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**CITY OF
MELBOURNE**

STAYING COOL: AN ANALYSIS OF THE COOL ROUTES CLIMATE ADAPTATION TOOL

An Interactive Qualifying Project in Melbourne, Australia

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PHOTO CREDIT: CITY OF MELBOURNE

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Abstract

The Cool Routes website is a navigation tool that uses a thermal map to choose the coolest route through Melbourne. Heat in Australia is a large issue due to the intensifying effects of climate change. Although the technology is innovative in its concept, it struggles to reach the public's attention. Our team collaborated with the City of Melbourne's Climate Adaptation Lead to suggest ways to increase the tool's uptake. Through background research, surveying, focus groups, and interviews with field experts, our team collected data concerning website design, community needs, and city resources. We ranked our recommendations based on difficulty and priority for changing Cool Routes' website design, utilizing marketing resources, and integrating this tool into local and global applications.

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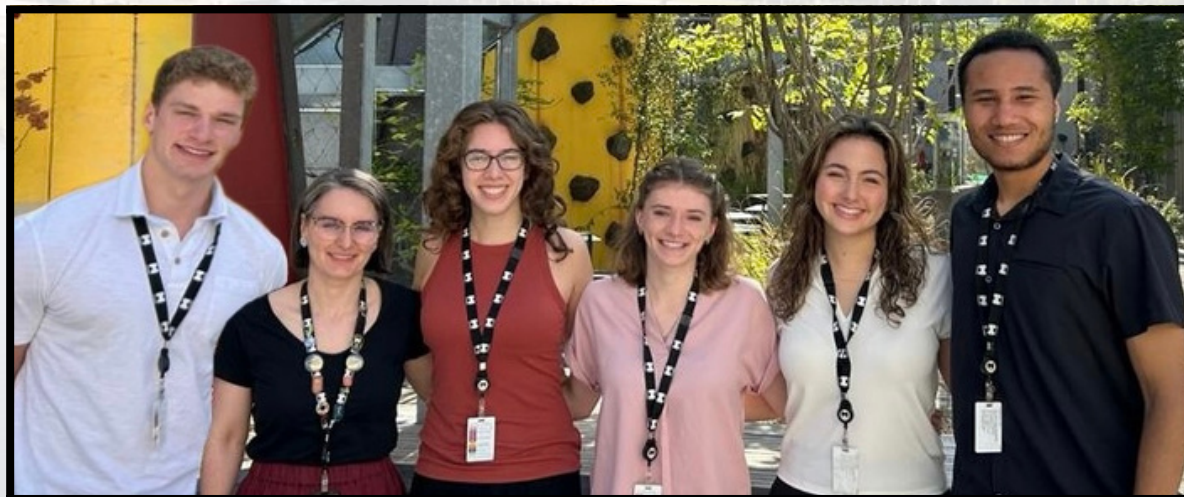
Jack Barrett & Dani Bramante, Nova Systems

Emma Bacon, Sweltering Cities

Alex Therrien, Sunrise Labs

CoM Focus Group Participants

Professors Aarti Madan & Ryan Madan, WPI



The City of Melbourne respectfully acknowledges the Traditional Owners of the land we govern, the Wurundjeri Woi-wurrung and Bunurong Boon Wurrung peoples of the Eastern Kulin and pays respect to their Elders past, present and emerging.

We acknowledge and honour the unbroken spiritual, cultural and political connection the Wurundjeri, Bunurong, Dja Dja Wurrung, Taungurung and Wadawurrung peoples of the Eastern Kulin have to this unique place for more than 2000 generations.

We are committed to our reconciliation journey, because at its heart, reconciliation is about strengthening relationships between Aboriginal and non-Aboriginal peoples, for the benefit of all Victorians.



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Melbourne's Surging Climate Change Threat: Skin Cancer and Heat Waves

Climate change is increasingly impacting Australia. The ozone layer over Australia, protecting civilians from harmful ultraviolet (UV) radiation, is thin in its current state. Over the 1970s, the ozone layer covering Australia was depleted due to the excessive use of carbon materials (O'Reilly, 2022). Despite climate change policies limiting carbon use, Australia is still a world leader in carbon emissions, caused by wildfires and burning fossil fuels. Over the past five decades, yearly carbon emissions in Australia have doubled from 211 million tons in 1979 to 487 million tons in 2022 (Australia's Greenhouse Emissions Quarterly Update, 2022; Australia CO Emissions Worldometer, 2016). Since this carbon usage has significantly damaged the ozone layer, Australians have become highly vulnerable to UV radiation. Due to both the thin atmosphere and its proximity to the sun, Australia sees a 15% increase in solar intensity when compared to Europe during their respective summer months (Specialist Clinics of Australia, 2015). Subsequently, there are increased rates of skin cancer in Australia. Around $\frac{2}{3}$ of all Australians develop a form of skin cancer before the age of 70 (Staples et. al, 2006). There is a clear need for Melbourne's pedestrians to stay out of the sun and protect themselves from UV rays and heat.

Across the country, city and state councils have dedicated resources to mitigate and adapt to the impacts of climate change. The City of Melbourne (CoM), a local governing body responsible for the well-being of approximately 910,800 people, has developed Cool Routes (Melbourne Facts and Figures - City of Melbourne, n.d.), a web-based tool designed to help people plan their journey through the city by foot or bike via the coolest paths. It first launched in December 2020 which coincided with the start of the Covid-19 pandemic. Consequently, CoM had to alter its attention to the health of its citizens and therefore the Cool Routes project was pushed to the side. This included the reduction of resources and funding for the project's development.

Our group's purpose was to not only to revive this potentially revolutionary tool but to also assist the city in making it a tool that appeals to its citizens. With this overarching goal, we had three main objectives for our project: first, assess the current usage of the Cool Routes website and understand the current travel demographics of people in Melbourne; second, conduct technical research to understand user-centered design and the feasibility of website changes; third, investigate resources within Melbourne that CoM could use to promote Cool Routes. After interviewing experts, conducting user experience focus groups, and collecting survey data, we provided an analysis of our collected data with opportunities for improvement. We hope to see the imminent uptake of the tool within Melbourne and that it will have an impact not only on climate change adaptation in Melbourne but also be recognized as the next generation of smart navigation.



Climate Change in Australia: The Complexity of Rising Temperatures

Climate change is a fast-evolving global issue driven by the increased number of greenhouse gas emissions created by the burning of fossil fuels. Greenhouse gases such as carbon emissions absorb light in the atmosphere, which prevents them from leaving the earth (Mobius, 2019). The thick cloud of gas prevents thermal energy or heat on earth's surface from leaving the atmosphere. Since this heat has nowhere to go, it remains in the atmosphere. This cycle continues resulting in rising temperatures, known as global warming, a now prominent issue. Australia has been experiencing global warming first-hand through extreme heatwaves that make its summers seemingly unbearable.

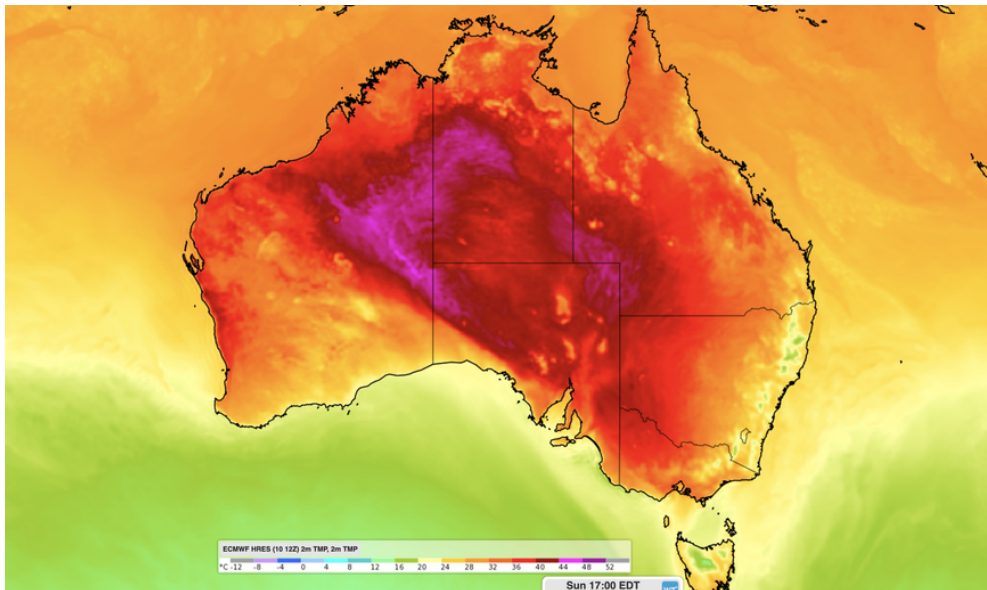


Figure 1: This is a heat map of Australia on February 13, 2022. Australia experienced extreme temperatures on this day. Adapted from "Summer heat returning to southern Australia", by A. Lange, 2022, *weatherzone*. <https://www.weatherzone.com.au/news/summer-heat-returning-to-southern-australia/536170>. Copyright 2023 by Weatherzone.

Sweltering Cities Executive Director, Emma Bacon, raises the concern of not only the increasing temperatures but also how Australia's cities and buildings are not capable of effectively mitigating this heat. Bacon states how Australia's urban planning is based on transportation through cars and trams, but severely lacks attention to these extreme temperatures and the thermal protection of its citizens. Australia lacks policies, strategies, and actions at the national level to reduce the effects of greenhouse gas emissions, and citizens are being forced to live with and adapt to the consequences (The Climate Council, 2022). Bacon supported this claim by stating, "I do not think there is any government in Australia that is adequately planning for climate adaptation." In truth, Australia seems to be looking in the opposite direction, not only are they the world's largest exporter of coal, they are also a leading country in uranium and liquefied gas exports. An industry worth nearly \$80 billion each year (Australian Energy Resource Assessment, 2014). From 2007 to 2008, Australia exported about two-thirds of its extracted geologically stored energy, known as fossil fuels (Head, 2014).

Heatwaves and rising temperatures are among the most harmful effects of climate change. Seen in Figure 2, from just 1910 to 2011, Australia's average temperatures increased by 0.9°C, whereas the global average was 0.7°C (Head, 2014). Over the years, there have been increasingly long periods of drought in Australia, with sporadic and extreme periods of rain. Since the mid-1970s, the Southwest region of Australia has experienced a 15% decrease in the amount of winter rainfall (Head, 2014), while Australia calls the years from 1995 to 2011 the 'Big Dry' or 'Millennium Drought' because they experienced the most severe drought in 120 years (Head, 2014). These changes in the climate have led to an increase in fires and flooding, as well as to a rise in ocean temperatures and sea levels. These climate change effects are severe, irreversible, and are only projected to worsen (State of the Climate 2020).

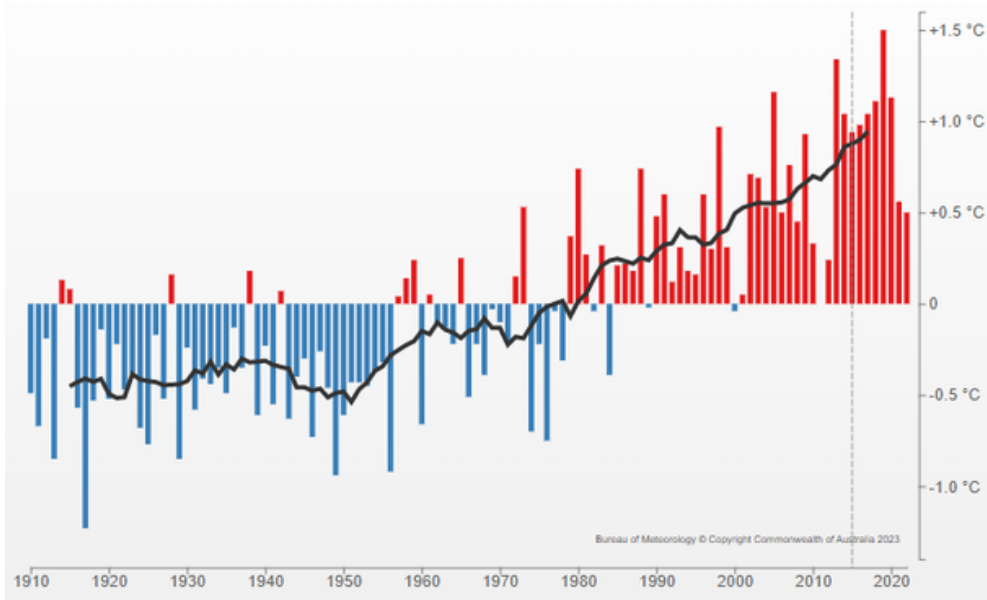


Figure 2: This graph demonstrates the fluctuation in average temperatures in Australia per year from the standard of 1961 to 1990. As shown in the graph, the average temperatures per year have increased dramatically after 1980, with these trends only expected to continue. Adapted from "Annual climate statement 2022", Australian Government - Bureau of Meteorology. <http://www.bom.gov.au/climate/current/annual/aus/#tabs=Temperature>. Copyright 2023 by Commonwealth of Australia, Bureau of Meter

The City of Melbourne Says Enough is Enough

With a documented lack of national initiative, it falls to local governments to enact change (The Climate Council, 2022). Australia was deemed to be in a state of climate and biodiversity emergency in 2019 due to long periods of droughts that aided the spread of wildfires throughout the country. CoM is taking specific actions to create an environment in which its citizens can survive and thrive in any future climate. In fact, the city has appointed two chief heat officers, Tiffany Crawford and Krista Milne, who oversee the work of managing the risks of extreme heat in the city. It is understood that they will not be able to stop climate change altogether, or even reverse its damage. However, they want to ensure their citizens can live healthy lives despite the current and future climate.

In 2017, CoM created the Climate Change Adaptation Initiative Refresh which they define as the “process of planning, preparing, responding, and driving adjustments in the city to ensure that people can survive and thrive no matter the change”. Melbourne’s four-year plan (2021-2025) focuses on six different objectives shown below in Figure 3.



Figure 3: This displays the six objectives of CoM's four year plan. Our project focuses specifically on Climate and Biodiversity Emergency.

CoM identified heat islands, sections with lots of concrete and little shade, as an extensive threat and therefore has taken great steps in preventing the accumulation of heat in areas within the municipality. CoM is driving its Climate Change Adaptation Initiative with projects which improve the amount of greenery within the city by increasing open space and urban forests in public and private areas.

Greenery not only creates a cleaner environment but also has practical advantages such as cooling alleyways and sides of buildings. Asphalt and other composite materials retain heat long after temperatures have peaked. Increasing greenery within Melbourne will not only benefit the well-being of its citizens but also allow for heat mitigation following hot days (Open Space Strategy, 2012). Flooding in cities is also a prominent issue. Projects such as adding rain gardens and tree pits help to better manage and absorb water in natural processes. These actions help to reduce flood risks, increase green space and canopy covers, and enhance biodiversity in the city (City of Melbourne, 2018).

Green It: How Integrating Smart Technology Can Lead to a Cleaner City

The development of technology and integration into urban planning in recent years has made greening a city considerably more effective. According to the Intelligent Community Forum (ICF) for the Intelligent Community Awards Program, four Australian cities have been named among the World's top smart communities in 2021. Adelaide, Prospect, Sunshine Coast, and Townsville all placed highly in categories like digital equality, provision of air space, air quality, sustainability programs and broadband connectivity. The distinction between a regular city and a smart city comes from the cities ability to integrate technology into the planning, development, operation, and management of city policies (Yigitcanlar, 2018). Technology is deemed "smart" when it is blended into the city to solve existing problems.

There are three driving factors that work together within a city, all of which must be considered when determining the feasibility of enacting change. First, cities must examine the resources available to them, including physical space, funds, and technology. Second, they must assess the policies in place, which drive campaigns while limiting potential harm. Third, they must take into account the stakeholders, which include the people who live in and govern the city. New initiatives in a city must balance the expectations and limitations set by these three elements.

Transitioning to a smart city can lead to many benefits, such as increased accessibility, inclusivity, economic growth, and citizen comfort. It is also true that smart cities have a positive impact on the environment, including

minimizing urban footprint, limiting emissions, or generating ecological stability (Yigitcanlar, 2018). In this vein, CoM is focusing on introducing smart navigation into the city. By creating an easier way for citizens to use public transportation or avoid Melbourne's extreme heat while walking or cycling, more people will ideally choose to commute via these methods. Increased use of public transportation, walking, and cycling in urban areas leads to a corresponding decrease in vehicular traffic, minimizing the city's overall urban footprint (Pucher et al., 2011).



Melbourne has many resources for its citizens to plan their journey through the city, encouraging users to utilize public transportation, walking, and cycling. Some popular resources include the Public Transportation of Victoria (PTV) and Arevo applications. These applications make it easy and efficient for people to travel through the city at any time. PTV can highlight multiple public transportation methods in a single route including trams, trains, and buses. Arevo includes access to rental electric scooters and bikes, locates inexpensive fuel, and provides quieter routes for those walking or biking.

Additionally, to make travel through the city easier, some applications have been designed to combat the extreme temperatures in Australia. Spatial Vision is working with a local university, RMIT, and the City of Greater Bendigo to create Shadeways. This thermal comfort map provides information to pedestrians on urban hotspots in the city. While Shadeways does not help users navigate, it can showcase cool locations through Bendigo. PTV, Arevo, and Shadeways are just three examples of how smart technology is successfully incorporated into Victoria to meet the needs of citizens and visitors.

Feeling the Heat: The Cool Routes Climate Adaptation Tool

Much like the previously described resources available, Cool Routes is a web-based climate adaptation tool that uses various data sets. Data including temperature, time of day, landscape, surface of pathways, city infrastructure, and shade covering help to assist citizens traveling in extreme heat. This data is implemented into a multilayered mapping technology to navigate users from one location to another within the city by suggesting the coolest route possible. This is shown in both Figures 4 and 5.

According to Jack Barrett and Dani Bramante of Nova Systems, the company originally tasked with designing Cool Routes, the tool is centered around a raster grid and mapbox technology. The raster grid divides the map into pixels, and every pixel has a value which translates to levels of thermal comfort, stating which spots are hotter than others.



Barrett used a Python module to track the sun's movement, which allowed him to have data regarding thermal comfort based on the time of day. Some factors that affect the values of this data are shadowing from trees, surface material, urban heat islands (a concrete area with limited shade coverage), and sun exposure. In addition to using a raster grid, the Mapbox technology utilizes a cloud based platform to overlay the map feature onto the thermal comfort scale. Therefore, Barrett's algorithm can detect the coolest, fastest route for the user to their inputted destination by cutting through parks and public buildings otherwise ignored by typical navigation tools.



Figure 4: This image shows the interface of the Cool Routes website. It includes a 3-D depiction of the city's geography as well as colorization to represent hot and cool areas throughout the city. In the top corner, a user can input a location and a destination so the website can navigate through the city.

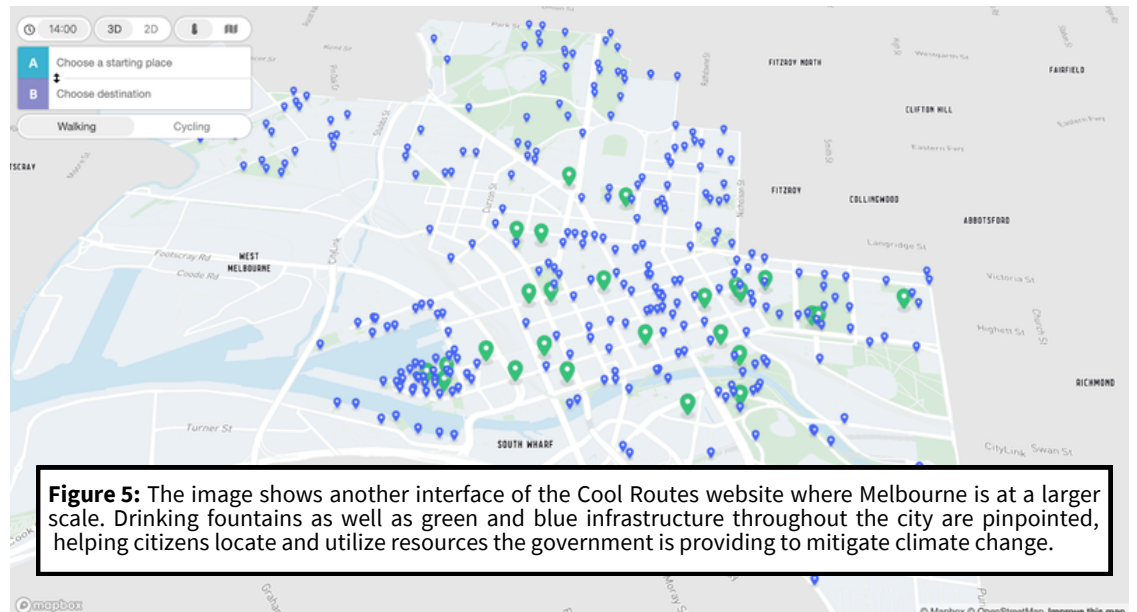


Figure 5: The image shows another interface of the Cool Routes website where Melbourne is at a larger scale. Drinking fountains as well as green and blue infrastructure throughout the city are pinpointed, helping citizens locate and utilize resources the government is providing to mitigate climate change.

In addition to routing users from point A to point B, Cool Routes locates drinking fountains and green and blue infrastructure. Green infrastructure is defined as increased vegetation, especially found on buildings or in urban spaces. Blue infrastructure is added vegetation that is passively irrigated with stormwater to assist with water management. Examples of blue infrastructure include rain gardens and tree pits. Though these installments might be overlooked by some, they are examples of the steps the city has physically taken to provide a more comfortable environment to its citizens. CoM's Climate Initiative, focused on driving adjustments and proactive mindset, emphasizes the need for incorporating smart mobility into the city. Cool Routes is one example of this (Frodeman et al., 2017). With temperatures expected to rise in the coming years, CoM will continue to increase heat mitigation within the city through innovative technologies and policies.



Figure 6: The image above demonstrates an example of green infrastructure around the city. This specific example is also referred to as a green wall. Photo credit to City of Melbourne.



Figure 7: The image depicts a rain garden with a tree pit and demonstrates an example of blue infrastructure.

Although the concept of this tool is very innovative and new, its potential has been severely suppressed due to the timeline since the launch date. With Covid-19 travel restrictions, the need for a temperature-based navigation tool became obsolete. Since then, the site has never reached over 100 views per week, as seen in Figure 8. Our project is centered around assessing the use of the Cool Routes website and providing recommendations on how to improve its user uptake. By assessing the needs of Melbourne citizens, we can determine whether the Cool Routes tool is successfully being integrated into the city as it was originally intended, contributing to the city's smart technology.

Cool Routes – 1,041 views



Figure 8: This screenshot from the Climate Change and Water Management Analytics Report provided by CoM reflects the small number of views between October 2021-2022.

Steps to Success: Methods for Data Collection

During our data collection processes, our group aimed to learn how Cool Routes could be adopted into citizens' and tourists' everyday lives. We identified three types of information we needed before making recommendations to the city: Website Design, Community Needs, and City Resources. By organizing a survey, our group was able to gain information on community needs and some user feedback. We collected over 200 survey responses through in-person and online networking. Our survey asked questions regarding demographics, traveling needs (especially during extreme heat), city resources, advertising strategies, and user experience. As seen in Figure 9, the information collected through our survey encompasses many of our project's objectives. From a design perspective, our team gained a better understanding of the strengths and weaknesses of Cool Routes. We gathered this information through interviews and research to further support these objectives.



Photo Credit: David Hannah

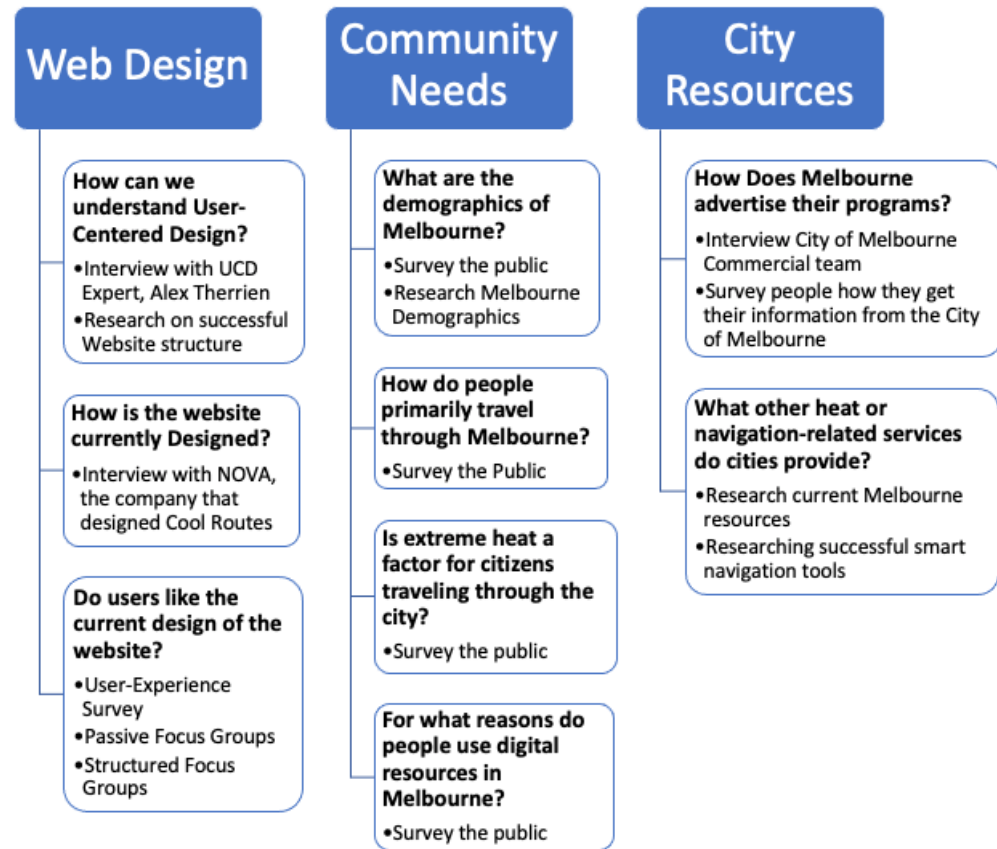


Figure 9: The infographic above shows our project methods outlined into our three objectives. The branches underneath reveal strategies we utilized to answer project questions.

We Want You!: Understanding Community Needs

To make specific recommendations to CoM, our team investigated the needs of citizens and tourists around Melbourne. First, we looked at how people primarily travel around the city to gain an understanding of the audience Cool Routes could reach. In addition, we wanted to know if extreme heat is a factor for citizens when planning their travel through the city. This gave us insight into the relevance and need for Cool Routes on days with extreme heat. Another main priority for our team was to find out when people use digital tools to navigate Melbourne, and for what specific reasons. With an understanding of these types of information, our team grasped how to recommend the integration of Cool Routes into citizens' and tourists' everyday lives.

With these goals in mind, we developed an online survey using Qualtrics. See Supplemental Materials (SM)¹ for a complete set of our survey questions. We chose survey locations based on recommendations from Candace Jordan, our liaison at CoM. Jordan provided us with a list of highly populated places and events. We surveyed at the State Library Victoria, Federation Square, the National Gallery of Victoria (NGV), and Queen Victoria Market. As shown in Figure 10, we designed a flyer with a QR code so we could efficiently approach people and ask them to take our survey online.

When conducting in-person surveying, our team offered two different methods for participants to answer our questions: scanning the QR code or taking it verbally. Providing multiple methods increased the accessibility of our survey. Dressing in professional clothing and wearing contractor badges from CoM increased our visual credibility. Additionally, we distributed our survey digitally to CoM and Nova System employees, as well as past and current WPI Melbourne IQP students.

In order to visualize and share our findings, our team needed a data analysis application. We found Tableau is exceptional in creating visualizations and is available for student use. We were able to create intuitive and engaging visuals. Our team paired questions together that would provide us with the most meaningful graphics.



We want your opinion on

Cool Routes

- CREATED BY THE CITY OF MELBOURNE -



PLEASE TAKE
OUR 5 MINUTE
SURVEY!

Cool Routes is a Climate Change
Adaptation tool created by the City of
Melbourne for its citizens and visitors to
help navigate Melbourne in a hot climate.
We would love to hear your feedback!

Cool Routes Website:



Figure 10: The flyer above was designed to help distribute our survey efficiently. It includes both a QR code for our survey and a QR code for the Cool Routes website.

1. Supplemental materials for this report can be found by searching for the project title at <https://digital.wpi.edu/>

GOING TO LUNCH? USE COOL ROUTES ON YOUR WAY!

Cool Routes is a heat-based navigation website helping you plan your journey in Melbourne using the coolest path possible. The City of Melbourne is looking for feedback on your experience using the website.

INSTRUCTIONS

Step 1: Try Cool Routes
Get comfortable with the features on the website. Note that you can plan your travel by adding start and end destinations as well as the time of day.
<https://www.coolroutes.com.au/>

Step 2: Navigate with Cool Routes
Grabbing coffee? Heading out for lunch? Try using Cool Routes on your way to your destination.
<https://wpi.qualtrics.com/>

Step 3: Take our survey!
We are collecting information on how people travel through Melbourne in the heat and user-experience regarding Cool Routes.
<https://wpi.qualtrics.com/>

Who are we?
We are a team of students from the US working with the City of Melbourne to assess the uptake of Cool Routes. Our final goal is to provide recommendations to the City of Melbourne on how to increase the usage of Cool Routes throughout the city.

Knowledge is Power: Investigating Website Design

Before making recommendations about the technical aspects of Cool Routes, we needed to understand user-centered design. User-centered design is an intricate methodology that software engineers use to increase the adaptability of their program. Rather than any fixed design, a user's needs are always the highest priority, and the product is constantly changing to fit these needs. To get a better understanding of this approach, we interviewed Alex Therrien, an expert in user-centered design. He gave us insight into the structure of designing software around user needs as well as an overview of important factors to prioritize when collecting data. He emphasized the need to understand how users think and act in their everyday lives to design a product they will use.

We also wanted to collect data about the user experience from the users' perspective. The final part of our survey focused on user experience. The survey asked if the respondent had ever used Cool Routes before. When yes was selected, the survey prompted a new set of questions asking about the experience, ease of use, and user-friendliness of the website. There was also an open-ended question allowing for commentary.

While collecting responses, we discovered that few respondents had previously used Cool Routes which prevented us from getting sufficient user feedback. Therefore, we designed a self-directed focus group to ensure we could collect opinions on the website's usability. We distributed a flyer, as seen in Figure 11, instructing volunteers to familiarize themselves with the Cool Routes website, navigate with it during a regularly scheduled lunch or coffee break, then take our survey. This way we ensured we would have more data under the user experience section of our survey.

Our team wanted to collect additional qualitative feedback about the website's user-friendliness. To accomplish this goal, we held a structured focus group to gather collaborative opinions about Cool Routes. Our participants consisted of three CoM employees. First, we allowed participants to explore the website and record first impressions. Next, each participant was assigned to a different predetermined location.

Figure 11: This flyer was created to conduct self-driven focus groups to aid our team in evaluating the usability of Cool Routes.

The participants were then instructed to use Cool Routes to navigate to their respective locations and back. Upon their return, our team led a discussion about their experience while using the tool. The entire session was voice recorded and two note-takers captured the data. See Supplementary Materials (SM) for detailed instructions for our focus group.

Our team also used Cool Routes firsthand so we could understand the thoughts and intentions of an individual who might rely on it to keep them at a comfortable temperature while traveling. We triangulated our personal Cool Routes experience with the opinions of others gathered through surveys and focus groups. Looking at this project from multiple points of view was fruitful in understanding the website's technical design.

The next step was to grasp what feasible recommendations would look like. We interviewed Jack Barrett and Dani Bramante at Nova Systems. They provided us with critical information about the cost, time, and amount of effort necessary to implement our proposed changes. After interviewing these Nova Systems technical developers, we reviewed our proposal for our second meeting, where we discussed our revised recommendations and finalized our technical suggestions.

Resources for Networking: Learning More About What the City Has to Offer

To understand how we could integrate Cool Routes into travelers' daily lives, our team explored a wide variety of local and national resources. We first met with our community partner, Candace Jordan, to learn about what CoM currently provides to their community during extreme heat. Additionally, we asked about transportation resources that could potentially be merged with Cool Routes, including self-guided tours. We also met with Nicki Colls, the Climate Partnership and Advocacy Lead for CoM, to understand how advertising and budgeting operate within the organization. Furthermore, we met with an external organization, Sweltering Cities, to learn more about the consequences of extreme heat in Australia and how communities are affected. Emma Bacon gave us insight into the damage intense heat waves have on more vulnerable communities in Australia.

Bacon explained the importance of city ambassadors, such as Red Shirts and Library Workers for vulnerable populations such as the elderly and people experiencing homelessness, and how Cool Routes would be a great resource to spread through these ambassadors.

In addition to meeting with both internal and external contacts within the Melbourne community, we researched different tools Melbourne has to help its citizens travel throughout the city. Our team investigated existing navigation apps designed for travel within Melbourne to explore the possibility of linking Cool Routes to these applications. Available options included Public Transportation Victoria (PTV), which helps people navigate the public transportation system, or Arevo, which locates inexpensive fuel and highlights public transportation routes. Our group did extensive research on marketing found throughout the city to learn about every resource Melbourne has to offer and determine accessible options. These include social media, newspapers, websites, city ambassadors, billboards, signage, and tourist information centers, known as Information Hubs.



Considering Limitations

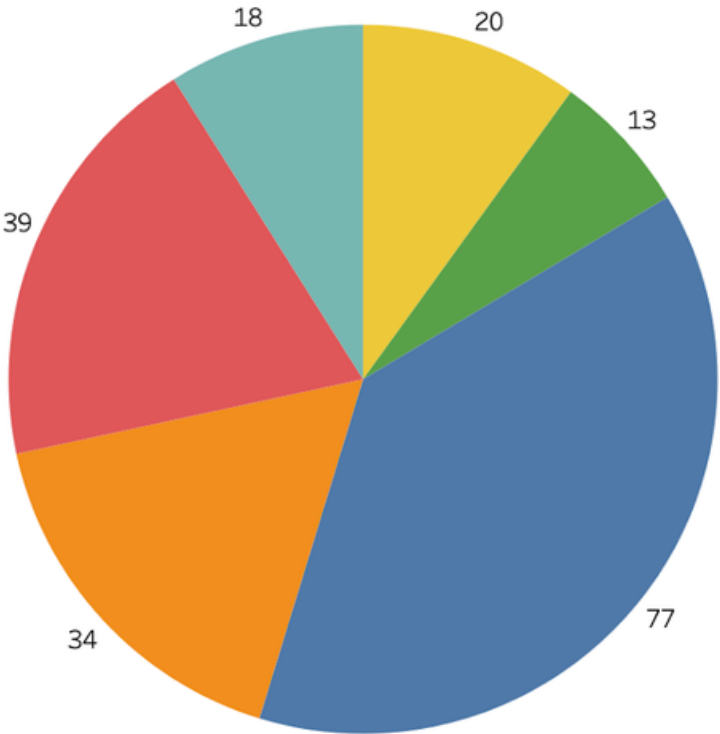
When collecting qualitative data, our team understood the limitations of the conclusions that we drew. Our findings included details about this website and how the people of *Melbourne* interact with it. While we provided recommendations to help improve the uptake in Melbourne, our conclusions may not be directly applicable anywhere outside of this city. We kept this in mind when interpreting and sharing our results.

In our case study, we were careful to collect data from a representative sample. A common problem when collecting data via surveying is not obtaining sufficient responses. A small sample can lead to results that are not accurate or are partial to a particular opinion (Berg & Lune, 2017). The usefulness of our survey results were limited by the relatively small number of responses from age demographics 13-17 and 55+. Due to this lack of widespread reach, we were cautious when drawing conclusions representing the entire population of citizens and tourists of Melbourne. To mitigate bias, we designed survey methods that reached a wide and diverse audience. We varied our surveying times and locations, and approached as many people as possible. Attending different events within the community to conduct surveys helped us try to reach a sample representative of Melbourne’s pedestrians.

To obtain useful results, we were sure to frame our survey questions in ways that allowed our team to draw accurate and realistic conclusions. For example, asking too many open-ended questions would not allow us to make claims that could be generalized. The only open-ended question on our survey was for commentary on the features of the website design. On the other end, asking too many questions with only *yes* or *no* answers would limit the statistical significance of our results. We used answer scales instead of yes or no responses to gather insightful data.

Identifying a Need for Cool Routes

By reviewing our collected data regarding transportation methods, extreme heat impacts, and digital navigation tools, we aimed to understand the community’s needs and how Cool Routes addresses them. Before analyzing this data, the demographics of our respondents must be acknowledged. Figure 12 shows the age breakdown of survey results. 38.5% of our total respondents were in the 18-24 age range. There are sparse responses in both the 13-17 and 55+ categories, which limits the conclusions we can draw on these demographics. By comparing age and transportation methods through Melbourne, our team gained an understanding of Cool Routes’ target audience.



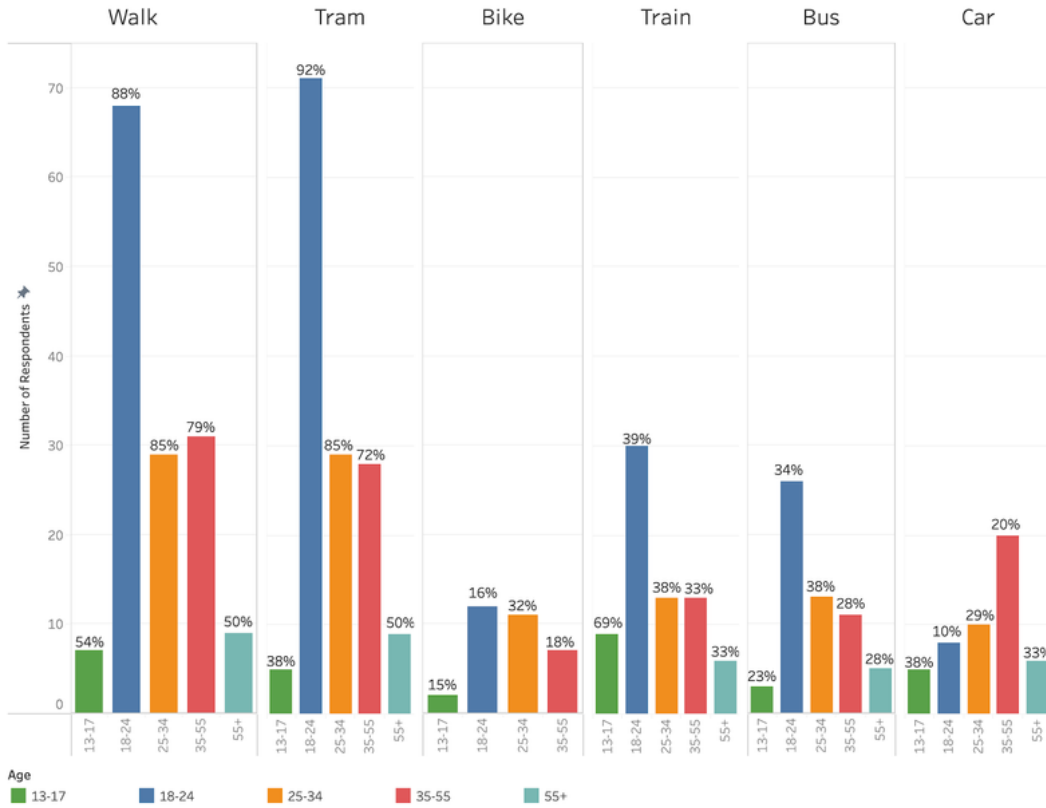
Age Breakdown

Age

Null 13-17 18-24 25-34 35-55 55+

Figure 12: This pie chart displays the number of respondents in each age range. We received the most respondents in the 18-24 age category. Due to large discrepancies in the number of responses we received in each age category, we compared age groups to one another using percentages instead of numerical values. Note that 20 respondents chose to not disclose their ages.

Preferred Mode of Transportation by Age



Mode of Transportation by Location Relative to Melbourne

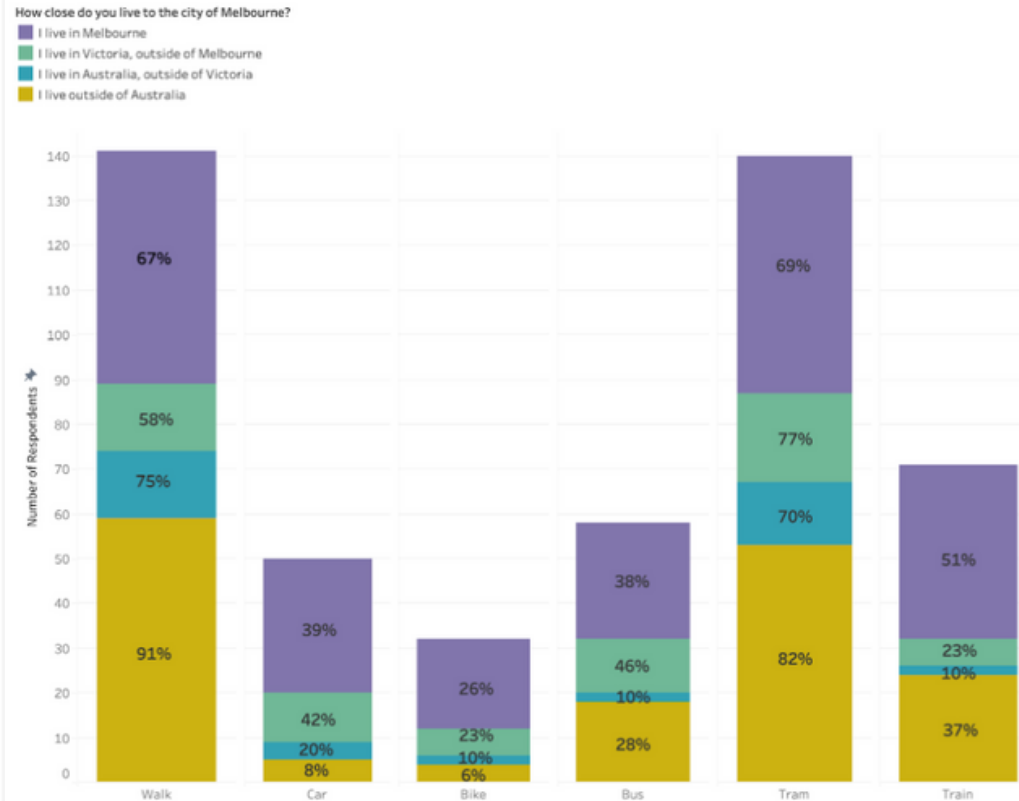


Figure 13: In this graph, the age of respondents is compared with the travel methods the respondents take through Melbourne. The bars represent the number of respondents who fall into each category. The percentages above each bar show how many out of each age category chose the transportation method.

Figure 14: The graph displays ways that people prefer to travel through Melbourne categorized by their location relative to the city. The labels represent the percentage of people within different radii of Melbourne who choose each mode of transportation regularly.

As seen in Figure 13, our team found that the vast majority of most age ranges either walk or use the tram to travel through Melbourne. The data reveals that Cool Routes will be applicable for any age range, but most especially for the 18-55 groups. In each group, 50% or more of respondents said they walk through Melbourne and nearly the same amount use the tram. This reinforces the need for Cool Routes, as the tool benefits people traveling by foot, and provides a shady outlet for walking between transit lines.

To understand people’s chosen modes of transportation, we compared their place of origin with how they travel through the city. As shown in Figure 14, the most popular modes of transportation of people from all locations are walking or taking the tram. These modes of transportation are the target demographic of Cool Routes, demonstrating that Cool Routes is helpful for both citizens and tourists of the city.

In continuing our data analysis, our team found connections between how close respondents lived in proximity to Melbourne and their preferred methods of transportation.

After confirming that a large percentage of respondents walk through the city, our team gathered information regarding how heat affects their travel. We analyzed how heat affects travelers via foot or bike because they are exposed to the most sun when moving through the city.

Does Heat Negatively Impact your Travel by Foot or Bike?

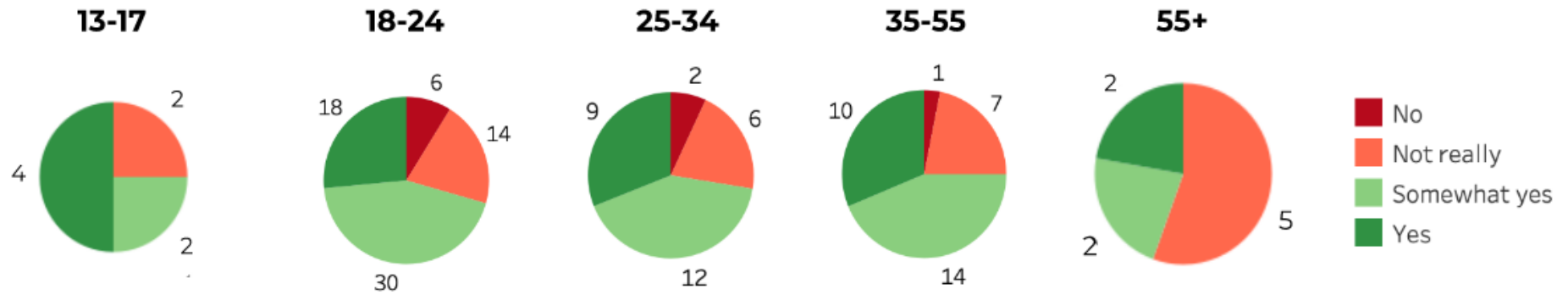
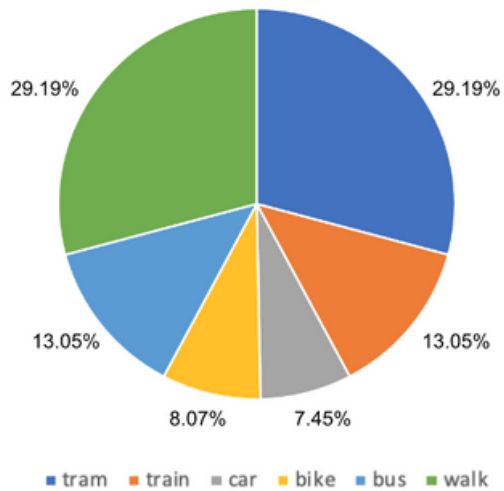


Figure 15: The chart shows Melbourne pedestrians' and cyclists' opinions on the negative impact heat has on their travel grouped by age. We only asked this question to respondents who answered that they regularly travel on foot or bike.

Preferred Mode of Transportation During Normal Weather



Preferred Mode of Transportation During Extreme Heat

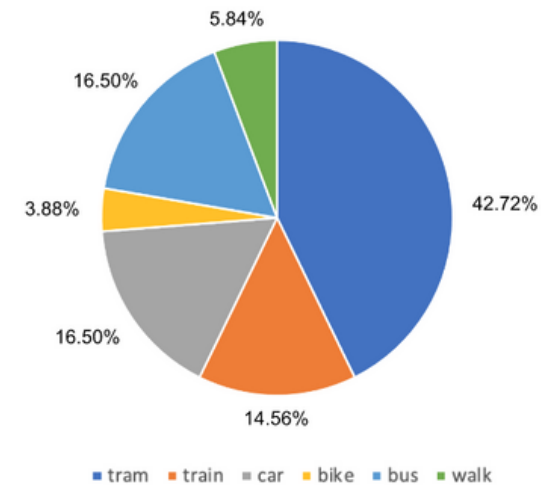


Figure 16: The two pie charts above represent preferred transportation methods in both normal weather patterns and during extreme heat. Of the 87 people who alter their travel, 52 choose a different mode of transportation. Since we allowed people to choose multiple modes, these graphs represent preferred methods.

Figure 15 demonstrates that people are negatively impacted by the heat, which justifies the need for Cool Routes as a navigation tool. Adding in the factor of demographics allowed us to see how different ages reacted to extreme heat. We saw all ages between 13-55 were significantly impacted, suggesting Cool Routes is useful to them. Despite the survey showing respondents over 55 do not feel impacted by extreme heat during their travel, we suspect they are a group vulnerable to the heat. We believe our survey does not have enough respondents in that category to draw insightful conclusions. This is supported by interviews with CoM and Sweltering Cities who both work to assist this vulnerable group.

Locating Website Design Faults

When asked about the tool's features in our structured focus group, the majority of individuals felt that thermal comfort imaging was a great aspect. Most participants felt that the route was surprisingly different from what they anticipated. The alternate route not only differed in terms of direction but most were impressed by how consistently shady and cool it was. One participant noted, "It took me on a route I typically would not have gone on, like up Bourke St.... but it did have a lot of shade because of the building facades." This information, combined with our surveying data, supported the claim that this technology is impactful in combating the effects of heat.

Although we gained a variety of information on the effectiveness of the tool, the focus group allowed our team to identify specific design faults with Cool Routes. The most prominent problems were those hindering the navigation of users through the city. Foremost, the lack of live navigation caused considerable confusion for the focus group participants. Additionally, the tool uses a predetermined list of directions, which utilizes the four cardinal directions to tell users where to go, rather than specific street-based instructions like other modern navigation tools.

“IT TOOK ME ON A ROUTE I TYPICALLY WOULD NOT HAVE GONE ON, LIKE UP BOURKE ST. ...BUT IT DID HAVE A LOT OF SHADE BECAUSE OF THE BUILDING FACADES.”

As a consequence of this structure, users can easily get lost when they are unsure of their current location. One participant remarked, "I was trying to follow the map and came to a dead end. So, I ended up not following the path... but then I came out to the scorching heat on the North side of Melbourne Central." The vague directions provided by the website caused additional confusion. One participant exclaimed, "South? I never know which way South is!" referring to the vague directions given by the tool. In combination, these factors led to two out of three participants getting lost on their 15-minute journeys. These findings emphasize the need for more clear, concise directions.

“I WAS TRYING TO FOLLOW THE MAP AND CAME TO A DEAD END. SO, I ENDED UP NOT FOLLOWING THE PATH... BUT THEN I CAME OUT TO THE SCORCHING HEAT ON THE NORTH SIDE OF MELBOURNE CENTRAL.”

Participants not only struggled to follow directions provided by Cool Routes, but also noted difficulty in accessibility. Multiple users had challenges in reading street names due to the size, placement, and coloration on the thermal comfort map. Additionally, all focus group participants remarked on the absence of verbal directions. The difficulty in distinguishing visuals, combined with the lack of verbal instructions, limits the number of people who can use the website.

Furthermore, people found Cool Routes difficult to interact with. Specifically, they identified the initial information pop-up to be too long. The overwhelming amount of information caused them to disengage from the section and close the tab. This action became a major cause of confusion when the participants were unable to access the information later. They were left with questions about the structure and functions of the website's various features. One feature, in particular, allows users to select their time of travel. Users were unaware of the default time of 14:00, which created inaccuracy in the placement of shadows and cool areas on the map. Additionally, there was difficulty switching between the angled and vertical aerial view of the map. Since the group was navigating with their phones via web browser, they were confused by a strange blue dot that occasionally appeared on the highlighted path.

After further investigation into this dot, Jack Barrett at Nova Systems explained this feature to be the location of your cursor. However, the users found it reminiscent of the blue dot marking your location on other navigating tools such as google maps. Since Cool Routes cannot track users' live locations, many were confused when the dot would show up sporadically. Together, these interface shortcomings made the website confusing and challenging to use.

Cool Routes also contains suboptimal personalization features for its users. Our survey shows that on a scale from zero to five, there is a mid-range interest of approximately 2.5 for the locations of blue and green infrastructure. In conjunction, focus group participants agreed that the location of those features would be interesting to some people but not others. In its current state, the website marks these vegetation-based projects on the map with no option to turn them off. When asked if participants had noticed any blue/green infrastructure on their routes, a few said they did notice several drinking fountains while another was too busy trying to navigate and chose to ignore the highlighted features. Some participants offered suggestions for alternative highlighted resources such as public air conditioning areas and major water features that offer a cooling effect to those struggling with the heat.

City of Melbourne's Current Marketing

Our survey results show that only 6% of respondents had previously heard of Cool Routes, identifying a severe lack of knowledge of the tool throughout Melbourne. Since CoM is responsible for marketing Cool Routes, it can be surmised that they have not invested a significant amount of resources to spread awareness of Cool Routes. Therefore, our team found it necessary to explore potential opportunities for growth with Cool Routes' marketing presence in Melbourne.

How Respondents Receive the City of Melbourne Information Categorized by Age

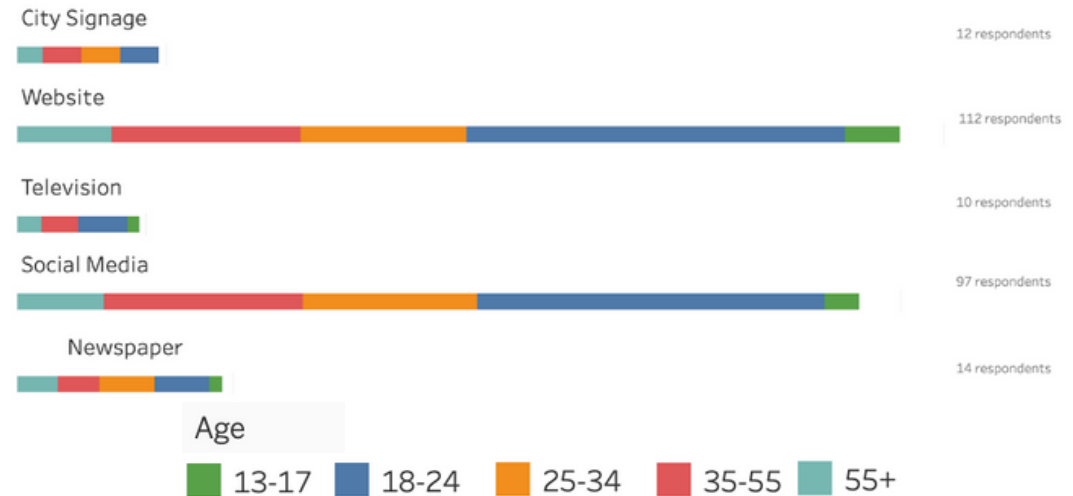


Figure 17: The following graph shows the number of people who receive information from specific marketing channels categorized by age.

Sections of our survey sought to identify how the public receives information. Knowing the primary media sources allowed our team to identify which platform was most effective in reaching certain demographics. As seen in Figure 17, across all age groups, the highest used marketing channels were websites and social media.

CoM has multiple websites which they use to share information such as their corporate website (melbourne.vic.gov.au), What'sOnMelbourne (whatson.melbourne.vic.gov.au), and ParticipateMelbourne (participate.melbourne.vic.gov.au). The corporate website is responsible for providing city government information to its users. Since this page contains so much information, it can pose a difficulty for users to reach their needs on the site. For example, the Cool Routes link is displayed on this website, however it can only be found with 3 or more clicks. The more redirects it takes to reach information, the less likely a user will reach it. What'sOnMelbourne is a page dedicated to events, activities, and restaurants in Melbourne whereas ParticipateMelbourne is a site where progress on city projects can be shared. Both of these websites aim to be more interactive with Melbourne's community. These websites utilize interactive techniques to share information and engage with various audiences. These techniques include quizzes, surveys, and portals.

Another unique feature of the ParticipateMelbourne website is the Neighbourhood Portals. Within Neighbourhood Portals, the 11 community leaders from different sectioned neighbourhoods in Melbourne can spread information specific to their region. For instance, if one neighbourhood had a large majority who spoke Mandarin, then that community leader would be able to translate the information into Mandarin to further the reach of the content. Currently, Cool Routes appears very minimally on these websites designed for community engagement.

CoM has four social media platforms: Instagram, Facebook, LinkedIn, and Youtube, each of which reach a different target demographic. Instagram is their most popular platform. Of the survey respondents who get CoM information by social media, 59% use Instagram. In preparation for a heatwave, CoM will send out a media blast alerting its citizens of the imminent intense temperatures. Included in these blasts are short videos highlighting resources the city provides, although Cool Routes is not typically incorporated in the content. Furthermore, there are certain heat advisory pages dispersed to Melbourne’s citizens. Although Cool Routes is linked to this page, it is hidden under a collapsible menu near the bottom of the page. In conclusion, Cool Routes is only minimally marketed by the city; its awareness could be drastically increased if CoM featured it more explicitly in its public-facing communication channels.

Addressing Identified Issues

All software is broken down into many parts of a structure. The lowest level of the structure is usually the framework. Code developed in the framework is fundamental to how the program functions and changing the code will have an immense influence on the rest of the structure. These changes are costly and time-consuming. In the higher levels of the structure, you will find front-end design segments that can be developed and edited without as many repercussions. Changes to this area are much easier than low-level changes. An analogy of this concept would be the process of building a house. The lower levels would be the skeleton of the house: the foundation, walls, and floors. Removing the foundation would be difficult and cause the structure of the house to change. The higher levels, in contrast, are decorations and furniture. Moving these around the house are much easier to do and has no impact on the structure of the house. This would be the front-end design of a website.



Figure 18: This visual depicts how features of a website are developed around a user’s needs. This concept was originally developed by Jesse James Garrett, a notorious user-centered designer (Garrett, 2011).

By understanding the concepts Garrett lays out in Figure 18, we can see what is foundational and what is not in Cool Routes’ design and therefore understand what improvements can be reasonably made to increase the adoption of Cool Routes into users’ everyday lives. While addressing the discovered problems regarding Cool Routes technical design, our team turned to Dani Bramante and Jack Barrett to understand the difficulty and cost of different technical changes. We learned that such changes face numerous development barriers.

Development Barriers

1

The licenses CoM has determines the programs and software that can be used to develop a website. The available tools determine which direction the project will take.

2

Cool Routes' core navigation technology is built upon Mapbox, an open-source platform that relies upon public input. The data is based completely on what users upload. Therefore, Cool Routes is limited by the public data provided by Mapbox, and replacing the Mapbox technology is difficult as it is integral to Cool Routes' structure.

3

Since Cool Routes is a website rather than an application, some desired technical changes are impeded, especially regarding live navigation. Adding a compass, for example would require transitioning the tool to an application first. Converting to an application would require heavy reconstruction and continual support. Maintaining an application requires great financial and physical upkeep, resources CoM does not have to allocate.

Our Recommendations to the City of Melbourne

CoM requested a set of recommendations that aligns with its goals and budget. Our research and interviews suggested the most effective approach was to rate the recommendations based on two separate scales: priority and difficulty. While some suggestions would be a high priority as they would clearly increase uptake of Cool Routes, they may be difficult and costly to carry out. These two factors are not correlated to each other; therefore, our team organized our recommendations on a two-axis grid to assist CoM in picking the best options based on their current and future circumstances and resources. Figure 19 displays the priority and difficulty of each set of recommendations, and CoM can make the best decisions with the information provided.

Below are explanations of recommendations our team provides to CoM. Our recommendations are given a priority score and difficulty score, each determined individually based on effectiveness, urgency, and implementation limitations. Exact scores were determined relative to other recommendations in terms of feasibility of enacting and the success they would bring. The recommendations are divided up into two categories: technical design and marketing. The technical design recommendations involve changes in the software of Cool Routes, while the marketing recommendations include various outreach strategies. Explanations include an overview of what the change would look like, why we believe each would be successful, and the difficulty of enacting change. The color of each recommendation corresponds to the colored quadrant in Figure 19.

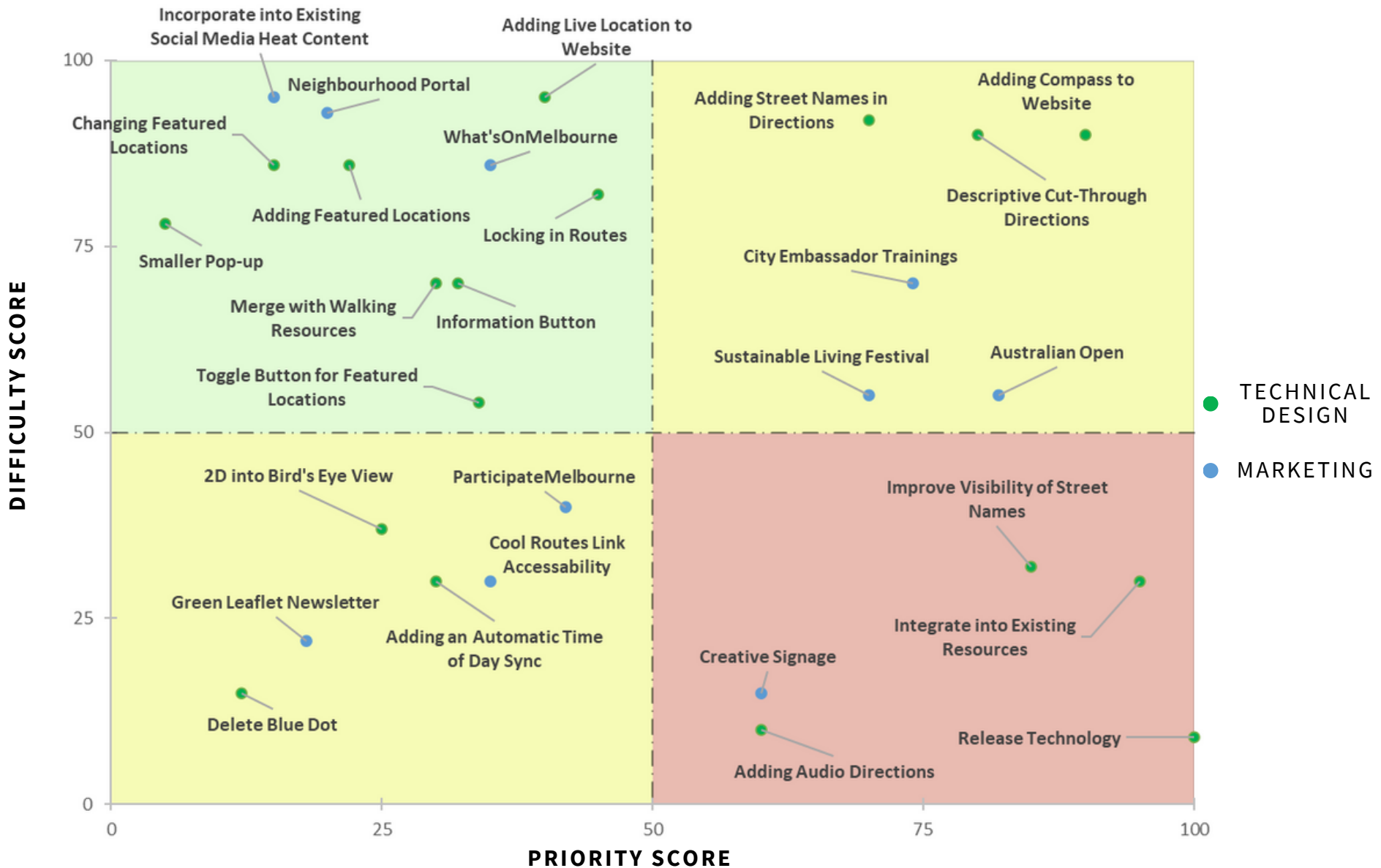


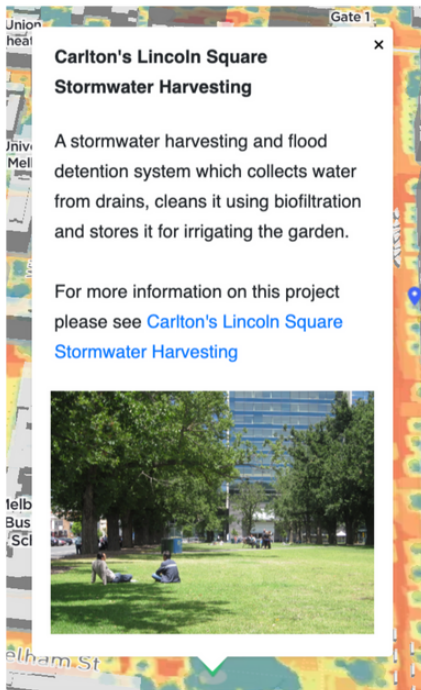
Figure 19: The two-axis grid shows opportunities organized by priority and difficulty. There are two types of opportunities: technical design and marketing. The four quadrants reflect the difficulty and priority each recommendation holds. The opportunities with higher priority and lower difficulty values are located in the green quadrant since they would be easy and generally inexpensive changes. The red quadrant contains less urgent changes that would be expensive or time-consuming. These suggestions may be explored further down the road. The recommendations in the yellow quadrants have more of a balance between the difficulty and priority.

RECOMMENDATIONS FOR TECHNICAL DESIGN

The following recommendations are based on technological design. These changes may be front-end improvements to the Cool Routes website, or back-end restructures to its design. There are also several opportunities for integration with external applications and programs to include Cool Routes in many other disciplines. The recommendations are split into 5 categories.

1. REFINE FEATURED LOCATIONS

CURRENT



UPDATED

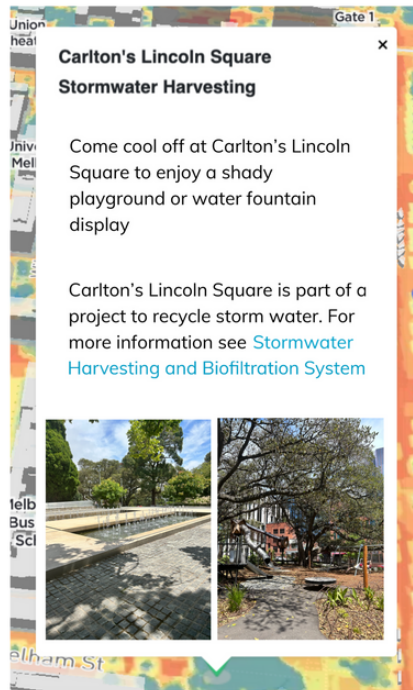


Figure 20: This figure portrays how Carlton's Lincoln Square stormwater harvesting is currently displayed on cool routes (left). In the updated version (right) our team demonstrated how we suggest it is portrayed.

Add New Featured Locations

Difficulty: 22 Priority: 86

Incorporating different types of featured locations allows users to see an increased variety of spaces in the city. Potential featured locations can include parks, libraries, museums, and restaurants. Featuring more interactive locations is a high priority because they appeal to a wider variety of people while helping users stay cool. Furthermore, this change is low in difficulty because it only requires appending a dataset to an already established list of datasets. This has been easily accomplished before by CoM and this change does not affect the rest of the website.

Change Featured Locations

Difficulty: 15 Priority: 86

While adding new locations are a priority, Cool Routes already features locations that could be better described to attract visitors. Currently, featured locations on the map are highlighted with a picture and description. However, not all of the best features of each location are displayed. For example, at Carlton's Lincoln Square, the stormwater harvesting system is highlighted. Meanwhile, the location has many attractions to cool off at, such as a water fountain display and playground. Shown in Figure 20, the description can include both the blue infrastructure project and the additional attractions, making the location appeal to a wider audience. Increasing the attractiveness of locations is a high priority, as it will encourage more use. This feature is low in difficulty because it requires adjusting the current data, but no further technical changes.

Add a Filter for Featured Locations

Difficulty: 34 Priority: 54

Adding a button to toggle between the featured locations allows the user to customize what they want to see on their journey with Cool Routes. Users could also toggle between having different kinds of locations highlighted in addition to the blue and green infrastructure currently featured. This alteration is of medium priority because it does not affect the content of the website or navigation, only suggesting how the information displayed should be more precise and customized

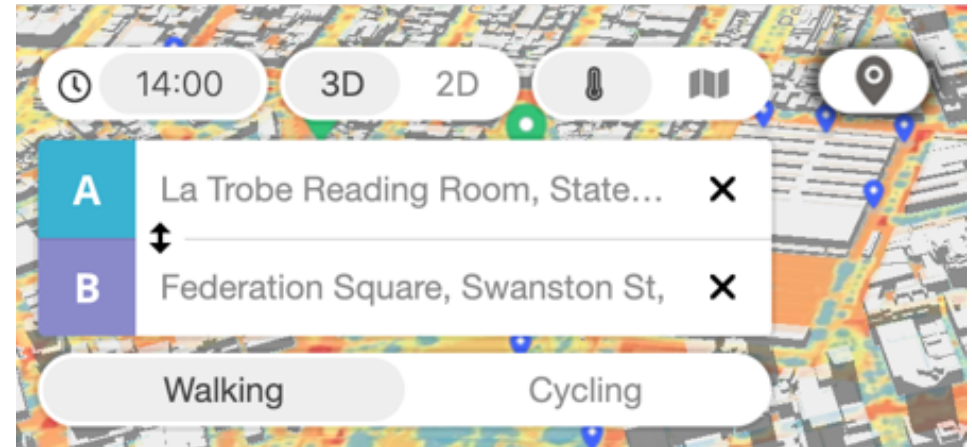


Figure 21: This portrays what the Cool Routes Interface could look like if it had a button to filter featured location (top right)

2. ADD FEATURES CRITICAL TO NAVIGATION

Add Live Location to Website

Difficulty: 40 Priority: 95

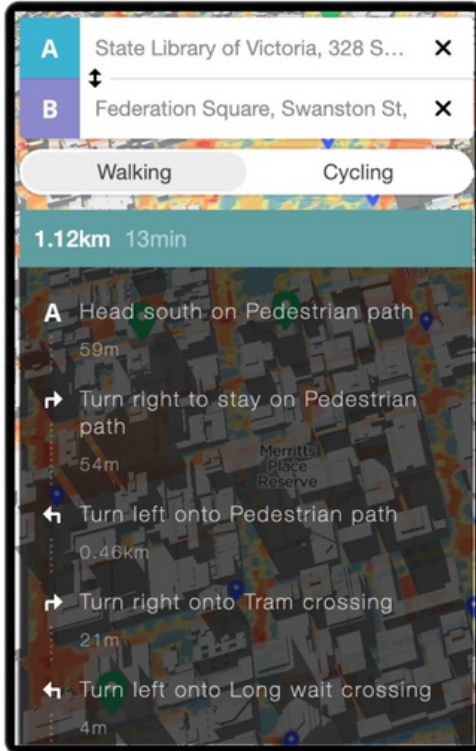
Adding live location to the website allows the user to see where they are on the map once they allow their browser to access their location. Implementing this feature is a high priority because it greatly reduces the likelihood of getting lost. A difficulty with navigation was the most prominent issue identified through our data. As a website, the accuracy of the live location would be imperfect, but still helpful to the user. The difficulty of this implementation is relatively low because the technology to access the user's location is an easily accessible resource and would require a minimal amount of redevelopment and testing.

Add a Compass to The Website

Difficulty: 90 Priority: 90

Adding a compass to the website allows the user to see which direction they are facing. In its current state, Cool Routes uses the four cardinal directions to navigate users. A compass would increase the user's understanding of which direction they should be heading. This addition is high in priority because users need to be able to follow the provided instructions to stay on the coolest paths. Unfortunately, the difficulty is quite high because this feature is only possible if the tool is converted to an app.

CURRENT



UPDATED

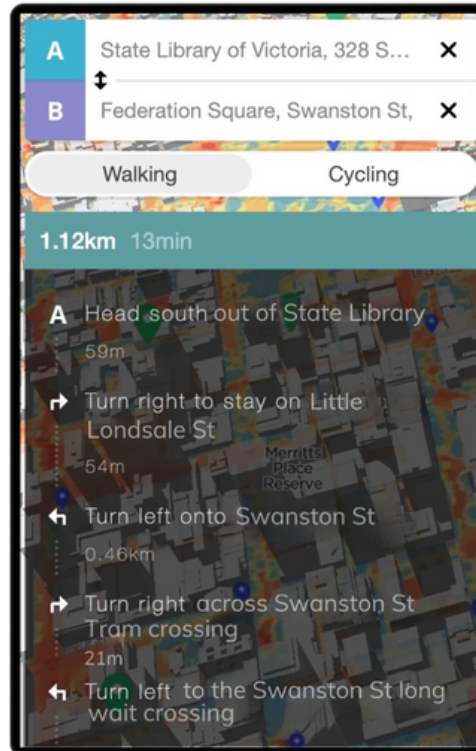


Figure 22: The image on the left shows a current example of what directions in Cool Routes looks like. There are no specific street names, just terms such as “pedestrian path” and “long wait crossing”. The image in the right shows a refined version of the directions if street names are added to the directions.

Incorporate Street Names in the Directions

Difficulty: 70 Priority: 92

Incorporating street names in the directions provided by Cool Routes allows the user to orient themselves based on the name of the street they are on and those around them. Including this feature is a high priority because it reduces the chances of the user getting lost. However, the difficulty is relatively high because the MapBox technology relies on public input. As a result, the street name data may never be uploaded. Without this outside improvement, the next option is to replace the Mapbox dataset with another navigation resource with more specific wording. This is demonstrated in Figure 22.

Include More Descriptive Cut-Through Directions

Difficulty: 80 Priority: 90

Including more clear directions when the user is moving through a building allows the user to be confident in the specific entrance and exit they should take to stay cool. This is a high priority because cutting through air-conditioned buildings helps users stay on the correct cool path. However, the difficulty of this suggestion is high because the current dataset Cool Routes uses for cut-through directions is open-sourced and depends on the input of others. This Mapbox data is unlikely to have updated street names and cut-through directions since its implementation. Therefore, switching datasets may be necessary and would involve more technical work.

3. IMPROVE USER INTERFACE

Add a Button to Lock in Routes

Difficulty: 45 Priority: 82

We recommend that CoM adds a feature to lock start and end locations when users start their journey. This feature can be similar to a “go” button. When users currently input their start and end locations, an accidental click on the map can change the route. Developing this feature requires a sufficient amount of testing and experimentation to find the best approach. Once the solution is found, however, the implementation is easy.

Default 2D View to Bird's Eye View

Difficulty: 25 Priority: 37

We recommend CoM reworks the 2D view to default to the bird’s eye perspective. Cool Routes currently defaults to an angled view with the 3D map. Although it is possible to move the map to a bird’s eye view with a right click, it is not intuitive nor are instructions given. Implementing this change would be very easy and would just require disabling the angled view option.

Synchronize Time of Day

Difficulty: 30 Priority: 30

We recommend that CoM syncs the shade cover map in Cool Routes to the nearest time of day automatically. The tool currently defaults to 14:00, one of the hottest hours of the day. This seems like a reasonable default time, but the shadiest areas of the city depend on the specific time of day. Automatically picking the user’s route with the closest half hour interval will limit user error and confusion. This is an easy feature to update, only requiring some minor redevelopment and testing.

Include Information Button

Difficulty: 32 Priority: 70

We recommend that CoM adds an information button. When a user currently opens Cool Routes, there is a general information and instructions pop-up, but once closed it cannot be reopened without reloading the page. Users should be able to reaccess this key information, otherwise they will lose any data already inputted into the webpage. It is not difficult to implement this change, as it would require some minor front-end changes. It would only require user interface (UI) work to endure the screen does not become cluttered.

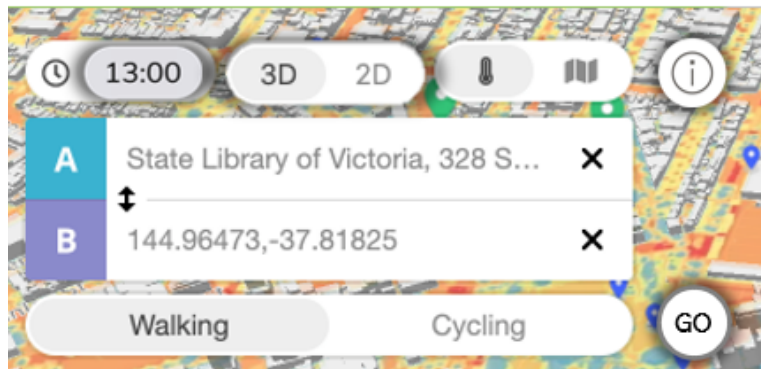


Figure 23: This image displays how some of our recommendations can be displayed on the Cool Routes user interface. The top left shows time of day feature which we recommend to automatically update. The toggle between 3D and 2D will also be used to enable Bird's Eye View. The right side shows an information pop-up button, where instructions for each feature can be accessed at any time. The "GO" button will lock in a route with start and end locations when navigating.

4. AID IN ACCESSIBILITY

Improve the Visibility of Street Names

Difficulty: 85 Priority: 32

We recommend that CoM improves the visibility of street names on the map while in 3D view. This would greatly increase the accessibility of the website. Currently, street names on the map do not appear unless you are fully zoomed in. Even then, the font is small and in a light color. For users to easily reach their destination, surrounding areas need to be clearly labeled. This issue is difficult to resolve because the Mapbox technology has a predetermined set of fonts for street names. The only way to fix this problem would be to remove the Mapbox technology and find another resource, or create street names manually. Both of these methods require an extensive amount of work to properly animate and illustrate.

Add Audio Directions

Difficulty: 60 Priority: 10

We recommend that CoM add audio directions to Cool Routes to increase its accessibility. This addition would narrate navigation instructions to increase the accessibility for all users navigating Melbourne's extreme heat. Reaching a larger, more diverse audience through audio directions will extend the tool to more people who can benefit from its features. Implementing this feature is not an easy task because the Mapbox technology does not have the audio feature equipped. Solving this problem would require either pulling resources from other technologies or developing audio components from scratch.

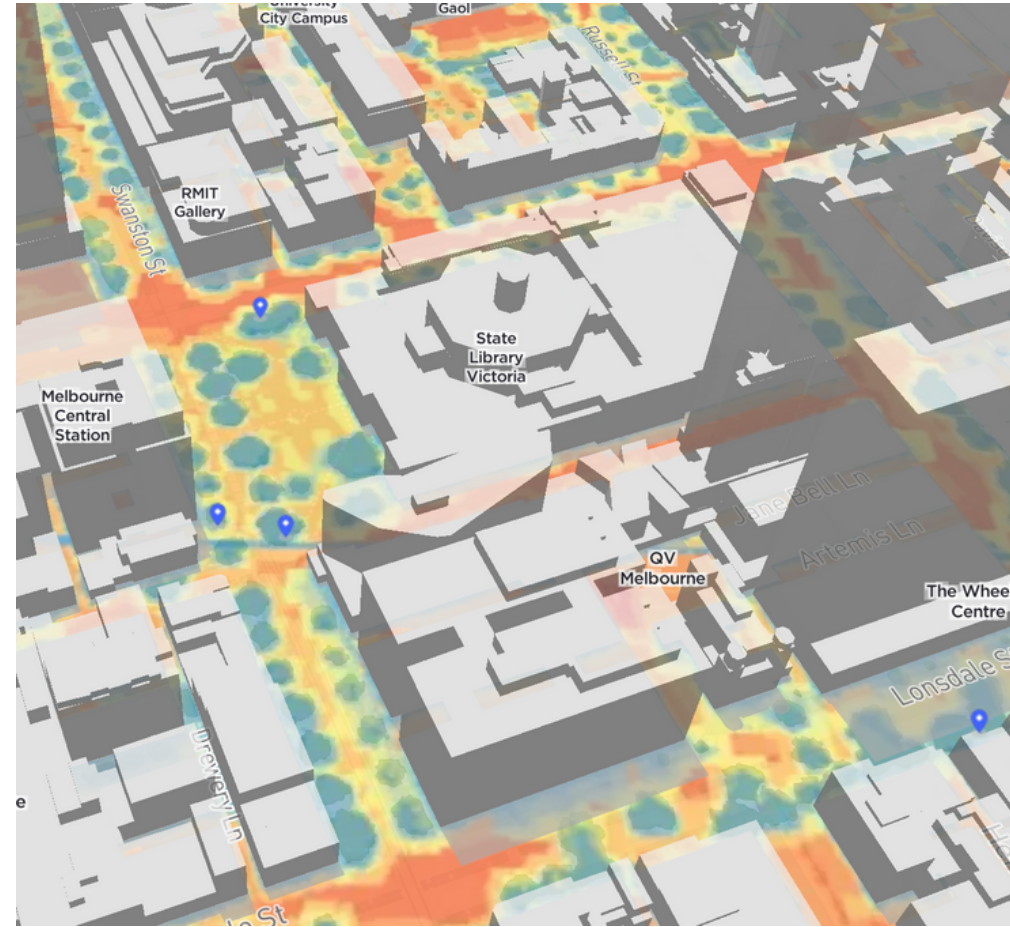


Figure 24: This image shows the 3D thermal comfort map as it is currently displayed on the Cool Routes Interface, showing how street names are difficult to read. Jane Bell Lane and Artemis Street are hidden behind buildings, as seen in the right side of the image. Other streets such as Swanston Street or Russel Street have labels that blend into the background, as seen at the top of the image. The street running parallel to Swanston Street and Russel Street, La Trobe Street, is missing a label. This could be improved by adding clear and consistent labels for street names.

5. INTEGRATE INTO EXISTING RESOURCES

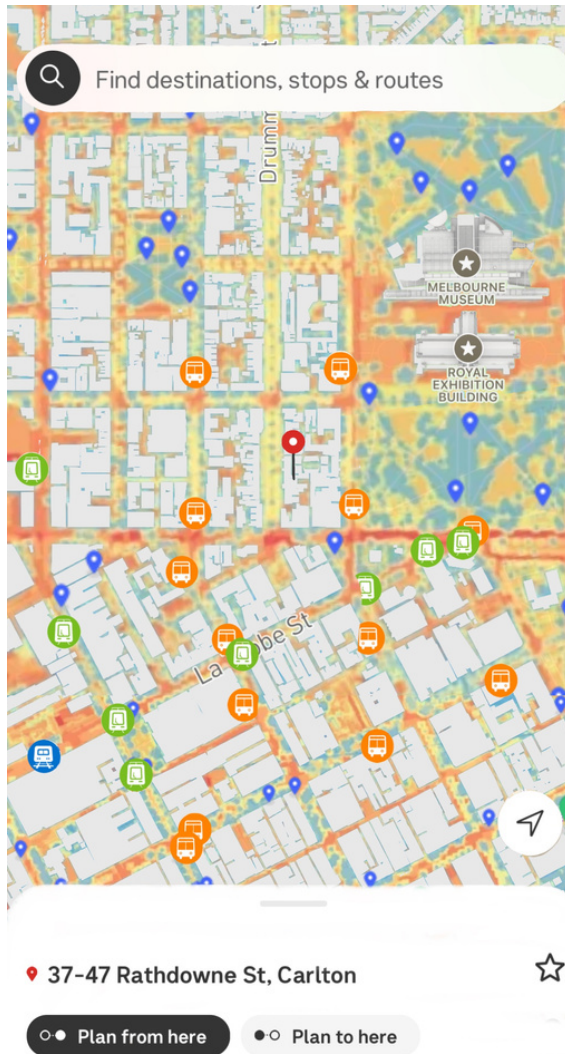


Figure 25: The image to the left displays what a potential application design could look like if Cool Routes was integrated into PTV.

Merge with Self-Guided Tours

Difficulty: 30 Priority: 70

Our team believes there are opportunities for Cool Routes to merge with various self-guided tours available to Melbourne’s pedestrians, such as Melbourne Walks or Sustainability Walks. Pedestrians who are already using any of these resources can use Cool Routes to take the shadiest path on their journey. This change would be fairly easy as users can input their own route depending on the tour, and is a great way to integrate Cool Routes into citizens’ and tourists’ daily lives.

Integrate into Public Transportation Applications

Difficulty: 95 Priority: 30

We recommend that CoM explores integrating Cool Routes with existing applications in Melbourne. Applications like PTV and Arevo help users navigate using their preferred form of public transportation. Since pedestrians typically need to walk in between public transportation lines, Cool Routes can be very useful during extreme weather. This suggestion is a lower priority because there are other avenues of opportunities CoM can explore to immediately improve the uptake of Cool Routes before integration. The primary issue with this recommendation includes the difficulty of coordinating the legal process that would ensue while working with the other companies.



Aboriginal Melbourne walk

Discover Melbourne’s Aboriginal heritage and culture on this walking tour of significant sites.



Southbank and Docklands by bike

Cycle along Melbourne’s iconic Yarra River to discover art installations and maritime history.

Figure 26: These two images portray some of the self-guided walking and cycling tours available to Melbourne’s citizens and tourists. These tours are on the WhatsOnMelbourne website.

RECOMMENDATIONS FOR MARKETING

Marketing limitations are set by the capability of CoM resources. With a wide variety of campaigns at CoM, platforms must be divided amongst all projects and departments. Larger campaigns are typically prioritized. Since Cool Routes is a smaller project, CoM will not allocate as many resources toward the tool. Therefore, social media content for Cool Routes is limited due to the priority of campaigns. The lead time of campaigns is another factor to consider. It typically takes CoM over six months to develop and approve non-digital promotions. Our team recognized that since physical campaigns will take longer to develop they will be more difficult to enact. So digital opportunities such as website updates and social media presence are prioritized.

1. MARKET IN PREPARATION FOR HEATWAVES



Figure 27: This is an example of content the City of Melbourne could promote on their Instagram story during extreme heat.

Incorporate into Existing Social Media Content

Difficulty: 15 Priority: 95

Cool Routes is more likely to be utilized during extreme heat. Marketing during heat waves would help citizens decide how to alter their travel plans. Incorporating Cool Routes into existing social media content will remind people of the resource when it is most useful. CoM puts forth great effort into providing resources for its community in preparation for heatwaves. Marketing these resources to the community is a high priority. Social media is one of the most used platforms; marketing for Cool Routes will reach a large audience here. Implementing Cool Routes into existing social media content will not be challenging. When creating campaigns for shady places and resources around Melbourne, incorporate Cool Routes as an additional navigation outlet.

Cool Routes Link Accessibility

Difficulty: 35 Priority: 30

Making Cool Routes more visible on CoM corporate website will allow users to find the tool with ease. This is not the highest priority because the Cool Routes link is already accessible on the website, but hidden further down the page. However, this change would be easy as it only requires restructuring the information readily available to the users.

2. UTILIZE EXISTING COM RESOURCES

Neighbourhood Portal

Difficulty: 20 Priority: 93

As a part of the ParticipateMelbourne website, each of the eleven neighbourhoods in Melbourne have a portal to access information specific to their location. Additionally, a community leader works within each neighbourhood to assist with marketing. Implementing Cool Routes information onto the neighbourhood portals is an easy way to reach target demographics across Melbourne. This only difficulty in this recommendation comes from coordinating with 11 different leaders to spread information.

Green Leaflet Newsletter

Difficulty: 18 Priority: 22

Spotlighting Cool Routes in the Green Leaflet Newsletter would allow people interested in the sustainability efforts of the city to discover and use the website. This effort is a low priority because the newsletter only goes out to a smaller audience every six weeks, however, this option is also rated low in difficulty because it is run solely by the Climate Adaptation Project Team and would not require external communication.



Carlton
Neighbourhood Portal



CBD Neighbourhood
Portal



Docklands
Neighbourhood Portal



East Melbourne
Neighbourhood Portal

Figure 28: This screenshot from CoM's Neighbourhood Portal website shows four of the eleven neighbourhoods within Melbourne.

ParticipateMelbourne

Difficulty: 42 Priority: 40

Marketing Cool Routes through the ParticipateMelbourne website could allow community members engaging in city projects to interact with the climate tool. This is of medium priority because it increases outreach, though the purpose of the website does not align as closely with the purpose of Cool Routes, which also increases the difficulty of getting the climate tool featured here.

What'sOnMelbourne

Difficulty: 35 Priority: 86

Marketing Cool Routes through the What'sOnMelbourne website would enable people looking for events and places to visit to easily access the tool when they are planning their travel. This avenue is a high priority because What'sOnMelbourne reaches a wide audience and people would already be in the journey planning mindset when they found Cool Routes. On the What'sOnMelbourne website, each event featured has a location with a link to google maps. Including an additional link to Cool Routes has a moderately low difficulty score because What'sOnMelbourne is a CoM-run website, although it is not run by the Climate Adaptation Project Team.

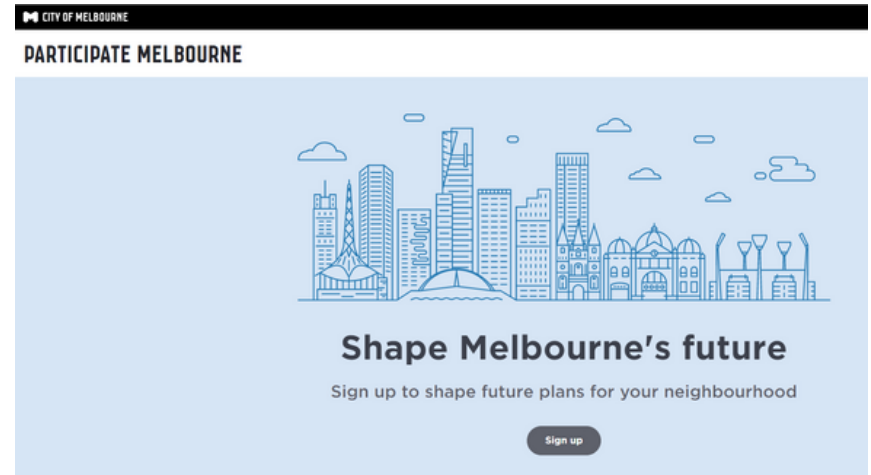


Figure 29: This is a screenshot from the ParticipateMelbourne homepage of their website.

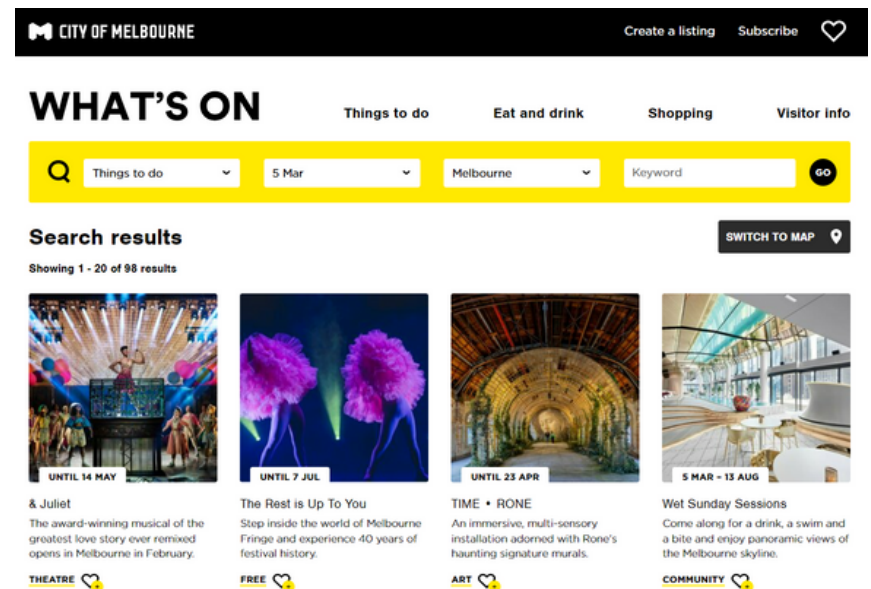


Figure 30: This is a screenshot from the WhatsOnMelbourne website that displays various upcoming events happening in Melbourne.

3. MARKET AT SUMMER EVENTS



Figure 31: This is an image of the Sustainable Living Festival in Melbourne

Australian Open

Difficulty: 82 Priority: 55

Having the Cool Routes QR code or website link on signage marketing the Australian Open would allow people to find the website when they are planning their journey to and from the Open. The Australian Open is the largest summer event in Melbourne that attracts multitudes of tourists and citizens alike during one of the hottest summer months. This is a medium priority option because it is a good marketing strategy, but would likely come after other avenues are explored. The difficulty is relatively high because CoM is one of hundreds of major sponsors of the Australian Open. CoM has a smaller influence here than they may with smaller events.

Sustainable Living Festival

Difficulty: 70 Priority: 55

Displaying the Cool Routes QR code or website on signage and electronic campaigns marketing for the Sustainable Living Festival would allow people to find the website when they are planning their travel to or from the events. This option is a medium priority because it is a good way to reach people in the hot months in the target demographic, but it is not as large scale as the Australian Open. It has a somewhat high difficulty because it involves outside partnerships. However, CoM already has a good relationship with the organization. The same strategy could be used for other summer festivals and events of this size in the city.

4. INCREASE PHYSICAL MARKETING

City Ambassador Training

Difficulty: 74 Priority: 70

Creating a briefing that includes Cool Routes before the warmer weather begins will increase the usage of the tool. This training can be given to City Ambassadors, Library Workers, and other employees throughout the city who often give information out to citizens and tourists. Library Workers can provide public access to digital resources, allowing the tool to reach vulnerable communities. The information that Cool Routes provides during heat waves is important for populations such as the elderly and people experiencing homelessness. Having more city ambassadors trained with the knowledge of Cool Routes can provide another resource to them is an opportunity to increase the accessibility of the tool. However, this training will have to be developed at least six months prior to training and may be time consuming to develop.

Creative Signage

Difficulty: 60 Priority: 15

CoM has many resources available to use for marketing purposes within the city. Many bins, poles, and trucks around Melbourne are owned by CoM, and therefore there are many outlets available to creatively display information. Creating physical promotions within the city is important so people already navigating through the heat can access the tool. However, creating physical advertisements has a much higher lead time and it may be complicated to identify the correct spaces to display the Cool Routes information.



Figure 32: Our team created this graphic to suggest some creative signage opportunities CoM could use throughout the city.

In Conclusion...

Sections of our survey sought to identify how the public receives CoM information. Knowing the primary media sources allowed our team to identify which platform was most effective in reaching certain demographics. As seen in Figure 14, across all age groups, the highest used marketing channels were websites and social media. CoM has multiple websites which they use to share information such as their corporate website (melbourne.vic.gov.au), What'sOnMelbourne (whatson.melbourne.vic.gov.au), and ParticipateMelbourne (participate.melbourne.vic.gov.au). The corporate website is responsible for providing city government information to its users. Since this page contains so much information, it can pose a difficulty for users to reach their needs on the site. For example, the Cool Routes link is displayed on this website, however it can only be found with 3 or more clicks. The more redirects it takes to reach information, the less likely a user will reach it. What'sOnMelbourne is a page dedicated to events, activities, and restaurants in Melbourne whereas ParticipateMelbourne is a site where progress on city projects can be shared. Both aim to be more interactive with Melbourne's community; these websites utilize interactive techniques to share information and engage with various audiences. These include quizzes, surveys, and portals.

Our team rated suggestions by difficulty and priority so CoM will be able to distinguish the different levels of effort that would go into each specific recommendation (see Figure 16 on page 18). This categorization will allow CoM to make informed decisions on which recommendations to enact in the short term, and formulate a long term plan for the future of the tool. Following this study, we hope to see some of these opportunities enacted in technical design to improve user experience, such as adding an information button to supplement the long pop-up that appears when opening the website, or locking in start and end locations when using the tool to navigate. Furthermore, we hope CoM will utilize more marketing resources such as incorporating Cool Routes into pre-existing newsletters, city websites, and neighborhood portals. Such changes would be relatively inexpensive since they harness existing resources.

Looking to the future, we hope that CoM enacts some of the green, easier recommendations our team has provided. We believe that with better usability and an increase in marketing, Cool Routes will have an increase of daily user appearances. These initial changes would be ground breaking for future improvements and overall uptake. After working extensively with the tool, we see the use for the adoption of smart navigation tools around the world. The Cool Routes technology has the potential to revolutionize the mobile navigation industry in a way that many governments and corporations have not even thought of. If other cities or countries were able to adopt this technology, they could tailor it to their specific communities needs. For example, colder cities can develop "Warm Routes", or cities that lack proper security can develop "Safe Routes". Either way, the technology behind Cool Routes has the potential to pioneer smart navigation around the world.



I was honored to have the opportunity to work with my groupmates on this project. Over the past seven weeks I learned how to develop a case study through a community oriented mindset. Furthermore I was able to improve my professionalism by taking several roles in interviews, meetings, and group tasks. With the help of my teammates we were able to develop insightful recommendations for the City of Melbourne on how it can improve its Climate Adaptation tool.

Jack Charpentier



I had the opportunity to work with my team and Nova Systems to learn and develop user-centered design and technological website recommendations. Brainstorming ideas and contemplating their technical value and difficulty was a new experience that taught me the mindset of a user-centered design expert.

Zaq Humphrey



I appreciated the opportunity to collaborate with my teammates and the City of Melbourne. I was able to expand my knowledge of user-centered design, marketing, and climate change adaptation. Additionally, I developed my professional skills in running meetings and conducting interviews.

Jacquelyn Nicoletti



I enjoyed collaborating with my team and various community partners to learn more about the Melbourne community. I also learned about user-centered design and website design, a field I was not knowledgeable in before this project. Additionally, I gained insight into different marketing aspects that the City of Melbourne utilizes when experiencing extreme heat.

Abbigail Poland



I enjoyed collaborating with my teammates and the City of Melbourne for this project. By working in many new disciplines, including user-centered design, data analysis, and website design, I have expanded my knowledge and professional skills. Through this project, I have strengthened my communication skills by conducting interviews, creating reports, and surveying the public.

Cassidy Williams

AUTHORSHIP

Our team collaborated extensively when developing our case study. After evaluating our strengths and weaknesses, we adopted a collective work style in order to be as efficient as possible. By completing subsections individually, we were able to critique each other's work while formatting each section into a cohesive flow. Additionally, revisions were evaluated as a team so everyone had a voice in direction to take. Each and every team member contributed a vast amount of knowledge and creative ideas in every aspect of this project.

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