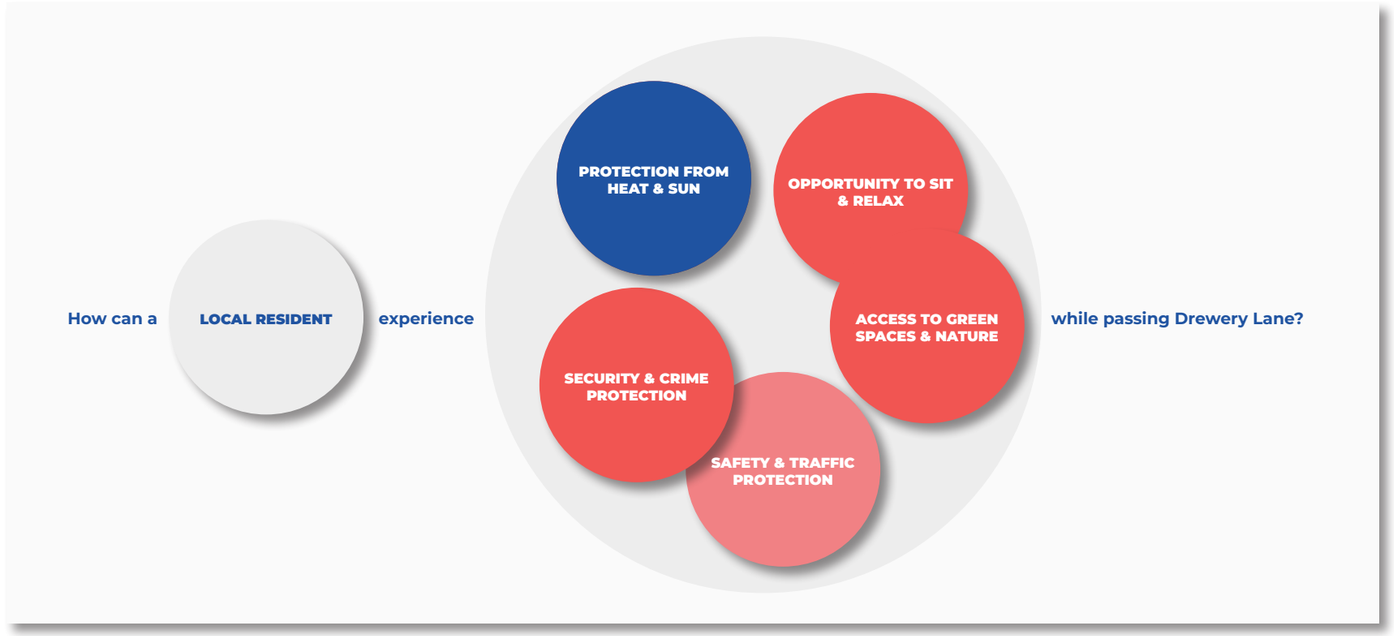
Spridgers Ln

Community Workshop 2
Desired Future Experience

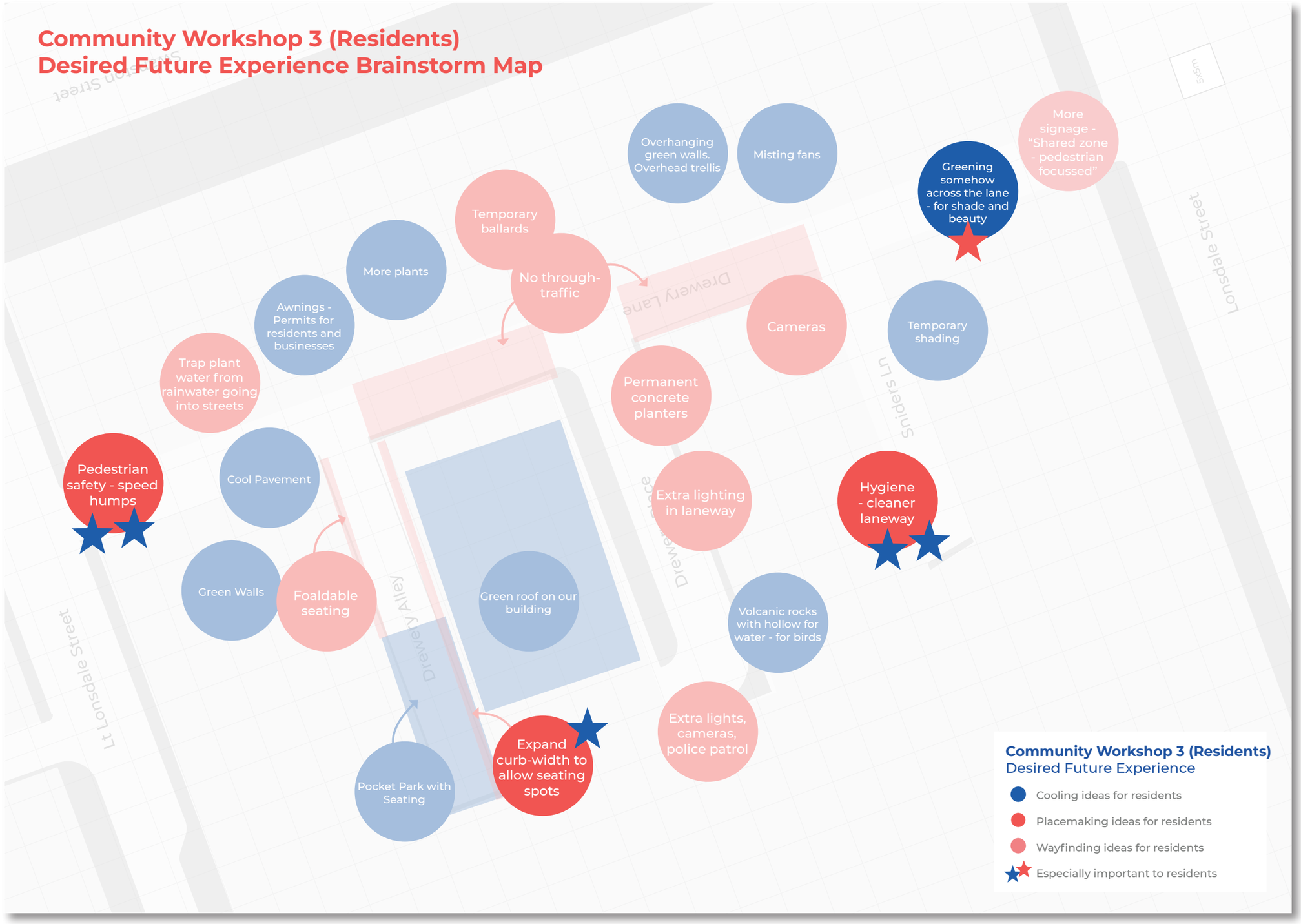
- Cooling ideas for tourists
- Placemaking ideas for tourists
- Wayfinding ideas for tourists
- Cooling ideas for elderly people
- Placemaking ideas for elderly people
- Wayfinding ideas for elderly people
- Especially important to community

Appendix S. **Future Desired Experience Community Workshop 3**

The participants of the third 'Future Desired Experiences' community workshop were residents and therefore asked to brainstorm solutions for local residents. The workshop activity sheet on the right shows which value & experience cards the participants considered most important for themselves as residents. Based on their selection they had to brainstorm ideas for how a resident can experience the selected values & experiences in Drewery Lane. The results from that brainstorming session can be found on the next page.

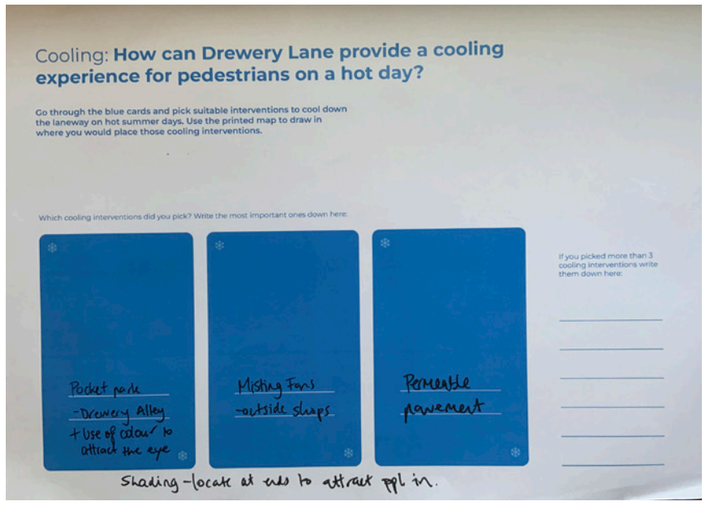


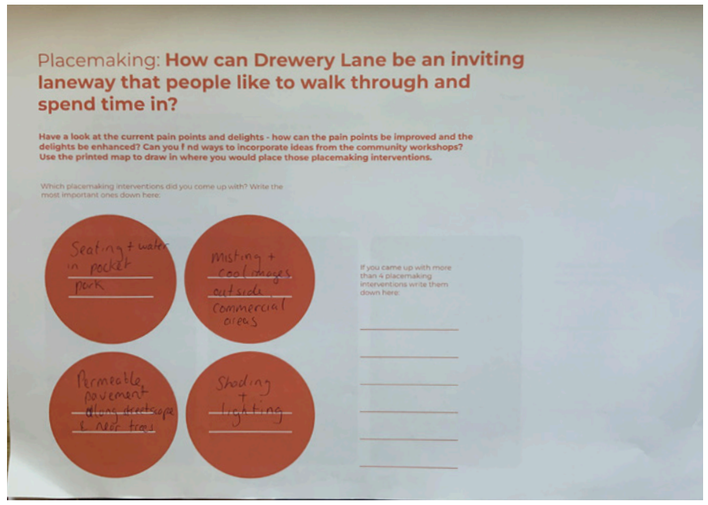
Community Workshop 3 (Residents)
Desired Future Experience Brainstorm Map

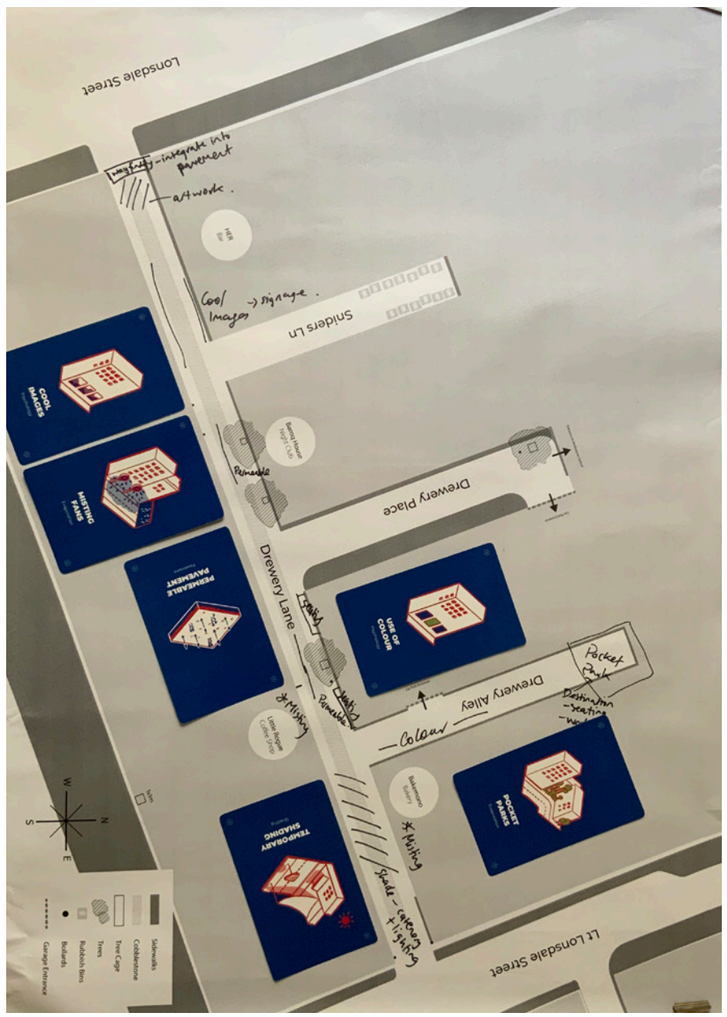


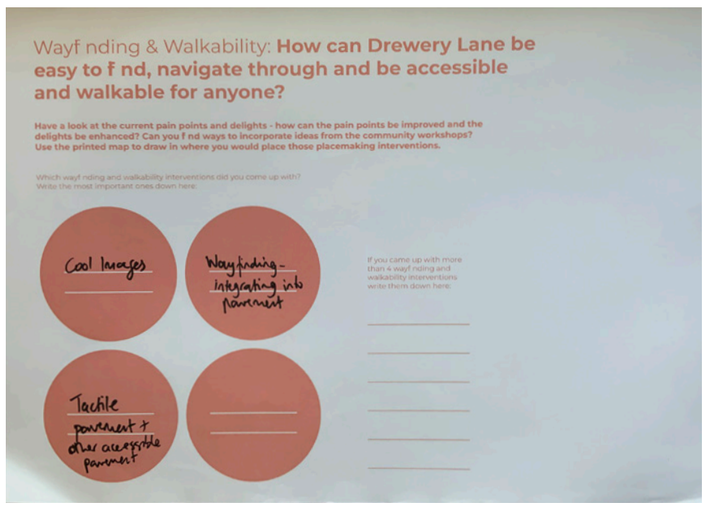
Appendix T. **Concept Development Workshop with Council (Group 1)**

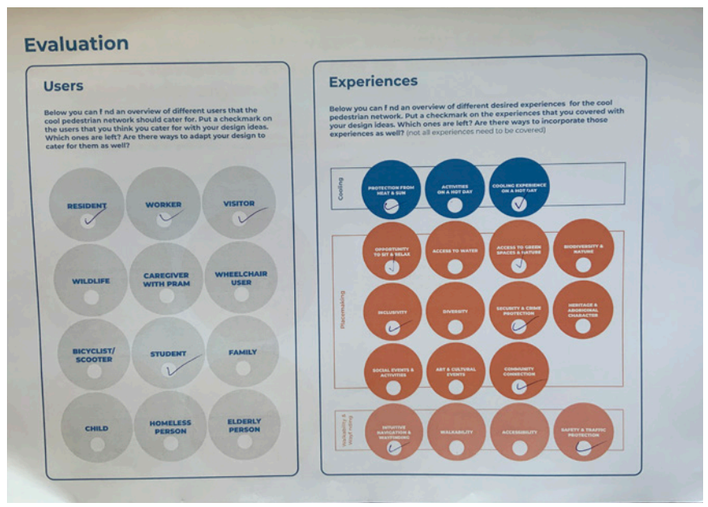
The workshop activity sheets below were filled in by group 1 in the concept development workshop with the council. They summarize the different interventions that the group has selected for the cooling, placemaking and wayfinding & walkability aspects in consideration with the community needs and wishes. The map on the right shows where the different interventions could be placed. A digitized summary of the developed draft concept can be found on the next page.



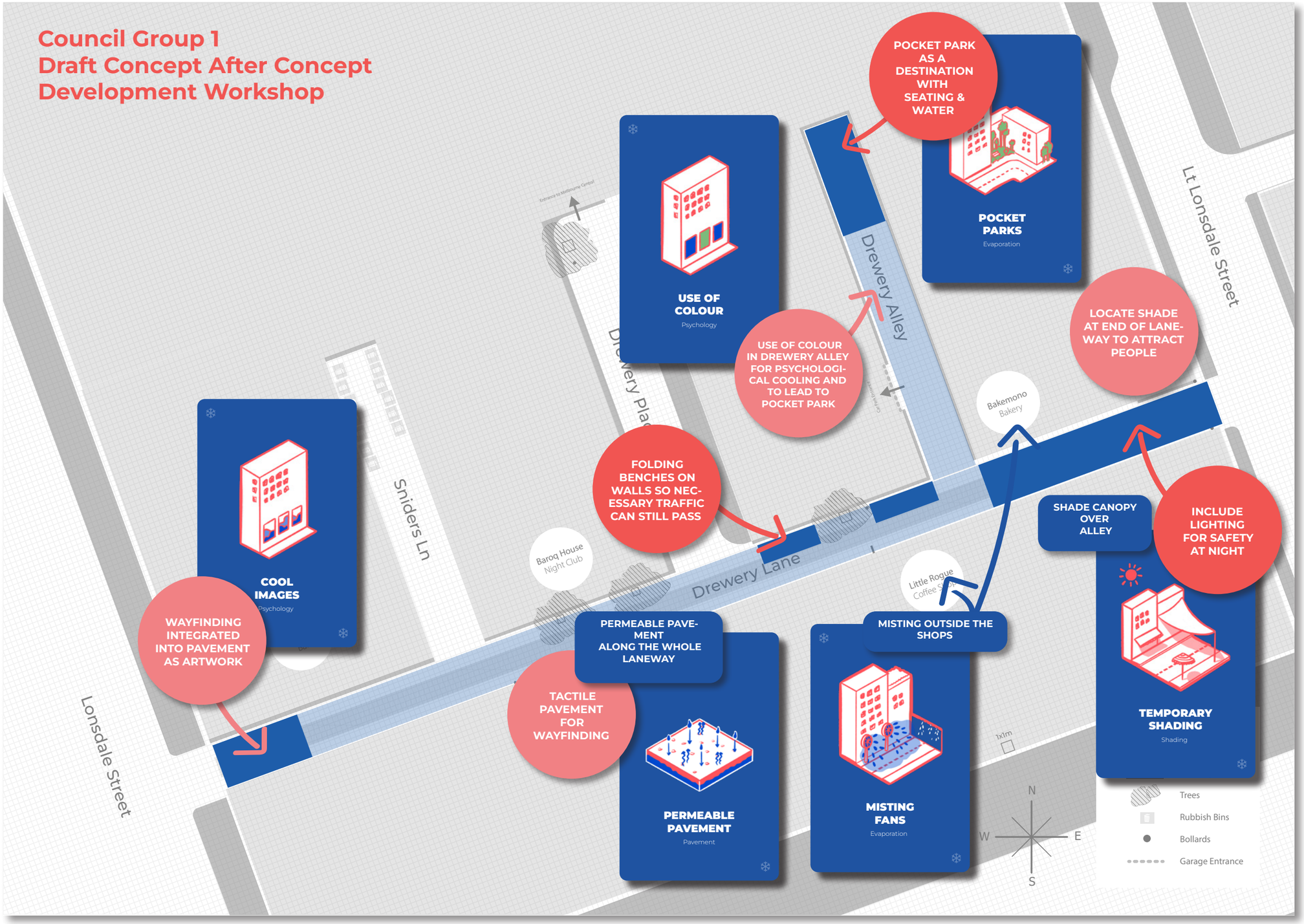






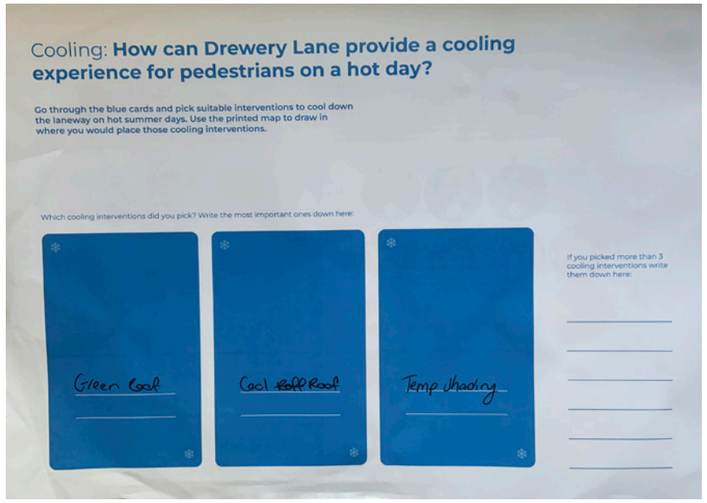


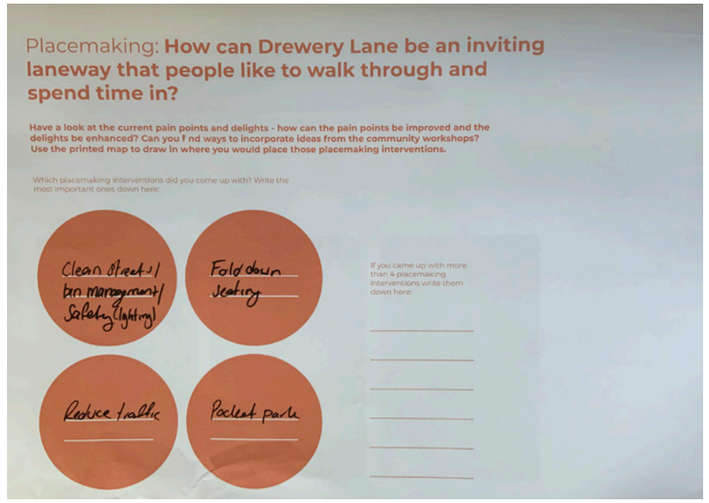
Council Group 1
Draft Concept After Concept Development Workshop

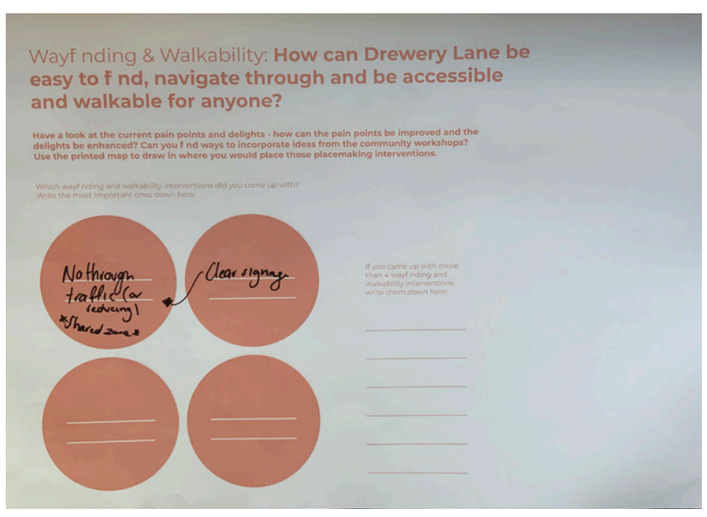


Appendix U. **Concept Development Workshop with Council (Group 2)**

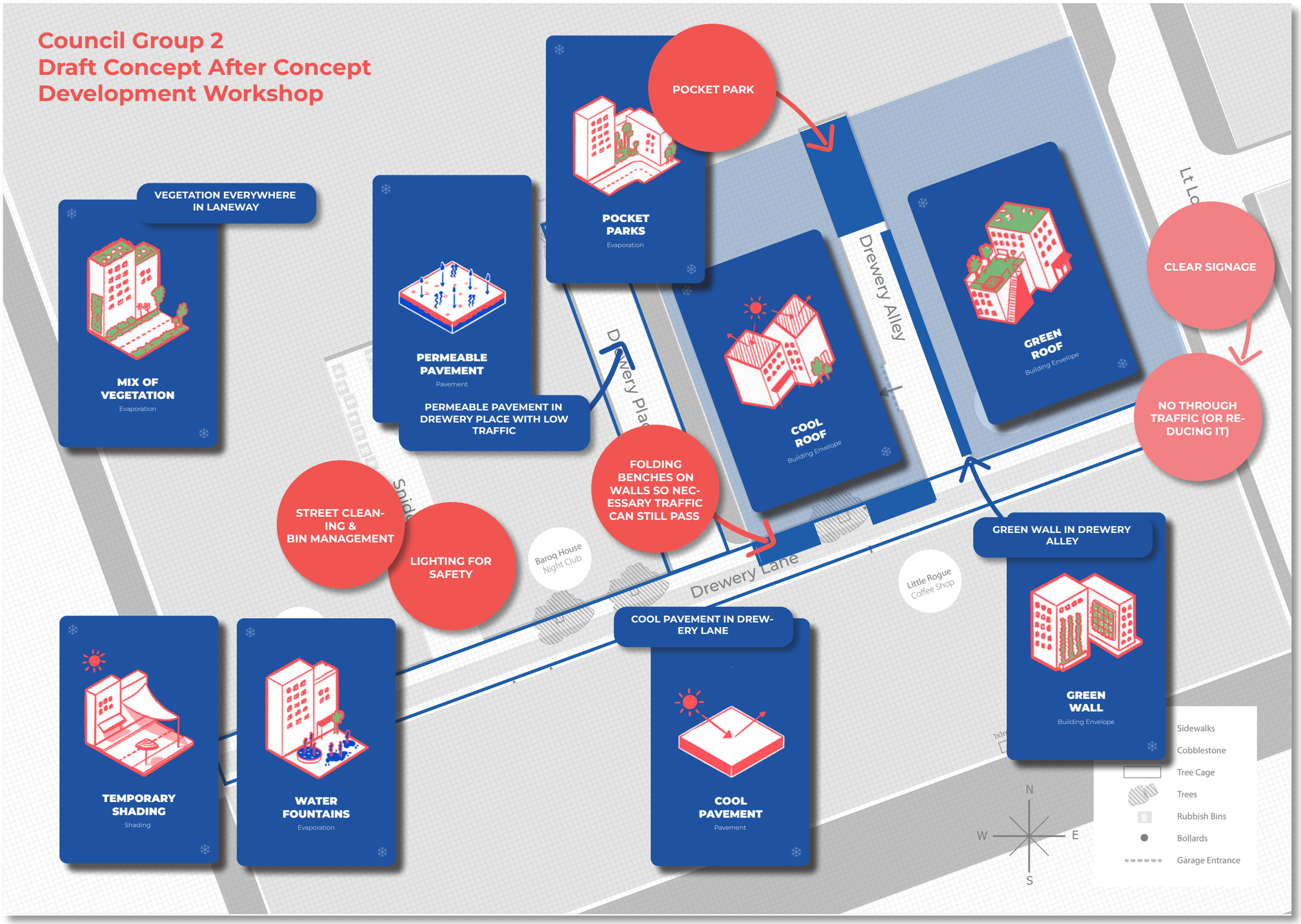
The workshop activity sheets below were filled in by group 2 in the concept development workshop with the council. They summarize the different interventions that the group has selected for the cooling, placemaking and wayfinding & walkability aspects in consideration with the community needs and wishes. The map on the right shows where the different interventions could be placed. A digitized summary of the developed draft concept can be found on the next page.







Council Group 2
Draft Concept After Concept Development Workshop



Appendix V. **Transcript Council Feedback After Concept Development Workshop**

After facilitating the concept development workshop with the council, the workshop participants were asked to give feedback about the workshop and the used workshop assets such as the workshop activity sheets and cooling intervention assets (cooling cards, booklet and map). A transcript from the feedback session can be found below.

What do you think about the workshop in general? What are things that worked for you?
C: I found it to be kind of fun. The way that you set it up with the cards and and yeah it is, you know, you're interacting with all the materials and stuff, but yeah, time went very quickly too. So I yeah, I actually found it to be fun, sort of enjoyable. Yeah. Yeah.

D: I think it's super inclusive and transparent. And, you know, often when we're talking about places in the City of Melbourne, we don't have any visuals. We're just basing it on prior knowledge or experience. But this opens it all up and gets everyone on the same sort of knowledge base. It's tactile, so it makes it more engaging to have a conversation. It almost feels like we need to do more of this type of activity when we're talking about places.

S: Yeah, yeah, I loved how engaging and interactive it was. And I can see how this tool could be adapted for like other kinds of City of Melbourne projects. Like I'm just thinking about like heritage reduction and reuse, that sort of projects, working with the community on that. Yeah, physically having the interventions...

D: ...yeah, the deck of cards.

S: And again, so helpful. You're going into the activity, and like obviously we have a bit of prior knowledge, but you're just like 'What would you do?'. And then you're just liked trying to think of a bunch of things and having the cards really helps to immediately get into that and be like, 'What is gonna work here, what intervention is possible?'

D: Yeah, you need to trademark these cards very soon and start shipping them around to players.

What are things that didn't work for you or that could be improved?

J: One very small thing is just like giving people enough time to read all the cards, because there's a lot and like we have the benefit of being familiar with these interventions, but lots of people won't be. That's the only thing I would say.

C: Yeah, it's a good point because I think, yeah, the cards themselves, in a way it saves time in having to come up with the ideas, but yeah, what are the ideas?

J: So yeah, just building that time into the workshop.

D: There's definitely a digital version of this to be made.

S: Would that be as fun though? It's so much better when there's physical stuff.

C: I know what you mean though, that it almost digitally gamifies it in a way that you can have these (points at the cards) and drop them on maps.

D: Yeah, because I think this is great, but then you kind of want it to lead to products that can be used for communication. If we tried to explain this to anyone outside of this, it would be hard for them to understand without something physical.

So, you mean doing a physical workshop but then having a very easy way of generating a digital output?

C: Yeah, and then digitalizing it that actually then takes it to the next step of developing a concept plan and giving an artistic impression of the space. You could just show then, you've identified these things and add little icons or images and just pop it in the space. It's kind of like a kit that lets you put it together digitally.

That also leads to the next question, so what would be the next step for you after such a workshop to get community feedback? Would this workshop provide you with a good start for coming up with concepts?

J: Yeah, I think so. I think yeah, that output if it's digital and kind of representing this (pointing at the workshop map with all the cards and post-its) then we can say, OK then like, let's take out a bit of a roadshow and see how people respond to it.

C: Because the way we would currently do it, an example at the moment is Franklin St., and so that has concept plans up for community consultation at the moment. They have artist impressions of the space with the different objectives and features of you know how we can transform it, and it's almost similar to that I suppose. You have that digital version or whatever it is that mock-up and then yeah, you test that further and whether you do that through other meetings or online, where you get that feedback.

D: ...yeah, on Participate Melbourne! Yeah, I think if you're, if you're looking at large scale community consultation and then there's existing platforms and then if these tools (points at the table with cards and maps) could be digitized, then you could get people to complete this process (of getting community input) online, sort of crowdsourcing. I think that would be very interesting, and I could see how AI could play a role in it to analyze this if there is a lot of data. We don't get a lot of feedback a lot of times, but let's assume in the future that we get a lot of engagement, that's where those technology tools would come in.

And, if you now had to present today's outcomes to the community, would you keep it on a conceptual level or would you first go through some more concept development?

J: I think we'll probably do a little bit of feasibility testing before we present it, because we wouldn't want to present anything that just wasn't possible to deliver or that wasn't appropriate for the space we chose or you know, was going to be too astronomically expensive or contravenes on the kind of policy. So I think we're gonna do a little bit of feasibility testing before we just to be like is this the right location? Is it possible to do within the policy and legislative context and operating and the like heritage considerations and that sort of stuff. Yeah. Is this something, like permeable pavement for example, at least in the projects that I have been in, is like five times more expensive than asphalt, so that's a consideration.

C: Yeah, that's spot on. So yes, it needs more work before being presented back to the community, because you don't want to overpromise and you need to manage the expectations.

D: It's something that I feel like some of these questions are hard to answer up front until you bring the experts in the room and then they kind of put the constraints on. And the budget is an issue, always.

O: So, when you do a project on a specific location, is there already a budget which is allocated to the project or is it coming after?

J: So, for capital works projects on like streetscapes, you basically do the project and you do a multi-year bid, but you put in the first year of funding, do a project brief and then get an initial cost plan and then based on that you'll get an additional amount of funding on the first cost plan so that's what I was saying that it's important to try and get as much into that first cost plan as possible, so the budget is pretty set from the very start of the project. There used to be more flexibility in being able to go back and ask for more funding, but not anymore.

D: So if you've got that and it was digital you could plug and you could cost some of these things and get consultation, but then you get people to play with the configuration.

C: Or even prioritize as well being like, well, you know, these are the options for the moment.

D: So they may want to add all these things, but then the cost flows out, they can see that. So they have to, yeah, they have to make decisions.

C: And then they have to prioritize, and be like 'okay, well then we just do this and this and we won't do that because we can't do it'.

D: So, it's like participatory budgeting, in a digital way.
What do you think of the workshop assets, so the cards, the booklet and the map? What works well and what could still be improved?

S: I liked this piece (points at the evaluation sheets) and actually reflecting all the things that we do, like all of the things that we've missed.

C: Yeah, having an evaluation of what you're trying to achieve. And even things like even just the way that these (points at workshop sheets) are designed for collating feedback and how you know, that's just the card that matches the activity sheet and the visual links and things, I think that's really good. It's very user friendly. Yeah. And I think I do like that you've got the extra information and having the QR code there, that's and then the extra booklet that we can put in our design guidance library is really great.

S: I just really love the cards, just the design and everything.

C: Yeah, I am wondering who would be the right person to talk to to print several copies and having them available for people to use, how we would support making them available in libraries or community hubs, different facilities. But it would be a really good idea, and then I suppose you can support the resource through that, you know the greening permit.

[...]

D: Yeah, this is kind of what we're asking, like this kind of scale. We want scientists to model the impact.

C: Yeah, that's the other thing, we wanna know, if we put permeable pavement in here, what will be the impact, what is going to happen?

S: And that map (the digital online map), actually starts to tell that story right of what's actually feasible right? That's very well done.

Yes, and I wanted to also add the shadow data from the cool routes app, but that data isn't publicly available. [...] It would be very interesting to have that data in here to also know where to install interventions that should provide shade in summer but let sun through in winter.
Thanks a lot for your participation and feedback!